Welcome to the SAAD Digest for 2013 and my first as President. It is a great honour to be following in the footsteps of the men and one woman who have led the society since our inception in 1957. My first few months have been busy with email correspondence: the SAAD Board are speedy and robust in their replies to recommendations and legislation affecting the practice of conscious sedation in the UK. It’s going to be challenging chairing Board meetings with this outspoken group.

SAAD has many roles to play; scientific society, political lobbying and educational provider. The Board consists of members from a variety of backgrounds including dentists and doctors from general practice, hospital and primary care who bring a range of skill sets to fulfil these roles. It is also important to reflect our membership and I am pleased to welcome Sadie Hughes and Paul Howlett to the Board helping to redress the gender imbalance and bring the average age down. Their profiles can be found in this edition. There will be places for elected members over the next few years and I would urge anyone who is interested to consider standing for election.

It is vital that we do defend the provision of conscious sedation in primary care for dental care. It would be all too easy for legislation and poor remuneration to stop general dental practitioners providing these techniques which allow thousands of anxious people to access dental care close to home. This is one of the most important challenges ahead particularly in the current climate in the NHS where we are facing reorganisation of commissioning against the background of unprecedented savings. It would be all too easy for sedation to be lost in this restructuring.

The other theme of my Presidency is to involve younger dentists - not surprisingly since much of my time is spent teaching under- and postgraduates sedation and special care dentistry. I know how much our students appreciate this teaching: seeing patients holistically, not just as teeth, and enjoy alleviating anxiety. I want to ensure we harness this enthusiasm and work with the Dental Sedation Teachers Group to ensure all dental undergraduates have ‘hands on’ experience of the basic sedation techniques. SAAD has a number of initiatives to engage with this group. The SAAD essay prize, subsidised places at the conference for two undergraduates from each UK dental school and research grants to aid research in pain and anxiety control in dentistry. More information can be found on the website. Without young practitioners the society does not have a future.

The website has an important role in this engagement – it is the face of the society and by the time this editorial is published the new SAAD website will have been launched thanks to the hard work of our executive secretary Fiona Wraith. Those of you who have practice websites will appreciate what a task this has been. The website includes an online shop for SAAD literature and booking for courses. It provides access to documents and legislation relating to the practice of conscious sedation. We do have a facebook and twitter presence, #SAADuk, but need more likes and followers! Email will be used far more to communicate with our membership and the summer newsletter will arrive in your inbox not mailbox. Please contact us at fiona@saad.org.uk if we don’t have your email address.

This year’s Digest is a bumper one. Under the editorship of Nigel Robb and the editorial board our society journal has gone from low key specialist society magazine to a scientific journal with a hint of ‘Hello!’ magazine. It is the most obvious tangible benefit of SAAD membership and I hope you enjoying reading the 2013 edition.

Highlights include scientific papers on clinical governance issues from the Queensway dental team in the North-East and one on local anaesthesia from Stanley Malamed from California. This year both the winner and the runner up in the SAAD undergraduate essay prize were judged to be of publishable standard: well done to Jasmin and Yvonne for writing such interesting essays.

We are very fortunate to have an opinion piece from Mike Sury who chaired the committee which produced the NICE guidelines on sedation for children and young people. The topic of paediatric sedation remains one of the most controversial areas in sedation practice. Michael Wood adds to this debate with two papers describing advanced sedation techniques used in his practice. The ‘Hello!’ element comes in the form of profiles of Board members and meeting reports from around the world.

There are challenges ahead in 2013 for SAAD members who are providing sedation services in both the NHS and private sectors. Your society is here to tackle those issues so do engage with us either by email, visiting the website or even via social media.

Enjoy reading your Digest. Carole Boyle
Introduction

The expectations placed upon modern dental practitioners with regards to governance are vast and constantly evolving, with pressures from commissioners, the Care Quality Commission (CQC), cross infection control guidance and data protection. As well as these burdens faced by all practitioners, clinicians involved with the provision of conscious sedation face an additional layer of governance, which must be managed in an effective, consistent and organised manner. It is imperative that organisations keep timely and thorough records relating to the implementation and maintenance of these issues.

In this article, we try to explore some key governance issues associated with conscious sedation, which are not directly related to actual clinical care and hope to provide practitioners with some useful and practical information. Please note, we have only discussed topics relating to standard conscious sedation techniques currently used in the UK and not considered alternative (advanced) techniques, although clearly, there is significant crossover.

The subject areas discussed are by no means exhaustive and are intended to be an adjunct to current national guidance documents.

Throughout this article we will examine the following areas:

- Pre-operative conscious sedation checks
- Clinical records and documentation
- Storage, handling and disposal of sedative drugs
- Storage, handling and disposal of gas cylinders
- Maintenance and servicing of equipment and devices
- Practice facilities
- Standard operating procedures
- Team training
- Audit and incident reporting

Pre-operative Conscious Sedation Checks

The importance of predictable and safe patient care within conscious sedation is of paramount importance and should always be at the forefront of any sedationist’s mind. To increase the probability of treatment episodes progressing smoothly and without incident one needs to adopt a systematic, logical and robust approach to all aspects of the process. This is especially true in terms of the necessary checks and steps taken prior to commencing treatment under conscious sedation. These checks need to be carried out consistently and the authors would advocate the use of a written checklist to avoid omissions and provide an audit trail.

Pre-sedation checks will include patient and equipment related factors, and those specific to the provision of inhalation conscious sedation (IS) and associated machines.

Patient factors

Escort and transport

All patients attending for treatment with intravenous conscious sedation (IVS) must be accompanied by an appropriate adult to act as an escort. This individual must be able to take the patient home via either private car or a taxi and provide care for them until the following day, or delegate care and transfer instructions to another...
appropriate adult. It is considered unacceptable for patients to travel home on public transport following treatment with conscious sedation, especially IVS. On the day of treatment this escort must not have sole responsibility for any other dependants e.g. young children or elderly relatives.

Paediatric patients having treatment with IS should also have an escort. However, it is not imperative that all adults receiving care with IS have an escort. Most adults should be capable of driving following treatment with IS, but it would be appropriate to insist on a recovery time of 15-30 minutes prior to discharge from the practice. The requirement for an escort in this situation should be applied at the discretion of individual practitioners and judged on a case-by-case basis.

The importance of a suitable escort should be emphasised at the assessment appointment and written and verbal pre-operative instructions need to make this issue abundantly clear.

Fasting
The guidance published by the National Institute for Health and Clinical Excellence in 2010 on sedation in children and young people clearly states that fasting is not required for minimal sedation, or moderate sedation where the patient will retain verbal contact with the medical professional. This definition would match with the accepted view of conscious sedation used in the UK and could reasonably be applied to adult patients as well. However, as per the guidance contained within the Standing Dental Advisory Committee document Conscious Sedation in the Provision of Dental Care, practitioners should probably advise adults to only have light foods prior to treatment with IVS and avoid alcoholic drinks.

Consent
Prior to commencing treatment, written consent should be checked for accuracy and completeness and reconfirmed with the patient or parent. This presumes that the patient assessment and completion of the consent process has occurred on a separate visit which should be the case for the vast majority of patients.

Changes to dental health/medical history
Patients should be asked if there has been any change to either their dental health, i.e. the development of acute symptoms, or their medical history since their assessment visit. Any changes may necessitate a modification of the treatment plan on the day, or in certain situations, may lead to a requirement to postpone or even abandon treatment.

Equipment factors
All necessary equipment should be checked prior to bringing the patient into the clinical area. Whilst it is important that all equipment is readily available at the start of treatment, especially with regards to the need for a constant chaperone, all dental instruments are best kept out of sight of anxious patients wherever possible.

Below is a list of the equipment required for both IVS and IS in addition to that which is necessary for the planned dental treatment.

**Equipment for intravenous conscious sedation**
- Cannula and an appropriate method to secure it in place
- Sterile swabs
- EMLA or ethyl chloride spray for skin anaesthesia, where appropriate
- Syringes – correctly labelled including drug concentrations
- Microlance needles to draw up drugs
- Tourniquet
- Midazolam 1mg/ml
- Flumazenil 100µg/ml
- Saline to flush cannula
- Blood pressure monitor
- Pulse Oximeter
- Medical emergency kit, including oxygen, blood glucose monitoring kit, bag valve mask and portable suction
- Automatic external defibrillator

**Equipment checks for inhalation conscious sedation**
Before using any machine used for the delivery of IS, the following safety tests must be performed by a trained member of staff. For logistical reasons, it may be better to carry out checks at the start of a session if several patients are scheduled for treatment with IS.

Prior to treatment with IS the team must check that the
- Oxygen and nitrous oxide cylinders are correctly connected and there are adequate back up cylinders
- Tubing, connections and the nasal hood are all free of leaks
- Reservoir bag properly inflates without holes or leaks
- Oxygen fail-safe and emergency nitrous oxide cut-off is working properly
Pre-operative instructions

Patients should be provided with written and verbal pre-operative instructions at their assessment visit. These should give clear and concise information relating to the requirement for a suitable escort, childcare arrangements, fasting, after-effects and activities to avoid for the remainder of the day of treatment.

Instruction sheet for escorts

It can be very useful to provide a separate instruction sheet specifically for patients' escorts, detailing their responsibilities and the importance of their role. By providing this information on a separate sheet, its importance is emphasised and the sedationist is not solely reliant on the verbal communication between the patient and their escort.

Consent forms

It is beyond the scope of this article to discuss in detail the consent process and how it should be managed. However, from a logistical point of view a reliable and clear consent form is mandatory to allow for written and informed consent for both the planned dental treatment and conscious sedation technique. It is also advocated that a separate copy is given to either the patient or the patient's parent or guardian in the case of children.

Pre-sedation assessment form

Having a written form to provide a framework for patient assessment is an excellent method of ensuring assessments are carried out in a logical, systematic and consistent manner. This form gives the opportunity to record relevant aspects of the medical history, body mass index, pre-operative blood pressure (for patients planned for IVS) and to assign an ASA status. This form can also be used to record the patient’s anxiety levels and to provide a justification for treatment with conscious sedation, e.g. anxiety, invasiveness of treatment or medical issues. The pre-assessment form can also be used as an aide-memoire to check all relevant instructions and written information have been provided.

General information sheet relating to conscious sedation

Patients should be provided with some general written information relating to conscious sedation and what they might reasonably expect from their treatment appointment. This material may also give information about various conscious sedation techniques available including possible referral to more specialist centres or secondary care.

Clinical records and documentation

Clear, thorough and contemporaneous patient records are essential for all clinicians and this is no different for conscious sedation. All aspects of the assessment, treatment and subsequent review appointments should be accurately recorded and contain all relevant information relating to the patient’s treatment, any complications and discussions had with the patient or their escort. Patients should be provided with clear verbal and written information relating to both their planned dental treatment and the intended conscious sedation technique.

Below is a summary of possible documents that could be used when providing treatment under conscious sedation.

Medical history form

Patients planned for treatment under conscious sedation should be asked to complete a written medical history form in the same way as any other patient. This completed questionnaire should form the basis of the patient’s medical assessment and aid the clinician in identifying any possible contraindications to treatment with sedation.

Anxiety questionnaires

Anxiety scales, e.g. Modified Dental Anxiety Scale, are an excellent way of assessing a patient’s anxiety and thereby providing justification for treatment using conscious sedation. These calibrated and reliable questionnaires can be given to patients to complete whilst they are in the waiting room and can be used as an additional tool in treatment planning.

In addition to carrying out these safety checks, practitioners should have access to the same emergency equipment as with IVS, however, the use of pulse oximetry and blood pressure monitoring is not considered mandatory when providing IS.
Peri-operative monitoring sheet
This is a very important document and allows the sedation team to accurately record events and provide a true and contemporaneous account of the patient’s management. The value of a standardised form cannot be over-emphasised as it minimises the risks of important omissions and encourages information to be displayed in a clear, meaningful and easily interpreted fashion.

This form should contain details of the patient’s escort, transport arrangements, changes to medical history, details of the pharmacological agents used, including dose, batch numbers and expiry dates, regular monitoring of oxygen saturation, pulse and blood pressure as well as the patient’s level of consciousness and co-operation. In addition, it should demonstrate a clear timeline from the start of treatment until discharge and show that the patient has met the practice’s agreed discharge criteria before being allowed to leave the premises.

Post-operative instructions
Following treatment with conscious sedation, both the patient and their escort should be provided with verbal and written post-operative instructions relating to their dental treatment and sedation. Crucially, they should also be provided with appropriate emergency contact details in the event of significant problems. Some of this will be repetition from their assessment visit, but it is vital that all parties fully understand their responsibilities and requirements.

Patient feedback forms
Patient feedback and questionnaires are an integral part of modern healthcare. Regular feedback from patients is extremely useful to improve and develop services and to ensure the quality of care is constantly increasing and evolving.

Storage, handling and disposal of sedative drugs
Benzodiazepines are mainly classified as schedule 4 controlled drugs except for midazolam and temazepam which are schedule 3. The Misuse of Drugs Regulations 2001 outlines who is authorised to supply and possess controlled drugs within their professional capacity, and describes appropriate use and storage.

Following recommendations from the National Patient Safety Agency in 2008, midazolam should only be held in 2ml or 5ml ampoules at a standard concentration of 1mg/ml in dental practice.

Midazolam is exempt from safe custody requirements and can be stored on the open dispensary shelf, but temazepam must be stored in a locked controlled drug receptacle. Both drugs are subject to the same special handwriting requirements as all Schedule 3 controlled drugs, except that temazepam can be dispensed in response to a computer-generated prescription but the prescriber’s signature must be added by hand. There is no legal requirement to record transactions for these drugs in a controlled drug register.

All schedule 2, 3, and 4 (part 1) controlled drugs, including midazolam, must be denatured or rendered irretrievable before they are disposed of. Invoices relating to the purchase of all controlled drugs must be retained by the practice for a minimum of two years.

Storage, handling and disposal of gas cylinders
Gas cylinders used for inhalation conscious sedation should not be stored for excessive periods of time. To ensure cylinders are not stored for a long time a system should be implemented to encourage appropriate rotation of supplies such that the longest held gas cylinder is always the next one to be used.

Spare gas cylinders should ideally be stored in a dry, safe place, and on a flat surface. They need to be in an adequately ventilated building or part of a building specifically designated for this purpose. Spare cylinders containing flammable gas should not be stored in part of a building used for any other purposes and should be kept away from sources of ignition and other flammable materials. During storage gas cylinders must be protected from external heat sources which may adversely affect their mechanical integrity. Once empty, the valve on cylinders should be kept shut to avoid contamination.

All gas cylinders must be clearly marked to show what they contain and the hazards associated with their contents.

Gas cylinders must be transported safely by trained staff, adhering to specific guidance and policies. When lifting and moving gas cylinders, all personnel should use suitable cradles, slings, clamps or other appropriate
methods. The use of valves, shrouds and caps for lifting cylinders is not advised unless they have been specifically designed and manufactured for this purpose.

Scavenging equipment used with inhalation conscious sedation delivery systems must adhere to COSHH regulations, which recommend a flow rate of 45 L/min.

Maintenance and servicing of equipment and devices
Machines used in the delivery of sedative agents, monitoring equipment and emergency equipment all need to be serviced regularly by a qualified engineer, as per manufacturers’ instructions. All machines and equipment must conform to British standards and, where appropriate, undergo annual electrical (PAT) testing. Servicing records and logs need to be documented, kept up to date and a system needs to be implemented to ensure certificates do not expire. Furthermore, all equipment should be regularly checked via a systematic approach to ensure devices are in good working order, fit for purpose and, if appropriate, within their expiry date. These checks should be logged, recorded and signed off by the designated individual.

Practice facilities
As with all premises used for the provision of dental treatment, practices providing conscious sedation need to be fit for purpose and comply with all national guidelines and legislation including CQC, HTM 01-05, health and safety and equality and diversity legislation. In addition, there are other factors considered a minimum standard for premises providing conscious sedation.

There should be a separate recovery room away from the main waiting room to allow patients and escorts to remain in until they are ready to be discharged home. This recovery room should have access to an oxygen supply and emergency equipment readily available. The practice team should be organised to provide close supervision of patients during their recovery period.

In the event of an emergency, there should be unimpeded access to the surgery, waiting rooms and recovery rooms for additional members of the team and ambulance staff and their equipment. There needs to be sufficient space around the dental chairs within treatment rooms to be able to effectively deal with an emergency scenario and the dental chair should be capable of placing patients into a rapid supine position.

If stairs are present, the practice must develop appropriate emergency evacuation protocols to facilitate safe transportation of sedated patients down stairs and out of the building should the need arise, e.g. fire.

Practices should undergo regular independent inspection and review via an approved, transparent and robust process, e.g. using the Society for the Advancement of Anaesthesia in Dentistry’s ‘Safe Practice Scheme: Conscious Sedation Evaluation for Dentistry in the UK’.

Standard operating procedures
A standard operating procedure (SOP) provides an established procedure to follow in any given situation or scenario. This approach is highly recommended within conscious sedation practice to achieve consistency, accountability and high standards. A conscious sedation SOP will describe the current standard techniques recognised in the UK including the requirement for titration to clinical end-point as opposed to a fixed or bolus dose and information relating to the necessary support team.

Other general information contained within the SOP should include
• Specific responsibilities within the practice team
• Inspection by commissioners or other external organisation and appropriate time scales for review
• Appropriate review period of the SOP
• Lead author and named people contributing to the SOP

Additionally, to be compliant with the CQC’s Outcome 9 – Management of Medicines, practices must have a SOP relating to the safe and effective use of controlled drugs and appoint an accountable officer. This should include details of where controlled drugs are stored, who has access to them, security arrangements and who to alert should complications arise.

Team training
Practices providing conscious sedation must strive to deliver the highest possible standards of care for their patients. Conscious sedation requires a high degree of competence to deliver safe and predictable outcomes.
based upon sound theoretical and practical training for the whole dental team. As in all areas of dentistry, all staff must be suitably qualified, registered with the General Dental Council, hold indemnity insurance and appropriate CRB and employment checks must be completed.

The importance of a team approach to delivering high quality and safe conscious sedation cannot be over-emphasised. Teams should carry out regular training in sedation-related complications and medical emergencies through a scenario-based approach. BLS training should be completed annually as a minimum and further training in ILS including airway management and use of an AED is highly recommended.

Training for dentists
Formal sedation training for dentists should include didactic learning in combination with supervised clinical practice and these cases should be recorded and logged as described in the Dental Sedation Teachers’ Group guidance. The gold standard for dentists is the Diploma in Conscious Sedation for Dentistry or equivalent, e.g. MSc. Following basic training, skills and knowledge need to be kept up to date through focused continuing professional development (CPD) relating to conscious sedation, the management of medical emergencies and BLS or ILS training.

Training for dental nurses
The gold standard for dental nurses is to complete the NEBDN certificate in dental sedation nursing which involves completing a log book in the workplace of sedations and practical competencies, followed by ongoing verifiable and non-verifiable CPD.

It is acceptable for dental nurses to act as the second appropriate person following in-house training, as long as this training is thorough, documented, and covers the topics included in the NEBDN syllabus.

Audit and incident reporting
The need for constant re-evaluation and review is central to the maintenance and development of high standards of patient care. Practices should support a programme of regular clinical audit, exploring all aspects of their conscious sedation service.

Practices need to introduce a system of robust and transparent critical incident reporting which must be reviewed on a regular basis and findings shared amongst all staff. This should be delivered in a non-threatening, supportive fashion and managed in the spirit of improving standards, quality assurance and minimising risk and adverse incidents.

Conclusion
The expectations in terms of governance for conscious sedation are extensive and ultimately, practices will be judged against these standards by commissioners, the GDC and patients. Therefore, it is crucial they develop thorough, reproducible and effective systems targeted to deliver a consistently high standard of governance, management and organisation within their service delivery.

References
BUFFERED LOCAL ANAESTHETICS: 
THE IMPORTANCE OF pH AND CO₂

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Introduction

Local anaesthetics are the safest and most effective drugs in medicine for the prevention and management of pain. The dental profession depends upon local anaesthetics to provide patients with comfortable and pain-free treatment. Deposit a local anaesthetic near to a nerve and it will provide analgesia. Table 1 lists the local anaesthetic formulations available in the UK with their expected onset time (for initial signs of soft tissue analgesia) and durations of pulpal and soft tissue anaesthesia.

Yet despite the effectiveness of these drugs in providing pain control there remain a number of vexing “problems” that dentists must manage, primarily associated with the acidity of the local anaesthetic solution itself. These include: (1) pain during the actual administration (injection) of the anaesthetic solution; (2) a slower than desired onset of profound (pulpal) anaesthesia; and (3) less than optimal effectiveness when seeking to anaesthetise infected teeth.

Problems Associated with Standard Dental Anaesthetics

Issue 1: Acidity Causes Pain During Injection of Local Anaesthetics

Fear of pain is the most common anxiety for dental patients. As effective as local anaesthetics can be in

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset Soft Tissue (minutes)</th>
<th>Duration Pulpal (minutes)</th>
<th>Duration Soft Tissue (hours)</th>
<th>MRTD mg/kg</th>
<th>Absolute Maximum (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mepivacaine 3%</td>
<td>1.5 to 2</td>
<td>20 – infiltration 40 – nerve block</td>
<td>2 to 3</td>
<td>6.6</td>
<td>300</td>
</tr>
<tr>
<td>Articaine 4% + Epi 1:100K</td>
<td>2 to 3</td>
<td>60</td>
<td>3 to 5</td>
<td>7.0</td>
<td>440</td>
</tr>
<tr>
<td>Lidocaine 2% + Epi 1:80K</td>
<td>3 to 5</td>
<td>60</td>
<td>3 to 5</td>
<td>7.0</td>
<td>300</td>
</tr>
<tr>
<td>Mepivacaine 2% + Epi 1:100K</td>
<td>3 to 5</td>
<td>60</td>
<td>3 to 5</td>
<td>6.6</td>
<td>300</td>
</tr>
<tr>
<td>Prilocaine 3% + Fely 0.03 IU</td>
<td>3 to 5</td>
<td>60</td>
<td>3 to 8</td>
<td>8.0</td>
<td>600</td>
</tr>
</tbody>
</table>

Epi = Epinephrine (Adrenaline)  
Fely = Felypressin (Octapressin)  
MRTD = Maximum Recommended Therapeutic Dose (as per MHRA-SPC’S)  
MHRA-SPC = Medicines and Healthcare products Regulatory Agency - Summaries of Product Characteristics
REFEREED PAPER

preventing pain during treatment, patients fear the act of receiving the anaesthetic as much or more than they fear the dental procedure itself. The dental anaesthetic injection also provokes more emergencies than actual dental treatment. A survey of 4307 dentists in North America revealed a reported 30,608 medical emergencies occurring over their practice careers. Syncope (fainting) was the most common, accounting for 50.3% (N=15,407) of all emergencies.2 Asked for the location and timing of these emergencies, the respondents said that over half (54.9%) occurred either during or immediately following local anaesthetic administration.1

In her 2004 article in Dentistry Today “How Dentists are Judged by Patients”1 Jennifer de St. Georges reported that the most important factor cited by patients was whether the dentist delivered a painless injection. Fortunately, some injection pain can be managed or eliminated by choosing certain armamentarium discussed in the dental literature (smaller-gauge needles1-3) or adopting anaesthetic methodologies and delivery techniques (reducing the delivery rate of injection,4-6 warming the anaesthetic before delivery,7-9). Other techniques such as using topical anaesthetic and stretching the tissue prior to needle penetration are well known. All these can help provide more comfortable injections.5-7

Yet many patients still complain of a burning or stinging sensation as the first drops of anaesthetic are injected. This is called the “bee sting effect” and it is due to the acidity of the anaesthetic solution. On the pH scale, 7.0 is neutral, above 7.0 is basic, and below 7.0 is acidic. Human physiologic pH is 7.4. All injectable local anaesthetics (‘plain’ drugs with no vasoconstrictor) are slightly acidic. The pH of lignocaine ‘plain’ is about 6.4 which is relatively close to physiologic compared with the more commonly used local anaesthetics that contain a vasoconstrictor.8-10

Vasoconstrictors improve both the depth and the duration of analgesia. Table 1 shows that for the most commonly used dental anaesthetics, the addition of adrenaline makes pulpal analgesia last approximately 60 minutes, with soft tissue numbness lasting 3 to 5 hours or more. However, adrenaline oxidizes rapidly at or near physiologic pH, so an antioxidant (most commonly sodium bisulphite13) is added to the solution, lowering the pH of the typical dental anaesthetic cartridge containing adrenaline to approximately 3.5. Clinical studies in dentistry that have measured the pH of lignocaine-adrenaline cartridges have reported that the anaesthetic pH ranged from 2.8614 to 4.16.5 By comparison, lemon juice has a pH range of 2.2 to 2.6. It will come as no surprise to anyone that has ever had lemon juice touch a cut on his or her skin that bathing a needle wound in the patient’s mouth with an anaesthetic solution at pH 2.9 can create a significant amount of pain.

Although clinical investigators have been demonstrating the benefits of alkalinizing local anaesthetics for more than 100 years7 until very recently, unlike other healthcare practitioners that draw up their LA into plastic syringes and have been buffering their anaesthetics for decades, dentists have had no practical way to raise the pH of their anaesthetics, which are provided in standardized sealed cartridges for use in dental syringes. Dentists note that some of their patients do not react at all to the needle stick, but will “wince” as the first drops of local anaesthetic are deposited. There is now a way to address this problem by alkalinizing the dental anaesthetic cartridge (discussed below).

Issue 2: Acidity Causes Slow Onset of Pulpal Analgesia

On completion of the local anaesthetic injection, dentists wish to commence dental treatment as expeditiously as possible. To determine when treatment can typically begin, we must be sure that we use consistent concepts and terminology, for which there is not uniformity in the published literature or even in the collateral information that has been provided with dental anaesthetics.

Local anaesthetics do not immediately and completely diffuse across the nerve membrane to block Na+ channels, but rather this is a process with distinct phases. The initial phase produces soft tissue analgesia, and then as more diffusion takes place there is a second phase within which the patient achieves pulpal anaesthesia.

The amide anaesthetics are generally stated to have an “onset” of between 3 to 5 minutes,16,20 however these figures are for the end of the first phase of the diffusion process: soft tissue analgesia. These numbers do NOT represent the completion of the second and most important phase of the diffusion process, where surgical or pulpal analgesia occurs. Of course, pulpal analgesia should be the dentist’s objective, because it is the level of numbness necessary to complete most dental procedures painlessly. Keeping this in mind, it is fair to say that the dental anaesthetics provide...
anaesthetic literature has done no favours to the dental practitioner by creating an expectation that local anaesthetics have a 3–5 minute onset time (see Table 1). Many practitioners reading this article will note that they have (consciously or not) figured this out in their own practices, and they wait significantly longer than this as a matter of course before returning to the surgery to check if the patient is numb. Most dentists report that they come back into the surgery after between 10 and 15 minutes, which is usually long enough for most patients to have achieved sufficient analgesia to start the procedure (the exception being missed blocks, which will require a second injection).

As the foregoing discussion suggests, it is known from the results of several well designed clinical trials indicate that there exists a significant practical and clinical distinction between the time that a patient displays signs of soft tissue anaesthesia and the time that the same patient has achieved surgical or pulpal anaesthesia. Lai et al. in 2006 found that at 4 minutes after inferior alveolar nerve block (IANB) with lignocaine 2% with adrenaline 1:100,000, 70% of patients achieved soft tissue anaesthesia (as determined with a sharp dental explorer), yet only 25% had pulpal anaesthesia (determined with an electronic pulp tester – EPT). At 6 minutes these numbers were 85% soft tissue, 40% pulpal. Kanaa et al. (2006) found that at about 8 minutes following IANB with 2% lignocaine with 1:80,000 adrenaline, 100% of patients had tongue anaesthesia; 93% lip, while only 52% had pulpal anaesthesia of the 1st molar and 1st premolar, and 27% lateral incisor. These studies, and the extensive clinical experience of all dentists, demonstrate that anaesthesia of soft tissues (e.g. lip, tongue) is not a guarantee of pulpal anaesthesia.

For practitioners looking for information showing when they might expect a significant number of their patients to be ready for the start of a procedure, there is some excellent data available. An analysis of 21 clinical trials looking at the time course of pulpal anaesthesia following IANBs with lignocaine with adrenaline (N=1078 patients) shows that 60% achieved pulpal anaesthesia (with EPT) at 10 minutes, increasing to 67% at 15 minutes.

That makes 10–15 minutes a reasonable and practical waiting period. Bearing in mind that few general dentists assess a patient with a pulp tester before beginning a procedure, the reader can appreciate that waiting a sufficient amount of time for most patients to become numb is the dentist’s best defense against having a patient “jump” whilst in the chair, when the procedure is begun. It is likely true that many of the patients that are not what we might describe as “stone cold numb” having achieved pulpal analgesia may nevertheless be well on their way down the anaesthesia continuum toward pulpal analgesia, meaning that every patient capable of feeling the procedure will not be in severe pain. In fact, we have spoken with patients who reported that they were not completely numb during a procedure, yet they consciously chose not to stop the doctor by raising their hand to indicate they weren’t completely numb, because they would rather take some continued procedural pain than subject themselves to another injection. Hopefully that is not a common occurrence. According to Fernandez and colleagues, the peak percentage of patients achieving surgical analgesia occurs at 45 minutes, where 95% of patients receiving an IANB had no response to an electrical pulp tester on the 2nd premolar.

Practitioners have to make a practical choice as they decide when to start their procedures and we have never heard anyone say they wait 45 minutes. The fact that most dentists deliver a block or an infiltration and wait approximately 10–15 minutes to start the procedure shows that most dentists have a practical awareness that their patients are generally going to be numb enough by this time for the procedure to begin and, if they are not yet numb, an appropriate amount of time has elapsed to deliver a second injection.

Still, having made the case that without much help from the textbooks and/or the manufacturers’ package inserts, dentists have found the right 10–15 minutes to excuse themselves from the surgery while the anaesthetic takes effect, the question stands whether local anaesthetics work as quickly as the dentist would like, and whether there is anything that can be done to make anaesthetic work more quickly. The answer may be “yes” and again the solution may be pH adjustment.

**Issue 3: Acidic Local Anaesthetics Work Poorly on Infected Teeth**

Finally, when it comes to the common complaints we hear most often regarding the way local anaesthetics perform, there is the infected tooth. The complaint usually involves an infected mandibular molar in need of pulpal extirpation or extraction. Many dentists know this situation to be the most difficult clinical scenario in which to achieve effective pulpal anaesthesia.
A monograph by the American Association of Endodontists describes several reasons why problems occur attempting to achieve pulpal anaesthesia in IANBs and how to overcome these issues. Fernandez, Reader, Beck and Nuestein wrote that one of the primary reasons that IANBs do not achieve adequate pulpal anaesthesia is that inflamed and infected tissues are more acidic than healthy tissues, and the acidity reduces the amount of base form of the anaesthetic that is capable of diffusing across the nerve membrane. Because the pH of the tissues (or more precisely the anaesthetic deposited into those tissues) largely determines how much de-ionized or “active” anaesthetic is available to block the nerve, if the patient has a “hot tooth” the infection and the accompanying acidity of the tissues means that there will be less of the de-ionized or “active” local anaesthetic in the area of the nerve being blocked, thus there will be less “active” anaesthetic that can cross the membrane and block the sodium channel.

Moreover, nerves associated with infection and inflamed tissue have altered resting potential and decreased excitability thresholds, minimizing the ability of local anaesthetics to prevent impulse transmission. Finally, patients already in pain from an infection and the accompanying inflammation are frequently apprehensive, which lowers their pain threshold. Local anaesthetics are very effective drugs . . . if enough of the drug crosses the nerve membrane and enters into Na+ channels to provide anaesthesia. In the vicinity of an infection, according to De Jong and colleagues, ambient tissue pH is considerably below normal, in the range of pH 5.0 to 6.0. In the concluding section we discuss how alkalinizing the anaesthetic can make a difference for patients with hot teeth.

How Local Anaesthetics Block Nerve Conduction

Local anaesthetics are injected as near to the target nerve as possible. The drug must then diffuse across the highly lipid nerve membrane to reach the inside of the nerve where the anaesthetic then enters Na+ channels to block nerve conduction. If we consider the local anaesthetic to be RN (e.g. lignocaine, articaine), then within an anaesthetic solution that contains adrenaline we find the following: (1) RN – the ‘base’ form of the LA; (2) H+ – hydrogen ions. The more acidic (lower) the pH of the solution, the more H+ is present; and (3) RNH+ – the joining of RN and H+. The percentage of each ionic form (RN and RNH+) of LA present in solution can be determined from the Henderson–Hasselbalch equation. At a 3.5 pH, 99.994% of a lignocaine with adrenaline solution exists in the RNH+ ionic form.

These percentages are clinically significant in that both RN and RNH+ are important in blocking nerve conduction. The RN form is lipid-soluble, thus is able to diffuse from the site of administration through tissues across the lipid-rich nerve membrane. Once inside the nerve the RN picks up a H+ becoming RNH+ which traps it inside the nerve. It is the trapped RNH+ form of the drug that blocks the sodium channel and inhibits the action potential of the nerve. According to the Henderson–Hasselbalch equation, in an anaesthetic cartridge containing lignocaine with adrenaline at a pH of 3.5, only 0.006% of the lignocaine will be in the drug’s active RN form. This is a major reason for the slow onset of anaesthesia. However the natural buffering capability of the human body is generally quite effective at raising the pH of an injected solution, albeit quite slowly towards the body’s normal pH of 7.4, where a much higher percentage of the drug is in the RN form, as described below. According to De Jong and colleagues, where the local anaesthetic contains adrenaline and has a pH around 3, this transformation occurs over a prolonged 45-minute period. As the starting pH of the local anaesthetic rises, according to the Henderson–Hasselbalch equation, so does the percentage of the RN in the active de-ionized form. If for instance the pH of the local anaesthetic is raised to 6.5 immediately before it is injected, for instance, 3.83% of lignocaine in the solution would be in the active RN form. At 7.1, the percentage would be 13% and at 7.4, it would be 24.3%. Obviously, in terms of onset time, all other things being equal, using local anaesthetic having a pH that is near physiologic would be optimal. Since local anaesthetics containing adrenaline provide the duration of analgesia necessary for dental procedures, and since local anaesthetics containing adrenaline must be formulated at a relatively acidic pH in order to remain effective on the shelf, one obvious question is whether the anaesthetic can be alkalinized just before the injection to make more of the active RN form of the drug immediately available, reducing the time necessary to achieve pulpal analgesia.

A Possible Solution to Issues Caused by Acidic Local Anaesthetics

Given the fact that local anaesthetics are extremely effective drugs but that there are ‘issues’ related to (1) speed of onset, (2) patient comfort and (3) effectiveness, research has continued into methods of improving these drugs, including into methods of alkalinizing anaesthetics in dentistry just before injection. Despite the fact that dentistry is the healthcare specialty with the longest history of use and most regular current use of local
anaesthetics in medicine, dentistry comes last to the art and science of pH buffering. Various other medical professionals utilise local anaesthetics to one degree or another: Ear-Nose & Throat specialists (ENT); Plastic & Reconstructive surgeons; Obstetricians; Dermatologists, Critical Care specialists, Podiatrists. These specialties use lignocaine plain or with adrenaline most frequently. Medical doctors employing local anaesthetics rarely use the sealed cartridges that are commonplace in dentistry, instead typically drawing the anaesthetic from a multidose vial into a disposable plastic syringe for delivery. Because it is quite easy to draw a small amount of bicarbonate from a vial into the same syringe, allow the two to mix, and then deliver a pH buffered anaesthetic injection, buffering outside dentistry has been taking place for decades. Depending on the mixing and delivery methods, the clinical results have been quite varied, ranging from resounding success to utter failure.45-48

What is a buffer?

A buffer is an aqueous solution consisting of a mixture of a weak acid and its conjugate base or a weak base and its conjugate acid. Its pH changes very little when a small amount of strong acid or base is added to it and thus it is used to prevent any change in the pH of a solution. Buffer solutions are used as a means of keeping pH at a nearly constant value in a wide variety of chemical applications. Many life forms thrive only in a relatively small pH range so they utilise a buffer solution to maintain a constant pH. One example of a buffer solution found in nature is blood. As applied to local anaesthetics, a buffer with a basic pH is added to the highly acidic local anaesthetic solution to raise the anaesthetic pH to that of the buffer.

Buffering local anaesthetics

By raising the pH of the anaesthetic solution it is theoretically possible to eliminate, or at least minimize, pain on injection, slow onset, and decreased efficacy in the presence of infection. The medical and dental literature is replete with studies attempting to accomplish these goals.

Davies conducted a meta-analysis of twenty-two prospective, randomized, controlled human trials evaluating pH buffering as a means of reducing anaesthetic injection pain, that included two studies in dentistry.49 He concluded that buffering provides a significantly more comfortable injection and that it may be particularly helpful for injections in sensitive areas such as the face and head, or when injection pain can cause difficulty in providing treatment, such as with pediatric patients. Other meta-analyses have likewise concluded that buffering results in a more comfortable local anaesthetic injection.50,51

Most recently, the Cochrane Collaboration completed a systematic review of 23 peer-reviewed published studies on buffering lignocaine and lignocaine with adrenaline, concluding that buffering decreases injection pain and improves patient satisfaction.52 Even so, the magnitude of the benefits of buffering is not uniform in these studies and buffering has yet to be adopted widely in the clinical practice in dentistry.

To what pH should the solution be raised to gain optimal results? Raising the pH of the anaesthetic solution from approximately 3.5 to over 7.0 appears to provide the greatest improvement in the results of clinical trials. Trials generally did not show improvement where the unbuffered anaesthetic solution was already near a pH of 7.0 or where the buffered anaesthetic was not raised above pH 7.0. This suggests that a meaningful performance improvement is probably achieved by buffering to 7.0 or more.

On the other hand, buffering lignocaine with adrenaline above 7.6 is known to cause the local anaesthetic to begin precipitating out of solution (Figure 1). Accordingly, buffering lignocaine and lignocaine with adrenaline to a range of 7.0–7.4 is probably optimal in terms of efficacy in improving performance, and in terms of safety to avoid over-buffering.

One precautionary note in this analysis has to do with buffering local anaesthetics other than lignocaine and lignocaine with adrenaline. There are well in excess of 50 published studies conducted over 30+ years evaluating the use of sodium bicarbonate to buffer 1% or 2%
lignocaine solutions, either with or without adrenaline. Among these studies, there are no reported adverse events, representing a strong indicator that this long-standing practice is as safe as these studies have shown it to be effective. On the other hand there are no clinical studies on buffering of 4% local anaesthetic solutions commonly used in dentistry (prilocaine, or articaine). In fact, with respect to articaine, there has never been a clinical study of any kind in medicine evaluating either the efficacy of buffered articaine or the safety of buffering articaine using sodium bicarbonate. Until there is such a study, there can be no basis for recommending buffering articaine in clinical practice.

One collateral benefit of buffering lignocaine and lignocaine with adrenaline using sodium bicarbonate solution is that, in addition to reducing injection pain and speeding the onset of analgesia, the buffering process itself creates free CO₂ in solution, which becomes part of the injection – provided that the injection is delivered within 30 or 45 seconds of buffering the anaesthetic. Bokesch et al. demonstrated the importance of this CO₂ when they showed a significantly more profound conduction block with lignocaine if free CO₂ was present in the solution. Similarly, Raymond et al. reported that free CO₂ made lignocaine twice as potent, while Condouris and Sakalis reported that free CO₂ in solution created a ten-fold increase in procaine action. This suggests that the creation and retention of free CO₂ in the bolus of the injection may affect the results observed in local anaesthetic buffering studies, as well as improving the results that can be achieved by buffering in clinical practice. Surprisingly, some of the buffering primers that have discussed the compounding processes and ratios for buffering lignocaine and lignocaine with adrenaline, fail to instruct practitioners that they should take advantage of the CO₂ created by the process. Instead the investigators in these studies buffered anaesthetic solutions in open beakers or graduated cylinders which would have allowed this beneficial CO₂ to escape. In addition, as CO₂ left the solution the pH of the solution would begin to rise, such that the practitioner would lose control of the pH of the buffered anaesthetic. An optimal method for buffering dental cartridgés of lignocaine and lignocaine with adrenaline would make it possible to preserve the CO₂, and to inject almost immediately after buffering.

When one considers any process for buffering dental anaesthetic, the anaesthetic cartridge provides a unique challenge for mixing and delivery. Cartridges do not lend themselves to the easy addition of buffering solution. In fact, at least one study noted that relatively few dentists knew about anaesthetic buffering when compared to other medical specialists attributing the difference specifically to the fact that the dental anaesthetic cartridge does not present the practitioner with an easily buffered container.

**Dental Anaesthetic Buffering System**

An automated buffering system was introduced in the United States in 2010 that uses the anaesthetic cartridge itself as the mixing vessel. It is expected to be available outside the US in the first part of 2014. This product takes advantage of the sealed dental anaesthetic cartridges to preserve the dissolved CO₂ just mentioned, making this CO₂ available in the bolus of the injection. In this context, the dental anaesthetic cartridge is actually superior to the plastic syringe as a mixing and delivery vessel for buffered local anaesthetic. The automated system is also designed to make the cartridge buffering process more precise as well as more convenient for delivering the buffered anaesthetic immediately after buffering. (Figure 2).

- **Figure 2.** Buffering system for dental local anesthetic cartridges (assembled)

**Conclusions**

Although anaesthetic buffering has been studied since the early 20th century and utilised regularly for decades, the relative volatility of the CO₂ present in buffered anaesthetic and the buffering solution itself may not have been widely appreciated. This volatility may have affected...
the outcomes that buffering researchers and clinical practitioners have observed. Other factors such as the starting pH of the buffering solution, delay in administering buffered anesthetic, and adsorption of deionised anesthetic in the mixing and delivery armamentarium may also have had an impact on the results observed in the studies.

It would benefit dental practitioners and dental patients if the benefits of buffering were repeatable and reliable, and if they were available via a buffering system that incorporated the standard dental anesthetic cartridge, and could be used without altering the dentist’s injection armamentum and technique. The automated buffering system mentioned above was released in the US in 2010 and has been used in over 1 million local anesthetic injections to date (November 2012). Buffered anesthetic now provides a way to address the three vexing problems associated with the acidity of local anesthetic, which include: (1) pain during the actual administration (injection) of the anesthetic solution; (2) a slower than desired onset of profound (pulpal) anaesthesia; and (3) less than optimal effectiveness when seeking to anesthetize infected teeth.

The clinical significance is that buffering reportedly reduces onset time enough so that dentists may administer anesthetic, stay with the patient and complete the procedure. This may eliminate the long-standing, but impractical, routine of injecting, then leaving the surgery. By making it practical to deliver anesthetic and go right to work, buffering allows the practice to adopt a more natural and efficient workflow, focusing on one patient and procedure at a time. The benefits that this routine may provide to the dentist, the dental staff and the patient have the potential to be transformational, and should be worthy of separate discussion.

Disclosure
Dr. Malamed is a consultant to Onpharma, Inc. Dr. Falkel is co-founder and Chief Medical Officer of Onpharma, Inc.

References


36. Mikesell A, Drum M, Reader A, Beck M, Anesthetic Efficacy of 1.8mL and 3.6 mL of 2% Lignocaine with 1:100,000 Adrenaline for Maxillary Infiltrations, J Endod 34(2):121-125, 2008.


38. Lawaty I, Drum M, Reader A, Nusstein J, A Prospective, Randomized, Double-Blind Comparison of 2% Mepivacaine with 1:20,000 Levonordefrin Versus 2% Lignocaine with 1:100,000 Adrenaline for


Abstract

In the UK, Dental General Anaesthesia (DGA) was removed from primary care at the end of 2001. Since then anxious and ‘difficult’ paediatric dental patients have been treated using local anaesthesia with or without conscious sedation. Evidence has been lacking as to the safety and efficacy of paediatric dental sedation in primary care. Various centres have presented evidence of good clinical practice1,2,3 when anaesthetist-led. This study describes an audit of 500 children treated using intravenous midazolam and ketamine, by an operator-sedationist in a primary care setting.

Aim

To determine whether a combination of intravenous midazolam and ketamine (IVMK) is safe and effective for paediatric dental sedation.

Objectives

• To determine the success rate of the procedure, i.e. whether the proposed dental treatment could be carried out successfully using this sedation technique.
• To determine whether the technique is safe by measuring the arterial oxygen saturation and heart rate during treatment as well as monitoring the level of consciousness.
• To determine the quality of the sedation by recording movement, sedation, crying and the Ellis’ Behavioural Score4.
• To record the type of dentistry carried out.
• To record the duration of treatment episodes.
• To record any adverse effects during and after treatment in the recovery area and during the first 24 hours following the procedure and for the first week post-operatively by way of a telephone interview.
• To determine the acceptability of this technique from the patients’ perspective.
• To determine the acceptability of this technique from the parents’ perspective.

Introduction

Since their inception, time-honoured techniques of sedation have proven to be safe and invaluable in the management of fearful and apprehensive patients. However, an attempt to extend the usefulness of these techniques to extremely difficult to manage children has, on occasion, produced disastrous results. The concept that if a little is good, a lot is better, has resulted in the production of serious morbidity and mortality.5 Without doubt, the respiratory depressant effect of drug overdoses was the culprit in the majority of cases.

Dissociation-sedation

A safe alternative to general anaesthesia has led to the development of another entity; “dissociation-sedation”. Dissociative anaesthesia was developed following the introduction of ketamine in the 1970s. Experience of this in adults showed that induction and emergence from the dissociative anaesthetic state (periods during which low drug levels were in effect) patients were able to respond rationally to verbal command, co-operated in a robotic fashion, appeared to possess a degree of analgesia, and yet had little recall of the period. Some say that there is no difference as far as depth of sedation goes with ketamine sedation and that small doses produce minimal sedation, higher doses produce moderate sedation and still higher doses produce deep sedation/GA.6 My view is that the sedation is different as the patient is detached from most stimuli while the vital signs are stable and the patient is none the less responsive to verbal command.
These observations led to the speculation about the feasibility of using low dose ketamine to produce a sedative rather than an anaesthetic state. Trials were successfully conducted in adults. Success of the dissociative analgesic state relied heavily on the judicious use of local anaesthesia for the control of intraoperative pain.

The greatest success was obtained using a loading dose of 0.25mg/kg followed by a continuous infusion of 0.05mg/kg/min. The dissociative sedation state is characterised by various patient reactions:

Table 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Consciousness</td>
<td>Assuming that the patient is of normal intellect and of sufficient age, rational response to verbal commands will be noted</td>
</tr>
<tr>
<td>Co-operation</td>
<td>Even the most obstreperous patients have been known to behave in a docile fashion</td>
</tr>
<tr>
<td>Robotic Behaviour</td>
<td>Movement is rigid and often exaggerated</td>
</tr>
<tr>
<td>Amnesia</td>
<td>Often total amnesia is obtained.</td>
</tr>
<tr>
<td>Analgesia</td>
<td>Although some analgesia, regional blocks are recommended for treatment. Often very little discomfort is shown when administering local anaesthetics in the mouth.</td>
</tr>
</tbody>
</table>

Protective reflexes remain intact throughout the operation. Ketamine is a dose-dependent respiratory depressant similar to that of opioids, but none was observed in the concentrations which we were using. The doses required for respiratory depression and airway problems are way in excess of our clinically required doses in this study. Furthermore in other studies apnoea, airway obstruction and laryngospasm have been reported, but these have been in much higher doses of ketamine. Coté reports that the hallmarks of ketamine are the preservation of the respiratory drive and airway patency in most patients. He goes on to state that “ketamine is a particularly useful drug with a wide margin of safety”. Dreams occur, but they tend to be of a pleasant nature. Bad dreams tend to be dose-related and are more prevalent in adults than in children.

The aim of using sedative drugs in paediatric patients is to diminish fear, pain and anxiety, thereby creating behaviour that will facilitate the provision of quality dental care. This will help the child get through a difficult treatment without a negative psychological response and help the child learn to cope with future treatment in the dental surgery. The ideal sedative for paediatric dental outpatient procedures would be effective, have a rapid onset, have a wide margin of sedation gap (difference between the therapeutic and toxic doses), have a reversal agent or not require a reversal agent (e.g. propofol with a short t ½), be inexpensive and easy to administer. It would carry minimal risk of cardiorespiratory suppression or prolonged CNS depression. It may also have analgesic properties. It should be able to be titrated against the patients’ response.

Method

Study Design: A prospective clinical audit of 500 cases of IV midazolam and ketamine.

Patient Selection

General Dental Practitioners referred anxious and uncooperative paediatric patients to a specialist dental Sedation Centre where the children had previously failed to have the necessary dental treatment completed at their own dentists. The Leagrave Dental Anaesthetic Clinic accepts patients who require anxiety management, patients with special needs and surgical dentistry from general dental practitioners, hospitals and from the community dental service. The patients in this study were referred to the clinic from Bedfordshire and from the surrounding counties. In excess of 1000 patients were treated under general anaesthetic in 2001 and dental treatment was provided under various form s of sedation for nearly 4000 patients annually. Sedation modalities include inhalational sedation with nitrous oxide and oxygen, oral and intranasal as well as intravenous sedation. Since 2002 only conscious sedation has been performed at the clinic. It is difficult to determine what percentage of children received this technique out of the range of sedation modalities.

The referral letter provided the name, age, sex, relevant medical history, treatment plan, risks and the reason for referral for dental general anaesthesia or sedation.

On the basis of the referral form, the patient was invited to take part in the audit.
Inclusion criteria:
• The patient must have been referred for a general anaesthetic or sedation.
• The patient must be between 2 and 16 years old.
• ASA I or ASA II.
• Have no respiratory tract infections.

Exclusion criteria include:
• Cardiovascular disease, history of head injury, CNS lesions, prior adverse reaction to ketamine, porphyria, glaucoma, thyroid disorder or psychosis.
• Dental treatment included extractions, restorative, mixed extractions and restorative with or without preventive treatment.

A letter of invitation along with an explanation of the procedure was sent to the patients with an appointment for the procedure. Patients who were premedicated or given intranasal or inhalational sedation were excluded from the audit. The first 500 cases where intravenous midazolam and ketamine were used were audited. This specific technique was used as it was taught as part of an advanced sedation course which had high efficacy and safety. Parents were required to confirm their appointments by telephone and discuss any concerns that they might have. Parents had the opportunity to cancel the appointment or insist on an alternative sedation technique or referral to hospital for a GA appointment if they thought that their child had severe behaviour management problems and would not be able to cope with treatment under sedation. A dental examination was performed and the treatment plan was confirmed with the parent. An appropriate sedation technique was discussed with the parent and consent was obtained. An information leaflet about the sedation technique was given to the parent along with pre- and post-operative instructions.

Children were asked to starve for 4 hours before the appointment and were limited to clear fluids for 2 hours before their appointment. Parents were asked to ensure that they did not starve the patient for longer than 4 hours.

At the appointment the patient was:
• Weighed.
• Medical history completed and checked and the presence of a respiratory tract infection excluded.
• ASA status determined.
• Dental examination carried out.

Appropriate radiographs taken and checked.
• Anxiety level determined using a modified Venham1 visual analogue scale using 5 pictures of facial expressions ranging from anxious and distressed to happy and relaxed with each being assigned a numerical value.
• Co-operation was assessed by using a 4-point scale (0–3) with one point being awarded for each action which the child would be able to carry out:
  1) to sit alone in the dental chair.
  2) to open their mouth and permit a dental examination.
  3) to allow any dental instruments into their mouth.
• Explanation of procedure was given and consent obtained.
• Baseline arterial oxygen saturation and heart rate obtained with a Nellcor N-180 pulse oximeter.
• Treatment plan formulated.
• Telephone number obtained and preferred hours to be contacted one week post-operatively.

The children and their parent(s) were informed that the treatment could be stopped at any stage and that a general anaesthetic would be arranged at a subsequent appointment at their local district general hospital.

The first 500 patients receiving IV midazolam and ketamine took part in the audit.

Clinical Technique
Parents were encouraged to stay in the surgery and be supportive throughout the treatment. Rapport was rapidly gained with the dental nurse who accompanied the child from the weigh-in, placing of the finger probe, holding of the hand while the teeth were checked and while having a ride in the dental chair. Continuous monitoring of the heart rate and oxygen saturation by pulse oximetry was obtained for the duration of sedation and the recovery period. Oxygen, advanced airway adjuncts suction and emergency drugs were immediately available during sedation and the recovery period. Venous access was obtained using a 22 gauge Venflon cannula usually in a superficial vein on the dorsum of the hand or the cubital fossa. Parents were asked to distract the child during this procedure while the nurse stabilised the child’s hand for venepuncture.

Midazolam 0.05–0.1mg/kg (maximum) was administered by slow IV titration (and after 1 minute of midazolam administration, a ketamine dose of 0.25mg/kg was administered IV). During this time the
pulse rate and oxygen saturation were monitored. The 10mg in 5ml IV solution of midazolam was used and ketamine 50mg/ml diluted to 5mg/ml for intravenous use.

The patient was allowed to cuddle or chat to the parent or staff member for 1 minute. Bubblegum-flavoured topical anaesthetic (20% benzocaine gel) was placed on the injection site of the oral mucosa. Arterial oxygen saturation and heart rate were read at various time intervals following the introduction of midazolam and ketamine by the dedicated sedation nurse contemporaneously:
1. intra-oral injection
2. + 5 minutes
3. + 10 minutes
4. + 15 minutes

All episodes of desaturation and other complications intra- and post-operatively were noted. Desaturation was defined as a decrease of more than 8% from the baseline saturation for longer than 2 seconds and less than 20 seconds. If desaturation occurred the position of the pulse oximeter probe was checked and then the position of the head and neck was checked and adjusted, if required. Desaturation was assumed to represent either respiratory obstruction or respiratory depression. Pulse oximeter alarm limits were set at 90% for oxygen saturation and for pulse rate, the upper limit was 150 beats per minute and the lower limit being 50 beats per minute.

Local anaesthesia was mostly achieved by buccal infiltration of articaine 4% with 1:100 000 adrenaline solution or by inferior dental nerve block injection. Palatal and lingual anaesthesia was achieved increasing the depth of papillary infiltration around the teeth, i.e. chasing anaesthesia. Inferior dental nerve blocks were used for lower molar extractions. Treatment was carried out as soon as the patient was sufficiently co-operative. If the patient was not co-operative, additional ketamine was administered in doses of 0.125-0.25mg/kg and at various stages of treatment where the patient was deemed to be too restless at that stage. The target zone was conscious sedation with eyes open or closed, but the child is responsive to verbal contact, i.e level 3 on the sedation scale. During ketamine dissociation-sedation the eyes rarely close. In recovery, the patient was monitored by nursing staff until able to walk, drink clear fluids (if not nauseated), and give age-appropriate responses to verbal commands and discharged using the Aldrete scale\textsuperscript{12} for consistency.

**Peri-operative Evaluation**
Acceptability of cannulation was determined acceptable if the child did not cry on cannulation.

<table>
<thead>
<tr>
<th>Table 2. Movement scale</th>
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<tbody>
<tr>
<td>Rating Scale for Movement</td>
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<tr>
<td>Hysterical Movement, Uncontrollable, Treatment Impossible</td>
</tr>
<tr>
<td>More movement Interferes with Treatment</td>
</tr>
<tr>
<td>Little Movement Not Interfering with Treatment</td>
</tr>
<tr>
<td>No Movement</td>
</tr>
</tbody>
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<tr>
<th>Table 3. Crying scale</th>
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<tbody>
<tr>
<td>Rating Scale for Crying</td>
</tr>
<tr>
<td>Hysterical Treatment Impossible</td>
</tr>
<tr>
<td>More Crying Interferes with Treatment</td>
</tr>
<tr>
<td>Little Crying Not interfering with Treatment</td>
</tr>
<tr>
<td>No Crying</td>
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<th>Table 4. Sedation scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedation scale – modified Ramsay scale</td>
</tr>
<tr>
<td>Fully awake and orientated</td>
</tr>
<tr>
<td>Drowsy</td>
</tr>
<tr>
<td>Eyes closed or open, responds promptly on verbal commands</td>
</tr>
<tr>
<td>Eyes closed, rousable on mild physical stimulation</td>
</tr>
<tr>
<td>Eyes closed, unrousable on mild physical stimulation</td>
</tr>
</tbody>
</table>

The modified Ramsay Scale was used (table 4). Oxygen saturation and heart rate were noted at specific intervals.
Data relating to patient, dental and sedation variables was collected as the patients were treated, in the recovery room and by a post-operative questionnaire about sedation morbidity (24-hour follow-up). Patient and parent satisfaction with the sedation procedures was also collected by recording data from the post-operative questionnaire.

### Results

#### Table 6: Patient Characteristics

<table>
<thead>
<tr>
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<th>Mean (SD)</th>
<th>Range</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>6.57 (2.9)</td>
<td>2-18</td>
</tr>
<tr>
<td>Male/Female</td>
<td>263/237 (53%/47%)</td>
<td></td>
</tr>
<tr>
<td>Mean weight kg (+/- SD)</td>
<td>26.2 (11.8)</td>
<td>12-91</td>
</tr>
<tr>
<td>ASA (I/II/III)</td>
<td>414/76/3 (84%/15%/1%)</td>
<td></td>
</tr>
<tr>
<td>Cannulation Acceptable/Not</td>
<td>343/157 (69% /31%)</td>
<td></td>
</tr>
<tr>
<td>Treatment duration mins (+/- SD)</td>
<td>15 (7)</td>
<td>5-45</td>
</tr>
<tr>
<td>Recovery duration mins (+/- SD)</td>
<td>25 (14)</td>
<td>10-115</td>
</tr>
<tr>
<td>Total midazolam dose mg/kg (+/- SD)</td>
<td>0.1 (0.05)</td>
<td>0.05-0.2</td>
</tr>
<tr>
<td>Total ketamine dose mg/kg (+/- SD)</td>
<td>0.42 (0.24)</td>
<td>0.2-1.25</td>
</tr>
</tbody>
</table>

In 50% of cases the patients required the midazolam and only the initial bolus of ketamine to induce the dissociative-sedation state. In the other children more increments of ketamine were titrated as required to permit adequate sedation for treatment to be completed. Doses of midazolam at 0.1 mg/kg ranged from 1-6mg. Total doses of ketamine ranged from 3–44mg with average dose being 0.42mg/kg (SD=0.24) with the median dose being 0.3mg/kg. Only 9 (3%) patients received more than 1mg/kg in total for the treatment visit. (Table 6)

A ‘paradoxical effect’ was observed in 12 (2.4%) patients.

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The quality of sedation was assessed by the dentist based on the ability to perform the procedure as planned and by the parents based on their perception of their child’s comfort level during the procedure.
Previous dental GA experience was enjoyed by 11.9% of the children. It was thought important to see how they would adapt to sedation and what the parents would prefer.

A total of 444 extractions were carried out with a maximum of 11 teeth extracted in a single patient. A total of 794 restorations were carried out. 1243 teeth received treatment (mean=4 per sedation session).

**OXYGEN SATURATION**

Only one child desaturated with an oxygen saturation falling to 89%. This was a very anxious child who vomited intra-operatively. His pharynx was promptly cleared and within seconds his saturation levels were above 98%.

Pulse rates usually increased a little after the administration of IV ketamine and would increase significantly for a minute after the administration of articaine 4% containing 1:100 000 epinephrine. The pulse rate then rapidly returned to normal pre-operative levels with the rate declining by +/- 5% during the dental treatment. There were no cases where bradycardia was recorded. There was also no respiratory depression requiring respiratory support, additional oxygen or reversal of sedation.

**Side-effects during recovery**

Most patients exhibited diplopia during the recovery phase. Blurred vision was common but after 15–20 minutes vision returned to normal. Five patients vomited in the recovery room. Twelve patients exhibited a degree of disinhibition and appeared to be disorientated. Two patients accidentally pulled their cannulas out. Some of the disinhibitory reactions started during the treatment phase. Inconsolable crying also occurred in eight of these cases.

**Dental Treatment**

A total of 794 restorations were carried out. 1243 teeth received treatment (mean=4 per sedation session).
patients. Unpleasant hallucinations were only reported in one patient during recovery. A mild, transient skin rash occurred in one patient and one patient had hiccups in the recovery room.

**POST-OPERATIVE POSTAL QUESTIONNAIRE**

Only 310 out of a possible 500 (62%) replies were received from the parents.

**ANALYSIS OF SEDATION LEVELS AFTER LEAVING THE CLINIC**

The target zone for all sedation during dental treatment was level 3 – eyes open or closed with patients responsive to verbal stimuli. Levels of sedation were documented during the first 24 hours after leaving the clinic. Levels of sedation during the journey home and on arrival home were also documented. Readings were followed up after 4, 8, 12 and 24 hours.

The State of Mind following sedation was documented during the first 24 hours after leaving the clinic. The State of Mind during the journey home and on arrival home was also documented. Readings were followed up after 4, 8, 12 and 24 hours.
All parents were asked to give a satisfactory rating score out of 10 for the dental treatment and how their child was managed under sedation and recovery. The average score was 8.62 (SD=1.7) with the median score being 9.

Discussion

In our experience, the combination of IV midazolam and IV ketamine provides safe, effective sedation for procedures in children. Midazolam and ketamine have been used to provide sedation for invasive procedures in paediatric oncology patients with good results. This combination consists of a good anxiolytic and sedative agent (midazolam) with a second agent that has both sedative and analgesic properties (ketamine). Although both midazolam and ketamine have been shown to be effective when used as single agents for sedation and analgesia, significant variation in the sedative response to midazolam has been reported previously. The use of high doses of midazolam is more liable to produce respiratory depression. When ketamine is used on its own, there may be an increase of emergence reactions that both the patient and the parents may find unpleasant. The use of a benzodiazepine with ketamine has been shown to result in fewer and less severe dysphoric reactions. This combination permits the need for less ketamine administration, and creates more amnesia of the procedure, and less risk of respiratory depression resulting from the lower dose of midazolam administered. The addition of midazolam to ketamine has also been shown to reduce or eliminate many of the undesirable cardiovascular effects observed when ketamine is administered as a single agent (e.g. hypertension, myocardial depression and increased pulmonary pressure).

This combination of drugs has advantages over many other sedative and analgesic agents in that therapeutic plasma levels can be obtained with oral, rectal, sublingual, nasal, and intramuscular administration. This ability to achieve therapeutic drug levels may be realistically achieved via different routes of administration and adds to this technique's flexibility.

The Population

Following a review of various sedation techniques which we perform at the clinic, i.e. inhalation with nitrous oxide and oxygen, oral sedation, oral and intravenous sedation, intranasal sedation and intravenous sedation with various sedative agents, or various combinations of the above – one being intravenous midazolam and ketamine, it was found that this technique accounted for 500 cases. A total of 500 patients were invited to take part in the IV midazolam-ketamine audit. There were 8 failed cases which were referred for DGA, i.e. 98% success rate.

Patients were referred to the clinic for sedation and some even for GA despite the fact that the GDC banned dental GA outside the hospital environment at the end of December 2001. Patients were either very young, pre-cooperative, had behaviour management problems where the dentist could not perform any basic dentistry, needed

SID E E FFE C T S

Figure 7

All parents were asked to give a satisfactory rating score out of 10 for the dental treatment and how their child was managed under sedation and recovery. The average score was 8.62 (SD=1.7) with the median score being 9.

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Patients were referred to the clinic for sedation and some even for GA despite the fact that the GDC banned dental GA outside the hospital environment at the end of December 2001. Patients were either very young, pre-co-operative, had behaviour management problems where the dentist could not perform any basic dentistry, needed
multiple extractions or unable to co-operate as a result of physical or learning disabilities. In some cases younger children 2–5 years old who were very anxious or those who were combative were orally premedicated and thus excluded from this audit. Some patients required two sessions to have the dental treatment completed. In most cases one half of the mouth – usually the side where they were experiencing pain – was treated first, with them returning 6–10 weeks later for the remainder of the treatment. The mean age of patients treated was 6.57 (SD=2.9) as a result of younger patients having other types of sedation like RA, oral, intranasal or oral followed by IV sedation.

Cannulation was achieved using a 22 gauge needle. Topical anaesthetic cream was not routinely applied. On cannulation if the child cried or protested, the cannulation was attempted. A ‘paradoxical effect’ was observed in 12 (2.4%) patients where it was felt that patients became disinhibited and extremely disorientated. This effect has previously been described in midazolam trials. This has also been called the ‘disinhibitory effect’ and is likened to the child who has alcohol at a wedding. Wilson describes this as ‘the angry child syndrome’ and says that it occurs in 5–20% of children in response to the administration of midazolam. Children typically cry, whine, are emotionally upset and want to go home. They throw toys around and may kick their parents. This is thought to be a result of the central pharmacological effect of midazolam. In this audit patients may have been reasonably calm and relaxed initially after receiving midazolam and ketamine but soon after children started to wriggle around more and to cry. One patient pulled the cannula out during treatment as a result of their thrashing about and one removed the cannula during recovery.

In attempt to reduce this movement and anxiety, additional doses of ketamine were given and may have been responsible for the higher doses in a few patients. Initially incremental doses of ketamine were given when the children seemed to be emerging from the dissociative-sedation state. The higher the degree of distress, the more drug is required to recover the sedative state. With a bit more experience using this technique incremental doses were given at the hint of emergence and this seemed to provide a smoother type of sedation – alluding to the fact that possibly an infusion of ketamine may be the answer to reduce the disinhibitory effect. Ketamine causes dissociation and the relatively low doses of ketamine used when compared to similar studies may have permitted the disinhibitory effects of midazolam to emerge. Another explanation which could explain these phenomena is the

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fact that hallucinations or the emergence phenomenon may occur following the administration of both midazolam and ketamine. It seemed appropriate for the clinician and parents to give reassuring orientating verbal and tactile cues to the distressed child when emerging from the sedation during treatment and the recovery phase. They usually responded appropriately to the presence of the parent.

Movement, Crying and Sedation Behavioural Score
Out of the 500 cases, 4 forms did not record this data. A total of 330 (66%) patients exhibited no movement during the sedation and lay very still while treatment was accomplished while 153 (30.6%) patients made small movements which did not interfere with treatment. Good or very good operating conditions were experienced in 97.4% of patients. Only 2 patients exhibited violent movements with the head, arms and legs with 6 patients showing continuous movement throughout treatment. Many of these were patients who also exhibited disinhibition.

382 (76.4%) of patients were quiet and did not cry at all during treatment. Mild crying was detected in 95 (19%) patients; this was usually after cannulation or at the end of treatment when extractions had been performed when the sedative levels of the drugs were getting lower. As more experience of the technique was obtained a small increment of ketamine was titrated a minute prior to performing the extractions and this seemed to improve operating conditions. Only one patient was hysterical while 16 (3.2%) exhibited continuous, persistent crying. After receiving the IV midazolam and ketamine patients became drowsy but their eyes remained open and they were responsive to verbal commands. The sedation scale may not have been appropriate for ketamine sedation as all patients had had their eyes open and so were given a sedation score of 3. Sedation level was difficult to score as one does not want to disturb the sedative level to stimulate the patient – this would be counter-productive. The obvious observation was asking the patient to open their mouth when changing the bite prop from one side to the other. To establish the quality of operating conditions during sedation the Ellis behavioural scale was used and 456 (91.2%) of patients were ‘very good’ or ‘good’. In one case it was impossible to perform any treatment and extractions being the only treatment possible in 4 patients. In 25 patients treatment was more difficult requiring further doses of ketamine and more support and restraint by the parents. Some of the children also became disinhibited. In 8 patients it was deemed better to refer the patient for DGA.

Side-effects
A total of 15 (5%) patients vomited either during treatment (1), in recovery (5) while some vomited both in recovery and during the journey home (3). Six patients vomited during the journey home and at home. This figure corresponds favourably with other authors using ketamine for sedation (Green 2000, 12.1% in children > 5 years and 3.5% in children < 5 years old). He felt that it was associated with increasing age and not dose-dependent. It was felt that the extreme anxiety was responsible for emesis in susceptible patients. Generally, emesis occurred well into the recovery phase but one patient vomited during treatment. A 4-year-old boy who had large tonsils became disinhibited requiring more increments of ketamine. He needed many fillings and swallowed some water from the air turbine. This was ejected. His head was turned to the side and suctioned. He was in full control of his laryngeal reflex and after he settled down the treatment was completed. His saturation fell to 89% briefly while his pharynx was cleared, the airway was opened by tilting the head and no additional oxygen was required. One patient had four episodes of emesis at home while a mother commented that her son always vomits when placed under any stress. 11 (3.6%) patients felt nausea. The fact that some patients experience nausea and vomiting may also be due to the fact that water and possibly blood may have been swallowed during the recovery phase.

The emergence phenomenon during recovery has been alluded to in the previous section. Ketamine ‘disconnects’ auditory, visual, proprioceptive and dermal stimuli. This loss of external stimuli induces a sense of bodily detachment that may contribute to the psychic reactions or ‘trips’ that are occasionally seen during the recovery phase. Some patients report the dreams as frightening, others report the dreams as pleasant, joyful, fascinating or bizarre. It has been accepted that the co-induction of benzodiazepines will reduce the incidence of these phenomena. This delays ketamine metabolism and prolongs recovery. Green reported that serious hallucinations and the emergence phenomenon was only 1.6% in an audit of 1022 cases of ketamine and not as much as 10% as previously reported. Reported risk factors for emergence reactions include age of more than 10 years, female sex, rapid IV administration, excessive noise or stimulation during recovery, prior personality disorders, or subjects who normally dream frequently. In addition emergence phenomena occur more frequently with IV administration than with IM administration. The observation that reduction of stimuli during the recovery phase (e.g. dim lighting, quiet location and avoidance of
physical contact) appears to lessen the frequency of emergence phenomena is widespread and universally recommended, yet unproven in controlled studies. A dose-related rate of recovery agitation reactions has not been reported.21

In one patient a transient, erythematous rash appeared. This rash remitted spontaneously after a few minutes without the need to intervene. Salivation has been reported by many authors when using ketamine for sedation. In this audit increased saliva production was noted, but this was not a significant problem being easily controllable by dental suction.

Other less significant side-effects were also noted, i.e. blurred vision as a result of the relaxation of the eye muscles. Headaches were noted late in the recovery phase. This may be due to an increase in intracranial pressure which ketamine may produce or the fact that the children were starved and may be hypoglycaemic. Some patients were also restless for the first 4-8 hours after treatment and one patient had hiccups for 8 hours after treatment.

Duration of recovery
Motor activity generally increased as recovery progressed and children gazed about with a look of apparent wonder. Verbalisations by children were often amusing to the parents and often this was accompanied by children humming or singing songs or ‘acting silly’. Anterograde amnesia was consistently noted. Crying was seen in 10 patients. Apart from the trauma of treatment, reasons for the crying could be the fact that their lips and tongue are numb – a very strange sensation, that there are strange people around them, they often have blurred vision or are experiencing double vision. They may be dissociated and may not be able to speak or hear things said to them. For young children the only way to express themselves in this situation is to cry. Only one patient was reported to experience horrible hallucinations during recovery. Duration was 25 minutes (SD=14). Children were left in the care of their parents after being discharged by the recovery nurse after meeting our discharge criteria.

Post-operative postal questionnaire
The fact that only 310 out of the possible 500 (62%) questionnaires were returned is attributed to apathy on the part of the parents and also by some parents failing to give their child’s name on the form. More emphasis could have been put on the explanation of the importance of returning the form by the recovery nurse. A better filing system involving numbers to be matched up improves the process. A significant proportion of the children belonged to ethnic minorities where communication difficulties existed and they may not have been able to complete the questionnaire.

Level of sedation on leaving the clinic
All patients were assessed for discharge using the Aldrete scale.12

During the journey home 43.7% of patients were still drowsy while 38% were awake. According to the parents only 1 patient was asleep and difficult to rouse while the remaining 17.7% were asleep and easy to rouse. On arrival home 55.5% of patients were awake and 40% drowsy. 9% of patients were easy to rouse from sleep while 2 patients were difficult to rouse from sleep. After 4 and 8 hours 78.8% and 91.6% of patients were awake respectively and 4 patients feeling effects after 24 hours. Parents often marked more than one option and hence the higher values recorded than the number of patients recorded in the survey.

State of mind after sedation
On departure 47.5% of patients were happy and 25% being indifferent and 20% weeping and 7% feeling agitated.

On arrival home 63% were happy, 6% were indifferent, 13% weeping and 17% became agitated. The percentage of happy patients increased steadily with 92.4% being happy after 24 hours. After 24 hours 6 (4%) patients were weepy and 2 patients were agitated. This shows that a significant event like a visit to the dentist for sedation may have effects that last for longer than 24 hours. Parents said that the children may have preferred a premedication. Some children did not like the venepuncture and the application of topical anaesthetic to the venepuncture site may have improved the experience.

Historically, parents have been excluded from the dental surgery during a child’s dental treatment because they may increase management problems, disrupt dental procedures, delay treatment and interfere with the dentist’s ability to establish a good relationship with the child. Guthrie,24 reported a correlation between maternal anxiety, child anxiety and negative behaviour in the dental surgery, which indicated a disruptive influence by an anxious mother. Conversely, parental presence may have a positive influence – increased security and coping by a young child. Frankl et al.25 concluded that child cooperation increased with the mother present during both exam and treatment appointments.
Parents were invited to stay in the surgery for the duration of the procedure. It was felt that separation anxiety could be reduced and societal attitudes have changed towards increased parental participation during the child’s dental experience. Parents were mostly quiet and sat in a chair away from the dental chair (54%) while 45% were encouraging and supportive to their children and held their hand throughout the procedure. The fact that so many parents were quiet could have been due to the fact that the children were sufficiently co-operative throughout the procedure so they did not feel the need to become actively ‘involved’ with the treatment. Some parents were clearly anxious themselves and did not want to observe the treatment directly but were content to listen to the treatment and often glanced up and offered encouragement.

Only 89% of parents would have preferred to have the procedure repeated although the procedure was 97% successful. Parents found the procedure acceptable in 90% of cases (2% unsure). Parents were asked to find out what the child thought of the procedure during the days following the dental visit. It was difficult from the post-operative interview to ascertain how the child viewed the dental visit and it was only through the replies of the parents that this opinion could be determined. Possibly, a direct question to the child may have obtained more accurate information. It was not determined as to which mode of patient management the parents would prefer their children to have in the future or if they preferred not to let their child have IV midazolam and ketamine. If a similar audit were to be undertaken in the future, this question would need to be addressed.

When parents were asked about the depth of sedation, 84% said that their child was adequately sedated, 1% too deep and 14% too light. 11.9% of patients had previously had experience of dental GA and despite the information leaflet explaining sedation and our verbal explanation, many still expected something closer to GA than conscious sedation. Many of the patients had previously had a GA at the clinic and possibly had different expectations. The fact that the eyes were open and there was movement during dental treatment and that the children were subjected to a number of intraoral injections upset some parents. Many parents were misinformed by the referring dental practitioner who told them that their child would be asleep.

When asked about how much the child remembered, 57% reported to have total amnesia and 37% patchy amnesia.

When the parents were asked what they would prefer their child to have in the future: GA or sedation, 87% said that they would prefer dental conscious sedation, but 11% would prefer their child to have a GA. If topical anaesthetic or premedication had been employed this figure may have improved. Slightly higher doses of ketamine may also have deepened sedation in some patients. The fact that more than one cannulation attempt was required in some patients upset some children and parents.

Out of the 500 patients only 8 patients could not be treated, usually due to disinhibition and they were referred for GA in the hospital; this represents a 98.8% success rate.

All parents were asked to give a satisfactory rating score out of 10 for the dental treatment, how their child was managed under sedation and recovery. The average score was 8.62 (SD=1.7) with the median score being 9.

We asked parents to comment on the treatment. Many responded that it was safer and better than GA. Other parents were pleased that they could stay with their child throughout treatment. Children were pleased and keen to return for dental treatment. Parents were pleased that it was pain-free and that their child recovered quickly.

Conclusion

A prospective series of 500 paediatric dental cases is described wherein painful or technically complex procedures in the dental surgery were facilitated by intravenous midazolam and ketamine sedation. These patients would otherwise have had to have a dental general anaesthetic in the hospital setting. Acceptable operating conditions were reliably achieved and parental reactions were strongly positive. Intravenous midazolam and ketamine produced rapid and consistent paediatric sedation with predictable onset and recovery time. There was a wide margin of safety without the respiratory and cardiovascular depression commonly seen with some alternative agents, e.g. opioids. Advanced conscious sedation for children in primary care may be effective and safe when provided by a highly trained and experienced team. The only significant complication was that of vomiting during treatment and mild and brief desaturation.

We suggest that intravenous midazolam and ketamine can be used safely and effectively by dental sedationists in children and young adults aged three to eighteen years.
We emphasise that equipment and expertise for advanced paediatric airway management for the sedationist and ancillary staff are mandatory.

Using this technique it was possible to significantly reduce the number of paediatric dental patients referred for GA. These techniques provide a safe and effective alternative to DGA and could dramatically reduce the amount of DGAs required.

References

INTRAVENOUS KETAMINE AND PROPOFOL IN PAEDIATRIC DENTAL SEDATION: SAFE AND EFFECTIVE?

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Background

Dental sedationists have been using midazolam and ketamine for dental paediatric sedation safely since dental general anaesthesia (DGA) was stopped in the UK at the end of 2001. In 2004 a case came to light where problems occurred where a previously healthy six-year-old child suffered permanent neurological damage following a dental sedation in the primary care setting. This and a few other cases where potential harm could have occurred to patients due to inadequate recovery and discharge protocols prompted a review of our service in terms of improvement in clinical care. More rigorous assessment and information to parents, improvements in recovery (two nurses) with discharge criteria and staff training in sedation related to medical emergencies were firm ed up. In addition it seemed that the longer the period of sedation, the more risk of adverse sequelae developing especially when the patient had been moved away from the direct observation of the sedationist. Midazolam has replaced diazepam as sedation drug of choice since 1983 for dental sedation for precisely that reason – i.e. the long half-life. Midazolam was used in combination with ketamine to reduce the adverse dysphoric effects of ketamine. Propofol has a shorter half-life and is suited to short medical interventions and has been used for dental sedation in adults and also in children.

Midazolam and ketamine had been demonstrated to be safe and effective for paediatric dental sedation. The combination of low dose propofol to prevent dysphoria and a titrated dose of ketamine for children’s dental sedation would be prospectively audited. Here 2082 consecutive cases using this combination demonstrate its safety and efficacy.

Aim

To determine whether a combination of intravenous ketamine and propofol (IVKP) is safe and effective for paediatric dental sedation.

Objectives

- To determine the success rate of the procedure, i.e. whether the proposed dental treatment could be carried out successfully using this sedation technique.
- To determine whether the technique is safe by measuring the arterial oxygen saturation and heart rate during treatment as well as monitoring the level of consciousness.
- To determine the quality of the sedation by recording movement, sedation, crying and the Ellis’ Behavioural Score.
- To record the type of dentistry carried out.
- To record the duration of treatment episodes.
- To record any adverse effects during, and after treatment in recovery, for 24 hours and after one week.
- To determine the acceptability of this technique from the patients’ perspective.
- To determine the acceptability of this technique from the parents’ perspective.

Method

Study Design

A prospective clinical audit of 2082 cases of IV ketamine and propofol.

Patient Selection

General Dental Practitioners referred anxious and uncooperative paediatric patients to a specialist dental sedation clinic. These are patients where the dentists have previously failed to provide the necessary treatment for various reasons. The Leagrave Dental Sedation Clinic accepts patients who require dental anxiety management, patients with special needs and surgical dentistry from...
general dental practitioners, hospitals and from the community dental service. The patients in the study were referred to the Luton clinic from Bedfordshire and from the surrounding counties. In excess of 1000 patients were treated under dental general anaesthetic (DGA) in 2001 and dental treatment was provided under various forms of sedation for nearly 4000 patients annually. Sedation modalities include inhalational sedation with nitrous oxide and oxygen, oral and intranasal sedation as well as intravenous sedation. Since 2002 only conscious sedation has been performed at the clinic.

The referral letter provided the name, age, sex, relevant medical history, treatment plan, risks and the reason for referral for sedation in accordance with GDC regulations.

On the basis of the referral form, the patient was invited to take part in the audit.

Inclusion criteria:
- The patient must have been referred for sedation.
- The patient must be between 2 and 18 years of age.
- ASA I or ASA II.
- Have no respiratory tract infections.

Exclusion criteria include:
- Cardiovascular disease, history of head injury, CNS lesions, prior adverse reaction to ketamine, porphyria, glaucoma, thyroid disorder or psychosis.
- Dental treatment included extractions, restorative, mixed extractions and restorative treatment.
- No previous history of allergies to propofol, eggs or soya.

A letter of invitation along with an explanation was sent to the patients with an appointment for the procedure. Parents were required to confirm their appointments by telephone and discuss any concerns that they might have. Parents had the opportunity to cancel the appointment or insist on an alternative sedation technique or referral to hospital for a GA appointment if they thought that their child had severe behaviour management problems and would not be able to cope with treatment under sedation. A dental examination was performed and treatment plan was confirmed with the parent. An appropriate sedation technique was discussed with the parent and consent was obtained. An information leaflet about the sedation technique was given to the parent along with pre- and post-operative instructions.

Children were asked to starve for 4 hours before the appointment and were limited to clear fluids for 2 hours before their appointment. Parents were asked to ensure that they did not starve the patient for longer than 4 hours.

At the appointment the patient was:
- Weighed.
- Medical history completed and checked and the presence of a respiratory tract infection excluded.
- ASA status determined.
- Dental examination carried out.
- Appropriate radiographs taken and checked.
- Anxiety level determined using a modified Venham visual analogue scale using 5 pictures of facial expressions ranging from anxious and distressed (5) to happy and relaxed (1) with each being assigned a numerical value.
- Co-operation assessed by using a 4-point scale (0–3) with one point being awarded for each action which the child would be able to carry out:
  1) to sit alone in the dental chair
  2) to open their mouth to permit a dental examination
  3) to allow any dental instruments into their mouth
- Explanation of procedure was given and consent obtained.
- Baseline arterial oxygen saturation and heart rate obtained with a Nellcor N-180 pulse oximeter.
- Treatment plan formulated.

The children and their parent(s) were informed that the treatment could be stopped at any stage and that the child could be referred for a DGA at their local NHS hospital.

2082 consecutive patients receiving IV ketamine and propofol were included in the audit.

Clinical Technique

Parents were encouraged to stay in the surgery and be supportive throughout the treatment. Rapport was rapidly gained with the dental nurse who accompanied the child from the weigh-in, placing of the pulse oximeter finger probe, holding of the hand while the teeth were checked and while having a ride in the dental chair. Continuous monitoring of the heart rate and oxygen saturation by pulse oximetry was obtained for the duration of sedation and the recovery period. Oxygen, advanced airway adjuncts suction and emergency drugs were immediately available during sedation and the recovery period.

Venous access was obtained using a 22 gauge Venflon cannula usually in a superficial vein on the dorsum of the hand or the cubital fossa. Parents were asked to distract the child during this procedure while the nurse stabilised the child’s hand for venepuncture.
The sedation was administered by a dentist trained and experienced in advanced sedation techniques. He was assisted by two nurses trained in dental sedation, one to assist with the dentistry and the other dedicated to monitor the patient. Propofol dose of 0.5mg/kg (maximum initial dose of 20mg) was administered slowly and after about 1 minute a bolus dose of ketamine 0.25mg/kg was administered. During this time the pulse rate and oxygen saturation were monitored. Additional doses of ketamine (0.25mg/kg) were usually administered, but additional 10mg doses of propofol were administered if patients were deemed to be becoming disinhibited.

The patient was allowed to cuddle or chat to the parent or staff member for 1 minute. Arterial oxygen saturation and heart rate were read at various time intervals following the introduction of propofol and ketamine:

- intra-oral injection
- + 5 minutes
- + 10 minutes
- + 15 minutes

All episodes of desaturation and other complications intra- and post-operatively were noted. Desaturation was defined as a decrease of more than 8% from the baseline saturation for longer than 2 seconds and less than 20 seconds. If desaturation occurred the position of the pulse oximeter probe was checked and then the position of the head and neck was checked and adjusted, if required. Desaturation was assumed to represent either respiratory obstruction or respiratory depression.

The eyes were covered by dark glasses or blindfolded to reduce visual stimuli.

Local anaesthesia was achieved by buccal infiltration of articaine 4% with 1:200 000 adrenaline solution or by inferior alveolar nerve block injection. Palatal and lingual anaesthesia was achieved increasing the depth of papillary infiltration around the teeth, i.e. chasing anaesthesia. Inferior alveolar nerve blocks were used for lower molar extractions. A mouth prop was placed to keep the mouth open. Oral suction kept the mouth clear of any water, blood, secretions or tooth or restoration fragments. Treatment was carried out as soon as the patient was sufficiently co-operative. If the patient was not co-operative, more ketamine was administered at doses of 0.125-0.25 mg/kg and at various stages of treatment where the patient was deemed to be too restless.

In recovery, the patient was monitored by nursing staff until able to walk, drink clear fluids (if not nauseated), and give age-appropriate responses to verbal commands.

### Peri-operative Evaluation

<table>
<thead>
<tr>
<th>Rating Scale for Movement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysterical Movement</td>
<td>1</td>
</tr>
<tr>
<td>Uncontrollable Treatment Impossible Movement Interferes with Treatment</td>
<td>2</td>
</tr>
<tr>
<td>Little Movement Not Interfering with Treatment</td>
<td>3</td>
</tr>
<tr>
<td>No Movement</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rating Scale for Crying</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysterical, Treatment Impossible</td>
<td>1</td>
</tr>
<tr>
<td>Crying Interferes with Treatment</td>
<td>2</td>
</tr>
<tr>
<td>Little Crying Not interfering with Treatment</td>
<td>3</td>
</tr>
<tr>
<td>No Crying</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sedation Scoring System - used to grade depth of sedation of patient</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fully awake and orientated</td>
<td>1</td>
</tr>
<tr>
<td>Drowsy</td>
<td>2</td>
</tr>
<tr>
<td>Eyes closed, responds promptly on verbal commands</td>
<td>3</td>
</tr>
<tr>
<td>Eyes closed, rousable on mild physical stimulation</td>
<td>4</td>
</tr>
<tr>
<td>Eyes closed, unrousable on mild physical stimulation</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ellis Behavioural Sedation Scale</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No uninvited limb movement. Total co-operation. No restlessness</td>
<td>1</td>
</tr>
<tr>
<td>Small amount of uninvited limb movement. Still total co-operation and no restlessness</td>
<td>2</td>
</tr>
<tr>
<td>More uninvited limb movement. Small degree of restlessness and anxiety. Patient less co-operative. Still able to perform procedures</td>
<td>3</td>
</tr>
<tr>
<td>Considerable degree of limb movement. Perhaps un-helpful head movements. Poor co-operation. Able to perform basic dentistry, advanced work impossible.</td>
<td>4</td>
</tr>
<tr>
<td>Restless, anxiety and limb movements severe. Impossible to perform any dentistry</td>
<td>5</td>
</tr>
</tbody>
</table>
• Oxygen saturation and heart rate at specified intervals noted.
• The dental treatment was recorded.
  The treatment was judged to be successful if all the proposed treatment was completed at that visit.

Recovery monitoring
• Duration of recovery.
• Any adverse effects in the recovery room.

Immediate post-op 24 hour follow-up evaluation
• State of mind at various time intervals: on departure, arrival at home, 4, 8, 12 and 24 hours post-operatively.
• Sedation levels at time intervals: on departure, arrival at home, 4, 8,12 and 24 hours post-operatively.

Results

Patient Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Median</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, (years)</td>
<td>8.99</td>
<td>(3.73)</td>
<td>1–7</td>
</tr>
<tr>
<td>Male/Female</td>
<td>1019 / 1062</td>
<td>(48.97% / 51.03%)</td>
<td>11–20</td>
</tr>
<tr>
<td>Mean weight (kg)</td>
<td>35.14</td>
<td>(15.87)</td>
<td></td>
</tr>
<tr>
<td>ASA (1/11/111)</td>
<td>1832 / 248 / 1</td>
<td>(88.03% / 11.92% / 0.05%)</td>
<td></td>
</tr>
<tr>
<td>Cannulation Acceptable/ Not</td>
<td>1662 / 419</td>
<td>(79.87% / 20.13%)</td>
<td></td>
</tr>
<tr>
<td>Treatment duration (mins)</td>
<td>6.45</td>
<td>(3.59)</td>
<td>1–4</td>
</tr>
<tr>
<td>Recovery duration (mins)</td>
<td>23.26</td>
<td>(10.12)</td>
<td>3–100</td>
</tr>
<tr>
<td>Total propofol dose (mg/kg)</td>
<td>0.54</td>
<td>(0.19)</td>
<td>2.14</td>
</tr>
<tr>
<td>Total ketamine dose (mg/kg)</td>
<td>0.32</td>
<td>(0.13)</td>
<td>1.25</td>
</tr>
</tbody>
</table>

Table 1

Graph 1. Pre-operative anxiety levels
Graph 2. Movement during sedation
Graph 3. Crying during sedation

Sedation related adverse side effects
Satisfactory rating score – a visual analogue score from 1 to 10
Comments.

The quality of sedation was assessed by the dentist based on the ability to perform the procedure as planned and by the parents based on their perception of their child’s comfort level during the procedure.

Data relating to patient, dental and sedation variables were collected as the patients were treated, in the recovery room, by a post-operative questionnaire about sedation morbidity (24-hour follow-up) and patient and parent satisfaction with the sedation procedures.
A total of 916 parents returned the post-sedation questionnaire.
Discussion

The dental and oral surgical management of anxious and unco-operative children is one of the most challenging aspects in dentistry. These children have not come to the sedation clinic out of choice, but have been referred to the clinic as an alternative to having a dental general anaesthetic (DGA) in the hospital setting. Children frequently present in pain due to infection from multiple carious teeth or from dental trauma. They have no desire to co-operate with the treatment and many do not possess coping skills to manage the situation as they have no prior experience of having dental treatment. These pre-co- operative children and those with behavioural problems, e.g. Autistic Spectrum Disorder (ASD) or Attention Deficit Hyperactive Disorder (ADHD), require pharmacological intervention to facilitate the delivery of dental treatment. Many children are from ethnic minority backgrounds and immigrant population groups where communication and dental health education is limited and there are high treatment needs.

Ketamine is a dissociative anaesthetic and has the ability to produce sedation in subanaesthetic doses. It also

Graph 9. Side effects during the journey home

Graph 10. Side effects during the first 24 hours after the sedation

Graph 11. Parents who would like a repeat sedation

Graph 12. Satisfactory rating score if deemed necessary for dental treatment
operative nausea and vomiting is the level of pre-operative concerns were raised in the UK when a previously healthy produces analgesia and amnesia and also avoids cardiorespiratory depression at these doses. One of the hallmarks of this drug is that it maintains the respiratory drive and airway patency and in most patients produces bronchodilation. It is particularly useful for sedating patients suffering from asthma by decreasing airway resistance. In paediatric sedation these are important considerations in relation to patient safety. Muscle tone is maintained but eyes remain open, often with nystagmus and the corneal reflex remains intact. Ketamine has a rapid, smooth onset of action and has a predictable duration of action with a distribution half-life of 10 minutes. Ketamine may be used safely in a patient who is susceptible to malignant hyperthermia (MH) and allergy to ketamine is rare\(^3\).

The most reported unwanted side effect – the emergence phenomenon – has been attenuated by the co-use of the benzodiazepine, midazolam. This phenomenon is characterised by vivid frightening dreams, confusion (with or without vocalisation), dizziness and hallucinations. Midazolam has been used in combination with ketamine in the emergency department\(^4\), for therapeutic and diagnostic procedures\(^5\) and also in paediatric dental sedation\(^6\). Concerns were raised in the UK when a previously healthy six-year-old boy had a dental sedation administered by an anaesthetist at a regional sedation centre involving midazolam, ketamine and alfentanil and the boy had a respiratory arrest within the recovery area. Midazolam replaced diazepam in the 1980s due to its shorter half-life and increased potency. Midazolam’s prolonged recovery and its long-term amnesic effects led us to use propofol rather than the midazolam to expedite recovery and return the child to a physiological state rapidly after the procedure had been completed. Some children who have received ketamine alone sometimes become disinhibited and experience hallucinations (particularly young female adolescents); this may be a dose-dependent effect. The administration of small doses of propofol (10–20mg) tends to settle the disinhibition and the patients appear calmer so that treatment may proceed.

Another side effect which is dose-dependent, is the stimulation of tracheobronchial secretions. This may be reversed by the administration of glycopyrrolate, but the use of judicious suction in the oral cavity and low doses of ketamine did not precipitate aspiration of secretions which may lead to laryngospasm. Post-operative nausea and vomiting is also a recognised side effect of ketamine sedation in 5–10% of patients\(^7\) but this may also be dose dependent. Another factor which contributes to post-operative nausea and vomiting is the level of pre-operative anxiety which may require that the patient may require slightly higher doses of ketamine to produce the same level of sedation and co-operation as for a less anxious child.

Ketamine, a cyclohexamine and phencyclidine (PCP) derivative, was developed and introduced in the 1960s. The unique dissociative sedation or anaesthesia which is produced in higher doses is characterised by dissociation between the thalamocortical and limbic areas. Afferent impulses are not correctly relayed between the sensory cortex and the association areas. Visual, auditory, anxiety and other sensory stimuli are attenuated – this is dose dependent. With sedative doses as used in this audit, patients responded to verbal command and eyes remained open.

Friedberg\(^7,18\) used a combination of ketamine and propofol for dissociative anaesthesia in 1264 cases for cosmetic surgery but it has been used mainly for procedural sedation in emergency departments (Loh and Dalen\(^7\), Willman and Adolfatto\(^7\)) where it has been found to be effective with high satisfaction and rapid recovery. In our audit it was found to be safe and effective for shorter procedure in the dental surgery as performed by an experienced and trained operator-sedationist working with two well trained assistants and recovery nurses. One nurse is dedicated to assisting with the sedation (including monitoring of the patient) while the other is dedicated to helping with the dentistry. The dose of ketamine in this audit is much lower than those used for procedural sedation and analgesia (PSA) as in dentistry the use of effective local anaesthesia is pivotal to success. An initial intravenous dose of 0.5mg/kg of propofol followed by 0.25 mg/kg of ketamine was administered to create dissociation sedation. Potent analgesia was achieved with many patients not even flinching when administering palatal injections. This is particularly beneficial to the patient when removing four teeth for orthodontic purposes when eight injections need to be given without distressing the already anxious patient.

Parental satisfaction was high using this technique and 96% of parents would want their child treated with sedation again in the future if they were to require further treatment. Many favourable comments were received and parents commented particularly on the rapid recovery and re-orientation of the child back to the ‘normal’ state.

From a safety perspective, there was no desaturation using this technique, no assisted ventilation nor was there any supplemental oxygen administration required. The target
zone for all the patients was conscious sedation and this was readily achieved with patients opening their mouths when swapping sides when reinserting the mouthprop. In the Willman study which took place for mainly orthopaedic procedures, a median 0.75mg/kg propofol and 0.75mg/kg ketamine was administered in 114 patients of all ages. He noted that three patients had transient hypoxia with one patient requiring bag-mask-valve ventilation and four patients requiring airway repositioning. No patients had any vomiting.

Despite this evidence for the benefits of this combination, that theoretically using lower doses of each drug may result in reduction of undesirable adverse effects, Slavik and Zed examined the evidence through researching many databases using this combination for procedural sedation and analgesia (PSA); their findings included eight trials in adults and children using variable drug ratios of ketamine to propofol and could find no optimal combination dose. Furthermore he found that the available evidence does not support a fixed dose combination of ketamine and propofol for PSA and that further research is required on this topic.

During the period of the audit, the general dental contract for England and Wales had changed and the referral patterns of dentists for sedation also changed. More children were referred for extractions on the new contract and sedations were limited and paid for ‘the course of treatment’ as opposed to receiving a fee per sedation contact provided. As can be seen from this audit, there are two peaks when looking at the age range of patients referred, the first being at mean six years of age for mainly extractions of teeth and then at 12 years for removal of usually four teeth for orthodontic purposes. Traditionally inhalation sedation with nitrous oxide, oral midazolam or intravenous sedation with midazolam has been used to facilitate these procedures and the patient needed multiple appointments. In this audit all the treatment was completed in one session.

The operator-sedationist is one who simultaneously assumes responsibility for both the patient procedure ‘operator’ and analgesia with sedation. A second appropriately trained person must be present throughout the sedation procedure. We have gone further and have recommended the use of the sedation team which is made up of the PALS accredited operator-sedationist, a dedicated nurse to monitor the patient, a dental assistant as well as the recovery nurse during advanced sedation techniques in children. As with emergency department physicians, it is important to monitor cardiorespiratory function, have resuscitation skills and airway rescue, have intimate knowledge of the drugs that they are using and have experience in sedating children in a primary care setting. Couloures analysed 131 751 paediatric sedations (moderate sedation) in an organised sedation service and found no statistical difference in complication rates between anaesthetists and non-anaesthetists (including dentists). They concluded that there was no increased danger associated with motivated non-anaesthesiologist providers of procedural sedation in an established system with rigorous safeguards. A literature review took place where 646 000 cases of Endoscopist-directed Administration of Propofol (EAP), i.e. no specialist anaesthetists involved with this sedation, where propofol alone or in combination with other drugs was administered. They found that propofol administration is superior to the published safety record of benzodiazepines and opioids for endoscopists for gastrointestinal endoscopy. A further study from France compared endoscopist vs anaesthetist-administered sedation for colonoscopy. It was found that the endoscopist used significantly less propofol median 94mg vs 260mg in anaesthetist administered sedation. There was greater desaturation in the endoscopist group which was corrected by minor corrections like jaw thrust or an increase in oxygen flow rate. They found that there was evidence that propofol administration by non-anaesthesiologists is a reasonable option during colonoscopy for otherwise healthy individuals who are carefully selected, provided that a standardised procedure and dedicated trained personnel overseeing the sedation are available.

In this audit propofol was utilised in a unique way, not so much to provide the sedation, but to remove the dysphoric actions of ketamine in the children and also to be added in 10mg increments during the sedation procedure if the child became disinhibited. The cornerstone and maintenance of the depth of sedation was provided by incremental ketamine administrations.

**Conclusion**

The team model brought about the safe administration of propofol and ketamine sedation to facilitate dental treatment for 2082 children by using an appropriately trained operator-sedationist working within a team with well defined roles. This treatment must occur within a well equipped and regulated environment with rigid protocols for assessment, sedation, recovery and discharge of the children. This advanced sedation technique proved to be safe and efficacious and could significantly reduce the number of children referred into hospitals for dental general anaesthesia.
References


16. NICE Sedation guidelines.


Abstract

The technique of intravenous sedation with a benzodiazepine is a well-documented and successful method for reducing fear and anxiety in many patients who regard dental treatment as challenging and potentially painful. One of the most important factors to achieving a well sedated patient is ensuring the dose of the drug given is titrated to the individual patient. Five years ago, a Rapid Response Report issued by the National Patient Safety Agency changed the concentration of midazolam within a 5ml ampoule from 10mg/5ml to 5mg/5ml. A retrospective audit of 300 patients undergoing oral surgery treatment under intravenous midazolam sedation at Birmingham Dental Hospital was carried out over a 6-month period to assess whether this difference in midazolam concentration had any influence on the average dose of midazolam given to these patients. Study group: the midazolam doses given by five clinicians were audited both before and after the concentration change. Results: the mean midazolam dose that was administered by three clinicians decreased following the change in concentration. In addition, the number of patients given greater than 5mg midazolam following the change decreased with all five clinicians. Conclusions – the change in midazolam concentration from 10mg/5ml to 5mg/5ml ampoules has resulted in the overall average dose of midazolam given by five clinicians at Birmingham Dental Hospital to decrease.

Background

Conscious sedation is defined as ‘a technique in which the use of a drug or drugs produces a state of depression of the CNS enabling treatment to be carried out, but during which verbal contact is maintained throughout the period of sedation. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely.’ Thus, the patient retains reflexes, can independently maintain their own airway and is able to understand and respond to verbal commands throughout treatment.

Since being published, this definition has gained widespread acceptance amongst numerous specialist sedation groups including SAAD (Society for the Advancement of Anaesthesia in Dentistry), DSTG (Dental Sedation Teachers’ Group), SDAC (Standing Dental Advisory Committee), NDAC and the Scottish Dental Clinical Effectiveness Programme as well as regulatory bodies such as the GDC and the DOH. In addition, these guidelines apply to all methods of sedation currently used in the UK, including nitrous oxide inhalation sedation, intravenous benzodiazepine sedation and oral/transmucosal benzodiazepine sedation. The 2007 guidelines by the Standing Committee on Sedation for Dentistry explore the use of drug combinations and sedation for children under twelve’.
The report also ensures the definition is respected.

The Standard Dental Advisory Committee states that: ‘The standard, recommended technique for intravenous sedation is the use of a titrated dose of a single benzodiazepine. The use of fixed or more rigid doses is unacceptable as success is directly related to titration according to the individual patient’s needs.’ Thus, the dose of midazolam required for conscious sedation will vary between individuals due to factors such as age, gender, anxiety, social habits, procedure being performed and medical conditions.10, 11, 12

Prior to December 2008, midazolam was routinely supplied as ampoules of 10mg/5ml (2mg/ml), usually drawn up into a 5ml syringe. Following the Rapid Response Report published by the National Patient Safety Agency in December 200813, these ‘high strength’ ampoules were replaced with a lower concentration of 5mg/5ml in virtually all treatment areas. The report’s reasoning behind this was that in medicine and surgery, between November 2004 and 2008, the National Reporting and Learning service had received 498 patient safety incidents, three of which had resulted in death because the dose of midazolam prescribed or administered to the patient was inappropriate. Specifically, most of these incidents were the result of shortcomings in medical sedation training, techniques and practices: quantities/concentrations not being checked prior to administration, bolus injections being given rather than titrated doses as well as the drug being given mistakenly due to unlabelled syringes. This suggests that it is not the higher concentration formulation of midazolam that is the problem, rather the medical training associated with its use. Only two of the reported incidents were related to dentistry and these were of prolonged recovery, rather than respiratory depression requiring the use of flumazenil. Dental practice therefore did not have a problem with the higher strength formulation of midazolam as ‘when it is administered by slow titration and in accordance with current guidelines, the risk of oversedation is extremely low’14. The SAAD response to the RRR Report goes on to state that ‘many adult dental patients require more than 5mg midazolam in order to produce effective conscious sedation’ and ‘using the lower concentration means that, for most patients, practitioners will have to draw up two 5mg in 5ml ampoules (making 10mg in 10ml) in a 10ml syringe in preparation for administering sedation’. Thus, if the sedationist routinely draws up only one ampoule of the newer, lower formulation at the beginning of a dental procedure, it may have a tendency to promote undersedation.

Aims and Objectives

A retrospective audit in the Oral Surgery Department at Birmingham Dental Hospital was carried out with three aims:
1. To investigate if the change in midazolam concentration from 10mg/5ml to 5mg/5ml ampoules has caused the average dose of midazolam given to patients to decrease.
2. To assess the range of midazolam doses given to patients undergoing oral surgery procedures.
3. To establish the procedures carried out under IV sedation in the oral surgery department.

Materials and Methods

The retrospective audit was carried out on five sedation-trained dentists who had been practising intravenous (IV) sedation in the department for a minimum of six years. The grades of surgeons included three specialist registrars and two associate specialists in oral surgery who had all carried out treatment under IV sedation both before and after the change in concentration, thus allowing a direct comparison of their practice. Sixty of each of the clinician’s patients who had undergone oral surgery procedures under IV sedation were included within the audit, thirty before and thirty after the change in vial concentration, therefore a total of 300 patients. Patient identification and the midazolam doses administered to them were obtained directly from a drugs logbook, a mandatory local protocol completed by all clinicians and nurses following any procedure done under IV sedation. Review of the patients’ clinical notes identified the clinician who treated the patient as well as the type of procedure that was carried out. Data collection was carried out by one clinician who was not being audited.

The mean, mode and range of midazolam doses administered to each of the five different clinicians was compared before and after the change in concentration as was the number of patients being given greater than 5mg midazolam.
Results

The mean midazolam dose that was administered by three clinicians (3, 4, 5) decreased following the change in concentration. For clinician 3, it decreased from 5.3–4.0, clinician 4: 4.9–4.6 and clinician 5: 5.7–5.0. For clinician 1, it stayed the same (5.8) whilst for clinician 2, it increased: 7.0–7.6. (figure 1) The overall mean dose of midazolam given by clinician 2 both before and after the change in concentration was much higher than for any other clinician.

Figure 1

The mode after the change in concentration was 5mg for four out of the five clinicians (1, 2, 4 and 5.) This had changed from 4mg for clinician 1 and clinician 4 and 6mg for clinician 2 and clinician 5. The mode for clinician 3 went down from 5 to 4mg. The range of midazolam doses given were very varied. With clinician 2, a dose of 24 mg was given for one patient, this being the highest recorded in all 60 patients. With clinician 3, the range was significantly small – only 4–7 mg for the lower concentration and 3–6mg for the higher concentration.

The number of patients being sedated with greater than 5mg midazolam following the change in vial concentration decreased in all five cases. For clinician 1, it decreased from 53% to 30%. For clinician 2, it went down from 80% to 60%, clinician 3: 37% –7%, clinician 4: 33% –20% and clinician 5: 63%–37%. Thus, the number of patients being given less than or equal to 5mg midazolam rose. For clinician 1, this rose from 47% –70%, clinician 2: 20%–40%, clinician 3: 63%–93%, clinician 4: 67 –80% and clinician 5: 37%–63%. (figure 2)

Figure 2

Although results for each clinician were recorded separately, for the purpose of this paper, they have been

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The number of patients being sedated with greater than 5mg midazolam following the change in vial concentration decreased in all five cases. For clinician 1, it decreased from 53% to 30%. For clinician 2, it went down from 80% to 60%, clinician 3: 37% –7%, clinician 4: 33% –20% and clinician 5: 63%–37%. Thus, the number of patients being given less than or equal to 5mg midazolam rose. For clinician 1, this rose from 47% –70%, clinician 2: 20%–40%, clinician 3: 63%–93%, clinician 4: 67 –80% and clinician 5: 37%–63%. (figure 2)

Figure 2

Although results for each clinician were recorded separately, for the purpose of this paper, they have been
grouped together (figure 4). The most prominent finding in this chart is the increase in patients who received 4 and 5mg of midazolam following the change in concentration and the decrease in the number that received 6mg and over. 8% (7.7%, n=23) received 4mg sedation before the change in concentration, and 14.3% (n=43) received 4mg after. 12% (11.7%, n=35) received 5mg sedation before the change in concentration and 14.3% (n=43) received 5mg after. In addition, 12.3% (n=37) of patients received 6mg before the change and only 4.3% (n=13) received 6mg after. Altogether, before the RRR, 70 out of 300 patients (23.3%) received a dose of midazolam less than or equal to 5mg whereas after the change, this rose to 34.7% (n=104). In contrast, before the change, 80 out of 300 patients (26.7%) received a dose greater than 5mg whereas after the change, only 15% (n=45) did. There were certain anomalies of 13.5, 20 and 24mg in the 5mg/5ml batch which increased the overall mean in this batch.

Figure 3 shows that the procedure most commonly performed by all clinicians under sedation were simple extractions, followed by surgical extractions or a combination of the two, respectively. Three apicectomy cases were carried out by clinician 1 and two cases by clinicians 2, 4 and 5. Two cyst enucleation cases were carried out by clinician 2 and one case by clinician 1. Clinician 2 was the only one to carry out more complex and protracted cases under sedation such as OAF closure, botox, cryotherapy, implant placement, coronectomies and plate removals.

Discussion
Achieving the optimum degree of sedation is crucial for both operator and patient satisfaction during dental treatment. It has been agreed that the only accepted way of achieving this intravenously is the use of a titrated dose of the drug. Whilst oversedation can result in respiratory depression and in certain cases fatality, undersedation can be equally problematic. The patient loses confidence that the technique works and the clinician loses the ability to treat effectively. This could result in an increasing tendency to prescribe general anaesthesia which does have a higher morbidity and mortality than sedation. Treatment may be rushed or topping up regimes employed, resulting in a protracted recovery time.

The results suggest that the change in midazolam concentration from 10mg/5ml ampoules to 5mg/5ml ampoules does cause the average dose of midazolam titrated to decrease. The mean midazolam dose administered by three out of the five clinicians decreased following the change in vial concentration. In addition, the number of patients sedated with greater than 5mg midazolam following the change decreased quite noticeably with all five clinicians. When questioned, some clinicians admitted almost to a ‘psychological block’: that once a whole syringe had been administered, enough had been given. In addition, rather than spending time opening another vial for an additional milligram, clinicians hesitate and almost compromise with the patient being slightly undersedated. This is important because SAAD’s report in 2009 does state that a large majority of healthy patients do require greater than 5mg to be adequately sedated.

A similar audit was performed at King’s Dental Institute in 2010 shortly after the RRR was published. It was
carried out due to informal reports from nursing staff that patients seemed generally less sedated following the change to low concentration midazolam ampoules. Their results showed that with ‘high strength’ midazolam, 61% of patients received a dose of midazolam greater than 5mg whilst with the introduction of low strength ampoules, this decreased to 42%. The institute subsequently changed their practice to open two vials of ‘low strength’ midazolam at the start of procedure in a 10ml syringe which, when re-audited increased the number of patients receiving a dose greater than 5mg to 76%.

With regards to the mode, four out of the five clinicians had a mode of 5mg following the change in formulation, whereas prior to the change, there was only one. This seems significant if the new formulation is 5mg in 5ml, drawn up in a 5ml syringe. To the operator, it may be a ‘convenient’ dose, i.e. the operator hesitates to opening another ampoule even if an additional one or two milligrams would be beneficial or the operator may just use up one whole syringe as it is available, even if 4mg would suffice.

For clinician 2, an increase in the mean midazolam dose given following the change in concentration may be due to slightly more complex procedures being carried out in the second thirty patients as outlined in figure 3. In any case, the overall mean dose of midazolam given by clinician 2 both before and after the change was much higher than for any of the other clinicians, likely because of the more lengthy procedures being carried out by the individual. It is unclear whether these ‘higher’ doses were given at the start of the procedure or a top up was required mid procedure.

Although the results indicate a definite decrease in the midazolam doses given to oral surgery sedation patients following the RRR, it is difficult to say whether, as a result of this, patients are being undersedated. Ideally, a gold standard of ‘adequate sedation’ would be set such that cases could be compared to this both before and after the formulation change, however what is presumed to be ‘adequate sedation’ will be variable between different operators. In fact, it is likely that even using the same clinician, intraoperator variability will occur between cases. At Birmingham Dental Hospital, local recording sheets allow the operator to highlight whether they felt sedation conditions were good, fair or poor. Retrospective analysis of this data could provide an understanding of whether undersedation was seemingly an issue, however this suffers much from subjective bias and in certain cases it is the accompanying nurses who complete this.

The issue of patient undersedation is clearly one that is important. This audit, in addition to the King’s Dental Institute study does indicate that this could be a problem following the change in vial concentration. Important to note is the influence that poor medical and surgical training in the use of midazolam has on conscious sedation in dentistry. Even though only two of the reported incidents to the NPSA were dentally related and these did not require flumazenil, a decision was made to change the formulation of midazolam in all clinical areas, even though this may not be beneficial and certainly will not solve poor medical practices.

As yet, in Birmingham Dental Hospital, the current use of 5ml syringes has not changed. Even so, the guidelines are not that rigid that an experienced sedationist cannot request a 10ml syringe when treating a patient who is likely to require a larger than average dose. The audit has raised awareness amongst sedation staff about the importance of stringent titration together with the use of special tests such as Eve’s which can objectively show whether a patient is adequately sedated. If another vial requires opening, it is important that this is done to achieve the correct degree of sedation. An audit of a similar nature may be beneficial in sedation departments and also, amongst primary care sedationists, highlight if the findings are a national occurrence.

Acknowledgements
Mr Gerald Flaum BDS DGDP(UK) introduced the idea for the audit and contributed to the overall study design.

References
Committee on Sedation for Dentistry 2007.

SAAD Annual Conference
and AGM

Saturday 21 September 2013

The Royal Society of Medicine
1 Wimpole Street, London W1G 0AE

Details will be posted on the SAAD website and included in the SAAD Newsletter
The aim of this study was to analyse the results of a questionnaire given directly to participants of SAAD courses in 2011, and posted to previous participants, on their own use of conscious sedation. Apart from general interest, such data will help the SAAD Faculty to tailor the courses in future better to meet the needs of participants by providing insights into the attitudes and level of experience in sedation of course participants. Questionnaires were distributed to participants on all the 2011 SAAD courses and to all members of the dental team. In addition, the same questionnaire was posted to dentists who had attended courses in 2010 and 2007. In total 71% of the 157 dentists who completed questionnaires were providing conscious sedation in their practices. The most common technique used was intravenous sedation. Only 3% carried out any advanced techniques. 14% (n=81) of dentists who had completed a SAAD course previously did not go on to use conscious sedation, and possible reasons for this are discussed. Participants’ overall confidence in specific areas of sedation training were rated from ‘good’ to ‘excellent’ after completion of a SAAD course. Participants completing SAAD courses believe they have gained in confidence and in knowledge, and obtained the skills required to provide conscious sedation although some identify barriers which prevent them from putting these new skills into practice.

SAAD has been providing training courses in conscious sedation since the late 1950s. They currently run 3 courses per annum in basic conscious sedation techniques for dentists, 3 per annum for dental nurses (delivered in 2 parts) and 2 per annum for dental therapist/hygienists, covering the use of intravenous midazolam, and inhalation sedation with nitrous oxide. All are usually fully subscribed.

The questionnaire at the heart of this study was developed to gain views on the current course content and presentation to inform future improvements, and to explore the attitudes and current sedation practice of present and past participants.

Method
A questionnaire was developed, a summary of the questions is shown below.

Summary of questions asked
Participant’s details
• Gender

pharmacological techniques currently used in conscious sedation show good levels of success. Conscious sedation is now taught to undergraduates at most UK-based dental hospitals, and the GDC document ‘Preparing for Practice’ requires the newly-qualified undergraduate to be competent in evaluating the risks and benefits of conscious sedation for individual patients and in making appropriate referrals. It is not expected that on graduation, most will meet the requirements listed by the DSTG to be competent sedationists and this is borne out by the continued high demand for additional training in sedation post-graduation.
• Place of work
• Work setting (general practice, salaried, etc.)
• Years since graduation

Current sedation experience
• Have you been on the SAAD course before?
• Do you use a conscious sedation technique?
• What sedation techniques do you plan to use?
• Have there been any barriers to prevent you from carrying sedation?

Remuneration
• Do you carry out NHS or private work?

Age of sedated patients
• Do you have an age range for sedation patients?

Knowledge and skills
• How confident do you feel in the following tasks?
  o Sedation assessment
  o Patient information
  o Patient consent
  o Sedation complications
  o Sedation guidelines

Treatment
• What treatment do you offer with conscious sedation?

Questionnaires were distributed to the participants during the November 2011 SAAD course, and a postal version was sent to dentists only who had previously attended the SAAD courses in 2010 and 2007.

Results
The November 2011 course questionnaire was completed by 15 hygienist/therapists, 54 dental nurses and 72 dentists; a total response rate of 84%. Postal questionnaires were returned by 102 dentists from a total of 405, a response rate of 25%. 19 questionnaires were rejected because they were not completed satisfactorily.

Demographics
For the participating dentists, there was a 3:2 male to female ratio, 80% were based in England, 14% from Scotland and the remaining 6% from Wales, Ireland and Germany. The majority worked in general dental practice (67%), with 14% in salaried service. Only 5% worked in a hospital/university setting. There was a wide range of experience, for example 2% of the dentists had been qualified for 40 years or more, but the vast majority (68%) had graduated within the last 20 years.

Conscious sedation techniques
Seventy one percent of the dentists carried out conscious sedation. The most common technique used was intravenous sedation (Figure 1), only 3% of dentists used an advanced technique.

Of the dentists attending the November 2011 SAAD course, 28% had attended a course before, and 55% were providing sedation. Five were not sure if they wanted to continue with conscious sedation and one participant did not want to carry out conscious sedation in the future.

Thirteen of the dentists who attended in 2010 and 1 who attended in 2007 did not practice conscious sedation at the time of completion of the survey. The barriers given for not practising sedation after attending a course are listed in Figure 2.
Barriers to starting sedation

<table>
<thead>
<tr>
<th>Barriers to starting sedation</th>
<th>Numbers of Dentists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to arrange mentoring</td>
<td>7</td>
</tr>
<tr>
<td>Lack of confidence in sedation techniques</td>
<td>6</td>
</tr>
<tr>
<td>Not enough financial gain in starting sedation</td>
<td>2</td>
</tr>
<tr>
<td>Set-up costs too high</td>
<td>3</td>
</tr>
<tr>
<td>Difficulty in acquiring adequately trained supporting staff</td>
<td>7</td>
</tr>
<tr>
<td>Primary Care Trust not supportive</td>
<td>2</td>
</tr>
<tr>
<td>Other barriers</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 2: Barriers preventing participating dentists from carrying out sedation following SAAD course attendance.

Just under half (41%) of dentists who offered sedation undertook this treatment under NHS regulations. Dentists who offer sedation were asked if they enforced age restrictions for intravenous sedation. A wide range of answers was given, and are summarised in Figure 3.

<table>
<thead>
<tr>
<th>Age limit</th>
<th>Percentage of dentists</th>
</tr>
</thead>
<tbody>
<tr>
<td>No age range</td>
<td>16</td>
</tr>
<tr>
<td>Patients described as adult</td>
<td>3</td>
</tr>
<tr>
<td>Under 14</td>
<td>3</td>
</tr>
<tr>
<td>14 and over</td>
<td>3</td>
</tr>
<tr>
<td>16 and over</td>
<td>37</td>
</tr>
<tr>
<td>18 and over</td>
<td>11</td>
</tr>
<tr>
<td>20 and over</td>
<td>7</td>
</tr>
<tr>
<td>Under 60</td>
<td>3</td>
</tr>
<tr>
<td>Under 65</td>
<td>6</td>
</tr>
<tr>
<td>Under 70</td>
<td>2</td>
</tr>
<tr>
<td>others</td>
<td>10</td>
</tr>
</tbody>
</table>

Figure 3: Range of age restrictions on sedation patients set by participating dentists.

Dentists' confidence

Dentists were asked about their level of confidence in the clinical aspects of sedation. The responses were analysed by different groups, depending on whether they were providing sedation or not. These results are shown in Figures 4–6.
Treatment offered
The range of treatments offered by the dentists is shown in Figure 7. 90% of dentists who carry out sedation would offer it for oral surgery procedures compared to 35% who would offer it for denture work.

Discussion
Unfortunately there was a poor response rate to the postal questionnaire, which limits the strength of any conclusions from this part of the audit. However, it is possible to consider some aspects of these data.

Regarding the demographics of participants, there was a wide distribution of dentists from across the UK, and in different working environments; however, the majority were general dental practitioners. This was to be expected as SAAD courses have been organised and designed to target this population.

It was surprising that 28% had previously attended a course but is probably explained by dentists requirement to acquire continuing professional development (CPD) credits, specifically in sedation to comply with the IEGTSSD guidance. This document recommends 12 hours of CPD over a 5-year cycle. However, it might be asked whether these are an appropriate course for experienced dentists who might be better served by a tailored update course?

A high number of dentists (55%) and nurses (83%) delivered sedation prior to attending their course. Only 9% of the nurses had previously been on a SAAD sedation course. Although there was no way of ascertaining if they might have achieved their sedation competencies in other ways, for example, by in-house training, the question should be asked whether some were previously carrying out the role as the second appropriately-trained member of staff without the required level of training and experience.

Fourteen percent of the dentists who had attended a course previously did not carry out sedation at the time of the survey. The 3 most common reasons given for this were:
• No-one to mentor their sedation cases
• Personal lack of confidence in carrying out sedation
• Unavailability of appropriate support staff

The first two reasons would both be addressed if there were a good mentoring scheme available to them, this should build their confidence and their willingness to provide sedation. Although there are joint mentor lists provided by SAAD and DSTG this could be further developed in the future to particularly target dentists attending courses who had not yet taken the plunge, and provided sedation.

Figure 7: Range of treatment offered

Regarding the age restrictions applied by dentists who currently give sedation, the results were extremely wide. The 2007 Standing Committee Report on alternative sedation guidelines states that the basic technique for sedation using intravenous benzodiazepine should be used with patients aged 12 and above. The majority of dentists stated that they only treated adults but clearly an adult can be categorised in many different ways not only by chronological age, but by biological age or by using legal definitions. For example, the legal age for consent is 16 in Scotland but is defined as 18 in England and Wales.

On the other end of the scale only 11% of practitioners had an upper age limit for sedation despite caution being advised in sedating the elderly. This is due to age-related pharmacodynamic sensitivity to midazolam in the elderly. It was not possible, however, for the author to find a definitive upper age limit for sedation in the literature, although a modified titration regime is recommended for the over-65s. Given this lack of clarity, it is not surprising that primary care dentists have difficulty in deciding their own upper age limit for sedation in primary care settings.

The confidence of dentists’ levels declared in the specific clinical elements of sedation is shown in Figures 4–6. Although it is difficult to draw conclusions from these graphs it would appear that by far the majority of dentists in all groups show ’some’ to ’excellent’ confidence
in the areas surveyed. This shows how the course has helped in achieving the knowledge and skills required. In all groups, dentists had the least confidence in managing complications. This may be understandable for dentists who have never carried out sedation due to their lack of experience but for dentists already performing sedation complications should be rare in a controlled clinical environment. It might be that these clinicians feel uncomfortable in dealing with possible complications because they do not often experience them. This demonstrates the importance of regular emergency scenario training in the practice, to develop and maintain confidence in this important area.

Finally the questionnaire reinforced the wide range of dental treatment types being offered using sedation, including simple to complex procedures in both restorative and surgical disciplines.

References


A synopsis of articles of interest from the last twelve months to inspire further reading

DEVELOPING A NURSE-LED CHILD SEDATION SERVICE.

C. Slynn, C. Hulkes
Nursing Children and Young People, 24 July 2012 p20–22.

Investigations and procedures that take place in hospitals range from painless imaging that requires immobility but can be frightening to minor surgery which may be uncomfortable. Adults can usually cope but children often need more than simple reassurance, play therapy and analgesia. They may need sedation or anaesthesia.

The challenge associated with sedation is the unpredictable effect on the child. This can be minimised by effective planning using a standard protocol. If sedation is inadequate the distress may be remembered and gaining co-operation for subsequent procedures may be difficult.

Before introducing the nurse-led system at Addenbrookes hospital families frequently arrived for the procedure unprepared. Sometimes the child had not fasted appropriately or was not sleep deprived, families may not have had information on what to expect or when they were likely to get the result. On arrival the family had to wait for medical staff to come and clerk, consent, and prescribe sedation. This was usually time-consuming for the nursing staff contacting busy doctors. Families often had a long wait before the treatment was carried out. To counter these problems a Patient Group Direction (PGD) document to allow nurses to dispense medication under set conditions was produced. Nurse-managed discharge was also a practice on the ward.

Previous practice was audited, this showed an overall success rate of 54% using oral/rectal chloral hydrate with a lower success rate in children over three at which age the maximum dose of chloral hydrate is reached. Protocol prevented a second dose if the first was spat out or defaecated. Other influential factors were preparation of child and family, delays in consenting, delay in obtaining medication and environmental factors. The MRI scanner is a distance from the ward and sedation in some cases was wearing off before treatment if the patient once sedated had to wait for portering.

Project development
A steering group was created. Information leaflets were ratified and it was agreed these would be sent to the parents with the appointment letter. This was reinforced by nursing staff telephoning families the night before they were due to come in explaining fasting times and the need for sleep deprivation, and answering questions. The sedation protocol was amended reducing the maximum age for chloral hydrate use from five years to three, and a
second ½ dose was allowed if the first was ejected. After due risk assessment it was also deemed fit for senior nurses to take verbal consent provided the protocol check list had been fully met.

A suitable training pack was created for nurse candidates who met prior experience criteria in seniority and specifically paediatric experience. Training was both theoretical and practice-based.

Results
Though not directly comparable due to changes in sedation protocol the success rate with the nurse-led system increased from 54% to 83%. The observed benefits were
1) Children and their families receive a seamless service as the nurse is responsible for admission, consent sedation and discharge.
2) Nurses feel more in control and more valued as professionals.
3) Productivity on the ward has increased.
4) Families are better prepared.

There was initially resistance from the nursing team to the extra responsibility but all quickly realised that the new system improved their job satisfaction. The patient experience had improved and the ward was more efficient. One disadvantage was deskilling of the medical staff who with lack of involvement may now book the wrong form of sedation against protocol.

Conclusion
Trained nurse-led sedation is safe, effective and efficient. Appointing a lead consultant to chair the steering group has ensured medical confidence, and closer liaison with the imaging suite has improved flexibility of appointments. Following this work nurse-led intravenous sedation has been introduced and this is working well.

Bill Hamlin

SEDATION IN CHILDREN UNDERGOING DENTAL TREATMENT(REVIEW)


Objectives
To evaluate the efficacy and relative efficacy of conscious sedation agents and doses for behaviour management in paediatric dentistry.

Search methods
MEDLINE, EMBASE, Cochrane Central Register, Dissertation abstracts, SIGLE, Google and the Community of Science were searched from 1966 up to 4th August 2011. Authors were subsequently contacted for clarification.

Selection Criteria
Studies were included if they were randomised controlled trials of conscious sedation comparing two or more drugs/techniques/placebo undertaken in children up to 16 years of age.

Main results
Thirty-six studies were included with 2810 participants. Thirty trials (83%) were at high risk of bias and six (17%) were at unclear risk of bias. There were 28 different sedatives used with or without inhalational nitrous oxide. Techniques and doses varied widely. Meta-analysis of the available data was possible for studies investigating midazolam vs placebo only.

Authors’ Conclusions
There is some weak evidence that oral midazolam is an effective sedative agent for children undergoing dental treatment. There is very weak evidence that nitrous oxide may also be effective. Further research is recommended.

Bill Hamlin

SEDATING APPREHENSIVE DEBILITATED PATIENTS FOR DENTAL PROCEDURES BY COMBINING PARENTERAL SEDATION AND HYPNOSIS WITH SUPPLEMENTAL ACUPUNCTURE THERAPY.


Treating apprehensive debilitated patients with normal doses of sedative may cause unexpected medical complications due to decreased functionality of their organs. The authors treated 34 apprehensive dental patients with a combination of sedation hypnosis and acupuncture. The Bi-digital O-Ring test (BDORT), worth looking up in Wikepedia, was used to pre-select compatible sedative drugs and the correct dosage for the patient’s medical condition. This was often a fraction of the drugs normal therapeutic dose, hypnosis and acupuncture being used to potentiate the low dose of sedative.
Method
Thirty-four debilitated patients ASA class II or III who had been previously treated by the authors were selected. There were 17 males and 17 females aged 47–76. Comorbidities were: 12 previous myocardial infarction, 4 cirrhosis, 4 renal dialysis, 1 hyperthyroidism, 7 congestive cardiac failure, 4 pulmonary disease and 2 hepatitis. Sedation for dental treatment with drugs at the doses compatible with their disease had previously been tried and failed.

Hypnotisability was assessed in three ways. The eye roll test, postural sway test and finger lock test. If all three tests were passed then the patient was highly hypnotisable, two tests with moderate scoring on the eye test showed a moderate susceptibility and failure indicated a poor susceptibility to hypnotism.

All operations were carried out in the morning with a maximum actual operating time of ½ hour. Patients were advised to have a good night’s sleep prior to sedation and hypnotics were prescribed to those with difficulty in sleeping. During the procedure pulse oximetry and blood pressure were monitored. Oxygen was provided to all those with cardiac disease.

The principal sedatives were midazolam 2.5mg with alfentanil 250mcg for shorter cases, and diazepam 5mg with fentanyl 150mcg for the longer cases. Sedation was titrated up to these maximum doses. For cases over 1 hour IM sedation was used, meperidine 1.5mg/kg plus promethazine 1mg/kg.

Sedative and dose were selected using the BDORT technique and using a copper rod or finger pointed at the compromised organ. Once the dose was determined then hypnotisation/sedation would proceed.

Induction of hypnosis was initiated before the sedative was given as it requires concentration and a degree of imagination, needle phobics were happy to be canulated once trance had been effected. Hypnosis was by voice suggestion with or without additional visual distraction. Eyelid droop was deemed to be the end point suitable for surgery to commence. If this was not gained with sedation/ hypnosis the P6 acupuncture point between palmaris longus and flexor carpi radialis was also used. Acupuncture was performed in 14 of the 34 patients. The anaesthetic glove technique transferring suggested numbness from the hand to the mouth was used in two cases where local anaesthesia was suboptimal.

The dental treatment included operative dentistry, periodontal scaling and curettage and oral surgery.

Post-op the patients were asked to score pain and anxiety modification with the technique. The dentists were asked to score the patients manageability throughout the procedure.

Results
Because of the low sedative dose no patients lost consciousness and all were able to follow verbal command. 20 were able to complete the treatment uneventfully, 8 had some body movement but this did not interrupt dental treatment. 3 interrupted treatment but the dentist was able to complete, and on 3 treatment failed, these were referred to hospital for treatment under GA.

23 patients reported tremendous diminution in their anxiety level, 1–3 on the analog scale. 8 reported moderate reduction 4–7 on the scale, and 3 reported no effect, it was these 3 who were referred to hospital.

Patient and surgeon satisfaction showed the efficacy of the technique to be highly significant P<0.0001 is quoted.

Conclusion
The combination of hypnosis, acupuncture, BDORT and sedation is well received by most patients. Hypnosis augmented parenteral sedation and the use of BDORT to predetermine the sedative dose is benefical to the patients and operating team. The sedative dose calculated by BDORT would be insufficient to work alone and requires the synergy of hypnosis and acupuncture.

Note: In 2003-4 The New Zealand Medical Practitioner Disciplinary Tribunal struck off a practitioner dismissing the use of BDORT as non scientific and his practice as negligent.

Bill Hamlin

CARDIOVASCULAR EFFECTS OF DEXMEDETOMIDINE SEDATION IN CHILDREN.


Dexmedetomidine (Dex) affects heart rate (HR), mean arterial blood pressure, cardiac index (CI), stroke index (SI) and systemic vascular resistance index (SVRI) in adults. This study looked to see if similar changes occur when Dex is used in paediatric sedation.
Method
Children <18 years undergoing sedation for a CT scan were eligible for the trial. Patients were fasted for two hours for liquids and 6 hours for solids prior to sedation. No premedication was used. All children received Dex 2mcg/kg bolus over 10 minutes followed by a continuous infusion of 1mcg/kg/hour until completion of the procedure. The initial bolus was repeated if the initial dose had failed to produce a Ramsay sedation score of > 4.25 equivalent to between moderate and deep sedation. As soon as a RSS of four had been achieved the procedure was started, if this occurred before completion of the bolus the bolus was still completed. The children were divided into two groups, procedures lasting less than 10 mins (Dexbrief), and longer than 10 mins (Dexlong).

All patients were continuously monitored for oxygen saturation and heart rate. Blood pressure was recorded every five minutes. If there was a fall in BP >20% 10ml/kg crystalloid was given and all patients received 20 ml/kg fluid intravenously in recovery. Physiological monitoring and RSS score were recorded until discharge with an Aldrete score of nine. Physiological score used to deem fitness for discharge each parameter scores 0,1, or 2.9 is safe to discharge.

Haemodynamic monitoring
Cardiac output measurement was with a portable non-invasive continuous monitor approved by the FDA. This works using normal ECG electrodes and works on thoracic impedance. The child’s height and weight are entered which gives the body surface area for CI and SI calculations. Data collection was from five minutes prior to start until five minutes after discharge. Patients were excluded if high quality records were not available throughout the procedure. This was indicated by four or five bars on the CO monitor screen.

Full sets of results were collated at time 0, +10 minutes, +20 minutes and recovery intermediate observations on the continuously monitored parameters were noted. With poor quality non CO data, extrapolation was used from adjacent data.

Results
33 patients were recruited. Five did not require sedation, one withdrew, one was excluded as he had received prior sedation and nine were excluded because of incomplete data. This left eight Dexbrief and nine Dexlong subjects who had complete high quality data sets. Gender, age and weight were similar for both groups. In the Dexlong group three received a second bolus of Dex as their RSS score was <4. No patients received pharmacologic therapy for fluctuations in cardiovascular fluctuations.

There was a significant decrease in HR and CI 5–10 minutes post-Dex bolus, these had recovered to base line 60 minutes after start of brief exposure. Prolonged exposure lead to decrease in HR CI that did not recover to base line, this was accompanied by an increase in SVRI which persisted for one hour after stopping Dex.

Conclusion
This was the first study in cardiac function during Dex sedation in normal children. Fall in BP CI and heart rate are similar to those found in adults and appear dose-related, the small group of three who received a second bolus having a further fall. Recovery in the longer cases is however more prolonged than with adults, 60 minutes against 50.

It was felt there was some limitation with the data as central venous pressure was not measured and although the CO monitor was calibrated accuracy was less than using an invasive system.

Bill Hamlin

CLINICAL PRACTICE GUIDELINE FOR EMERGENCY DEPARTMENT KETAMINE DISSOCIATIVE SEDATION: 2011 UPDATE


The dissociative agent ketamine has been the single most popular agent to facilitate painful emergency department (ED) procedures in children for nearly 2 decades. Previous guidelines (1999, 2004) are now out of date and have now been updated according to latest evidence involving the use of this drug in the ED.

Ketamine displays unique features that warrant considering it separately from other sedatives. It produces a cataleptic state of sensory isolation characterised by potent analgesia, sedation and amnesia maintaining cardiovascular stability and preserving spontaneous respirations and protective airway reflexes. It does not have a dose – response continuum like most other sedatives. The sedative state may be achieved by a single intravenous or intramuscular dose. Ketamine-related airway and respiratory events are rare. A definition of this type of sedation which is unlike the sedation achieved by
traditional sedatives is described by Dissociative-Sedation (DS). "A trancelike cataleptic state induced by the dissociative agent ketamine, characterised by profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respirations and cardiopulmonary stability."

**Indications:** The literature is strongly supportive of the safety and efficacy of ED dissociative sedation for a variety of brief painful or emotionally disturbing procedures in both children and adults. It is also useful in mentally disabled patients who may be unco-operative.

**Absolute contraindications:** Age younger than 3 months (higher risk of airway complications). Known or suspected schizophrenia – can exacerbate condition.

Relative contraindications: Major procedures stimulating posterior pharynx (e.g. endoscopy) increases risk of laryngospasm. History of airway instability (previous surgery or malformation). Active pulmonary disease (e.g. asthma) or infection. Known or suspected cardiovascular disease, hypertension and elderly patients with risk factors of coronary artery disease. CNS masses, abnormalities or hydrocephalus (increases intracranial pressure with ketamine). Glaucoma or acute globe injury (increased intra-ocular pressure). Porphyria, thyroid disorder or medication (enhanced sympathomimetic effect).

**Personnel:** DS is a 2-person procedure, one (trained nurse) to monitor the patient and the physician to perform the interruptible procedure. Both must be knowledgeable about the unique characteristics of ketamine. Evidence supports the safety of monitoring by an ED nurse while the physician performs the interruptible procedure. Skills required include knowledge of the unique features of ketamine, skilled at procedural sedation and analgesia, resuscitation, advanced airway management, and vascular access; these skills are considered to be adequate and qualify the clinician to administer DS without specific additional hospital credentialing.

**Ketamine administration.** IV route is best due to rapid effects and can administer additional doses if required. Recovery is more rapid with IV administration. Benzodiazepines may be administered should disinhibition occur. There is less risk of vomiting when the IV route is used. IM route is recommended for unco-operative or combative patients. IV recommended loading dose is 1.5–2.0mg/kg in children and 1.0mg/kg in adults (recommended route) over 30–60 seconds. The IM dose is 4.0–5.0 mg/kg in children.

**Procedure:** Suction equipment, oxygen and bag/mask/valve and age-appropriate equipment for advanced airway management should be immediately available.

**Fasting:** There is insufficient evidence to recommend a specific fasting duration before DS. Despite 40 years of continual worldwide use, there are no documented reports of clinical significant ketamine-associated aspiration except in ill neonates.

**Monitoring:** Close observation of airway and respirations by an experienced health care professional is mandatory until recovery is well established. Drapes should be positioned so that airway and chest motion can be visualised at all times. Occasional repositioning of the head or suctioning of the anterior pharynx may be indicated for optimal airway patency. Maintain continuous monitoring until recovery (e.g. pulse oximetry) is well established. Pulse and respiratory rate should be recorded periodically throughout the procedure. BP measurements are usually unnecessary beyond the baseline value.

**Potential adverse effects:** Airway misalignment requiring repositioning of the head (occasional). Transient laryngospasm (0.3%), transient apnoea or respiratory depression (0.8%), emesis – usually late in recovery (8.4%), recovery agitation (mild in 6.3% and clinically important in 1.4%), muscular hypertonicity and random movements (common), and clonus or hiccupping or rash on face and neck of short duration may occur.

**Recovery:** Maintain minimal physical contact or other sensory disturbance. Maintain a quiet area with dim lighting and advise carers or parents not to stimulate patients prematurely.

**Discharge criteria:** Nil per mouth for 2 hours. No independent ambulation for 2 hours. It has been shown that no important adverse events have occurred 30 minutes beyond the final administration in children sedated with either ketamine or midazolam.

**Future research questions:** Although the ED ketamine literature in children is robust, more evidence is required to obtain the evidence in adults as robust as it is in children. Propofol use in the ED is increasing and questions remain as to its safety profile in the ED. The use of a combination of ketamine and propofol may have benefits, but research is required to determine whether this combination is better than each of the individual drugs.

**Sub-dissociative ketamine:** some ED physicians administer ketamine in lower doses that produce
analgesia, disorientation and obtundation rather than dissociation or because satisfactory conditions can be achieved with adjunctive local anaesthesia or physical immobilisation. Faster recovery can be expected, but there are questions as to relative benefits over DS. The use of the S(+) isomer of ketamine may exhibit enhanced dissociative/analgesic potency, greater amnesia, faster elimination and fewer recovery reactions and may have neuro-protective effects. Target controlled infusion has demonstrated benefits (less total ketamine – reduced dose and reduced recovery time) and deserves further study.

Ketamine sub-dissociative sedation has been used safely in the UK for paediatric dental sedation for the past 14 years. Usually 0.25–0.5mg/kg doses are used for paediatric dental sedation. For continued safe use of ketamine sedation it is important that evidence-based guidelines are followed.

Michael Wood

ACCEPTABILITY OF BEHAVIOUR THERAPY FOR DENTAL PHOBIA.

Forbes MDL, Boyle CA, Newton T.

Abstract – Objective: To determine how people with dental phobia rate the acceptability of behavioural therapy.

Methods: One hundred and twenty individuals with dental phobia participated in a three-factor experimental vignette-based design. The three factors examined were dental treatment history, nature of intervention (intravenous sedation or behavioural therapy) and treatment outcome. There were eight different vignettes representing all combinations of the three experimental variables, and 15 participants completed each vignette. Results: Treatment outcome had a strong effect on rated acceptability ($P = 115.76$, $P < 0.001$). There was a weaker effect of treatment type ($P = 5.49$, $P < 0.05$) with behavioural therapy rated as more acceptable than intravenous sedation. Previous history of intravenous sedation was associated with a decreased perception that it is possible to overcome dental fear.

Conclusions: The perceptions of individuals with dental phobia of the acceptability of behavioural approaches to management are influenced by the perceived outcome of the treatment.

This study found that about 50% of dental phobic patients would be prepared to try behaviour therapy but this was not the perception for those who had previously had intravenous sedation for dental treatment. Commissioners for dentistry should think about the integration of behavioural management within the range of anxiety management options and fund this appropriately.

Michael Wood

ANALYSIS OF OXYGEN SATURATION RECORDS DURING DENTAL INTRAVENOUS SEDATIONS: A RETROSPECTIVE QUALITY ASSURANCE OF 3500 CASES

Andre Viljoen, MDS, FRACDS,* Karen Byth, PhD,* Malcolm Coombs, MDS,* Greg Mahoney, PhD,* and Douglas Stewart, MS;Med

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The death of a patient under sedation in New South Wales, Australia, in 2002 has again raised the question of the safety of dental sedation. This study sought answers to 2 questions: Can safe oxygen saturation levels ($\geq 94\%$) be consistently maintained by a single operator/sedationist? Does the additional use of propofol, in subanesthetic doses, increase the risk of exposure to hypoxemia? Three thousand five hundred cases generated between 1996 and 2006 were randomly examined and divided into 2 subcohorts: 1750 patients were sedated with midazolam and fentanyl, and 1750 patients received propofol, in subanesthetic increments, in addition to midazolam and fentanyl. Initial sedation was established using midazolam and fentanyl in both subcohorts. The second subcohort received propofol during times of noxious stimulation. Patient exposure to 2 or more oxygen desaturations below 94% was uncommon. The variables that were significantly associated with low saturations were age, gender, and weight. Neither the dose of midazolam nor the additional use of propofol was a significant risk factor. ASA classification (I or II) was not a determinant of risk. The data, within the limitations of the study, showed that a single operator/sedationist, supported by a well-trained team of nurses, can consistently maintain safe oxygen saturation levels. The additional use of propofol did not increase exposure to hypoxemia.

This study lends more evidence as to the safe provision of advanced conscious sedation by an operator—
sedationist working within primary care. It also demonstrates that intermittent small boluses of propofol may be administered safely by an operator - sedationist as part of a well-trained team.

Michael Wood

PROCEDURAL PEDIATRIC SEDATION BY NURSES: AVAILABLE, COMPETENT, AND SAFE

Lavoie L, Vezina C, Paul-Savoie E et al.

Int Jnl Pediatrics, Article ID 820209, 5 pages 2012 Hindawi Publishing Corp.

Sedation and/or analgesia are standard of care for pediatric patients during painful intervention or medical imaging requiring immobility. Physician availability is frequently insufficient to allow for all procedural sedation. A nurse-led sedation program was created at the Centre Hospitalier Universitaire de Sherbrooke (CHUS) to address this problem.

Objective: to evaluate the effectiveness and safety of the program.

Methods: A retrospective study of all the procedural sedations done over one year was performed. ASA 1–3 children were sedated by nurse-sedationists. Complications were separated in 4 categories: (1) major complications (call for help, unexpected admission, aspiration and code); (2) reportable sedation events (oxygen desaturation <90%, bradycardia (more than 2 SD away from the normal for the age of the child) and hypotension (more than 2 SD away from the normal for the age of the child); (3) difficult sedation (agitation, inadequate sedation, and failure to perform the procedure); (4) minor complications.

Results: 448 patients, 249 boys and 199 girls, received sedation for 555 procedures. Overall 78% (432) of interventions were successfuly accomplished. 0% of major complications, 8% of reportable sedation events; 5% of difficult sedation, 9% of minor complications. Almost 50% of children presented with a chronic medical condition at the time. Midazolam was used in 65% of procedures, ketamine (22%), fentanyl (21%), chloral hydrate (8%) and pentobarbital (8%) was used, with 52% of children receiving a combination of 2 drugs – most commonly administered midazolam/ketamine and midazolam/fentanyl combinations. Reportable sedation events were associated with the use of fentanyl, age less than 6 months of age and during endoscopy procedures.

Conclusion: Our nurse-led sedation program compares favourably with other similar systems, e.g. the Great Ormond Street Hospital program of using nurse-sedationists.

Michael Wood

PROFESSIONAL SKILLS AND COMPETENCE FOR SAFE AND EFFECTIVE PROCEDURAL SEDATION IN CHILDREN: RECOMMENDATIONS BASED ON A SYSTEMIC REVIEW OF THE LITERATURE.


Objectives: To investigate which skills and competence levels are imperative to ensure optimal effectiveness and safety of procedural sedation (PS) in children and to analyse the underlying levels of evidence.

Study Design and Methods: Systematic review of literature published between 1993 and March 2009. Selected papers were classified according to their methodological quality and summarized in evidence-based conclusions. Next, conclusions were used to formulate recommendations.

Results: Although the safety profiles vary among PS drugs, the possibility of potentially serious adverse effects and the predictability of depth and duration of sedation define the imperative skills and competence necessary for a timely recognition and appropriate management. The level of effectiveness is mainly determined by the ability to apply titratable PS, including deep-sedation using short-acting anaesthetics for invasive procedures and nitrous oxide for minor painful procedures, and the implementation of non-pharmaceutical techniques.

Conclusions: PS related safety and effectiveness are determined by the circumstances and the professional skills rather than by specific pharmacologic characteristics. Evidence-based recommendations regarding necessary skills and competence should be used to set up training programs and to define which professionals can and cannot be credentialed for PS in children.
Since anaesthesiologists cannot cover the growing demand for PS, non-anaesthesiologists have organised their own PS strategies. By the end of the last century, PS by non-anaesthesiologists was criticized by anaesthesiologists for neglecting transparency and standard safety precautions. About a decade ago, dedicated non-anaesthesiologist specialists, who recognised the urgent need to improve the safety and quality of PS in children, joined the initial criticism of the anaesthesiologists, pointing at the safety problems of the untrained. In order to prevent PS-related tragedies, guidelines on PS were published. Recommendations were made on indirect evidence, ‘expert opinion’, ‘common sense’ and widely accepted rules for general anaesthesia.

Recent papers focus increasingly on the duty to deliver effective PS, not only from a procedural point of view (i.e. achieving optimal procedural comfort and minimizing procedural stress and failure). Young children who are anticipated to suffer from substantial emotional distress need a titrated form of PS in order to have a successfully completed procedure, and to avoid major psychological trauma to the child, the family and healthcare staff.

Safety of PS: the incidence of severe adverse events of 1/10 000 appears to be a fallacy as the majority of studies are underpowered to prove this conclusion. Vague definitions of ‘adverse events’ are used and the absence of directly life-threatening events are used as a synonym for ‘safe’. In his article of 2000, Cote demonstrated that PS-related safety is determined by circumstances and professional skills rather than by specific pharmacological drugs. Professionals who do not have the requisite competence to recognise and treat the potential PS-related complications constitute a significant risk factor for the occurrence of fatal complications or complications causing permanent harm to the patient.

Overall conclusions regarding the relation between professional competence/skills and PS-related safety:

1. In children with an underlying disease.
2. If multiple sedatives are used.
4. In certain drugs compared to others: the combination of a benzodiazepine with an opiate (e.g. midazolam + fentanyl) is associated with a higher risk of respiratory complications (21–23%) compared to the use of midazolam alone or ketamine + midazolam).

In comparison with ketamine, midazolam and midazolam + ketamine, the following drugs generate a higher risk of hypoventilation and desaturation – midazolam + fentanyl, and propofol.

Serious PS-related adverse events occur less frequently if specifically trained professionals working in dedicated teams perform sedation according to international guidelines.

Drug-specific conclusions regarding the relation between professional competence/skills and PS-related safety:

1. Non-titratable drugs intended for deep sedation: During PS, intended for moderate to deep sedation, with the use of benzodiazepines, chloral hydrate, barbiturates, opioids, or combinations of these medications, and during the subsequent recovery phase there exists a variable but real risk of potentially serious drug-induced adverse events. The risk for respiratory depression and/or airway obstruction necessitates specific skills and competence from the professionals in charge in terms of recognition and treatment.

2. Propofol: During PS using propofol, there is a real risk of potentially serious drug-induced adverse effects. The risk for respiratory depression and/or airway obstruction necessitates specific skills and competence from the professionals in charge in terms of recognition and treatment. PS with propofol, including deep sedation, is equally safe in the hands of anaesthesiologists and non-anaesthesiologists if the latter are well trained and part of a dedicated sedation team.

3. Ketamine for PS: There is a small but real risk of potentially serious drug-induced adverse events. These necessitate specific skills and competence from the professionals in charge in terms of recognition and treatment.

Independent risk factors for respiratory adverse events during PS with the use of ketamine are high IV doses, administration to children under 2 years of age or age 13 years and above, and the co-administration of anti-cholinergics and benzodiazepines.

4. Nitrous oxide: PS with nitrous oxide is associated with an extremely low chance of serious adverse events. Specific risks exist for adverse events if children are younger than 1 year old or simultaneous use of other sedatives.
General recommendations on necessary skills and competence for achieving optimal PS related safety and effectiveness in children:

1. Knowledge of the drug dosing, dosing techniques, indications, contraindications, and requisite precautions of the sedation technique used, acquired through specific training or demonstrable relevant experience.

2. Regular personal experience of the applied medication or technique (recommended 50 PS sessions per year).

3. Applying the form of sedation that is most appropriate for the procedure and the patient. This implicates the ability to guarantee the optimally effective sedation level in a predictable manner. An optimal PS technique should achieve near 100% predictable procedural success and timing, an optimal match between desired achieved levels of sedation, minimal induction, and recovery times and an optimal patient comfort by minimizing procedural pain, anxiety, and the need for physical immobilization or restraint.

4. The ability to perform pre-procedural screening and systematic risk analysis.

5. The ability to inform the patient, parents or carers about the sedation technique, the effects, potential side effects and the possible alternatives. The information must be given in time and be appropriate for the comprehension level of the patient and/or carers.

6. The ability to guarantee a child-centered approach within a general policy that favours children before, during and after the procedure.

7. The ability to apply, or arrange for complementary non-pharmacological techniques like preparation, distraction, combined cognitive-behavioural interventions, and hypnosis.

8. The ability to (a) apply effective local or topical anaesthesia, if appropriate, and (b) to recognise and intervene with possible toxicity of local anaesthetic agents.

9. Organising the necessary monitoring and rescue facilities during and after the procedure for as long as the consciousness level is lowered.

10. The ability to organise a supervised recovery phase and to define the discharge criteria.

11. The ability to organise the prompt availability of a resuscitation team or a professional trained in Paediatric Life Support.

12. Supervising, registering, assessing and optimising the quality of the sedation in terms of safety and effectiveness.

During PS involving mild sedation (conscious sedation) and during the subsequent recovery phase, a professional must be present with at least the following additional competence and skills.

- The ability to assess and interpret the sedation depth.
- The ability to maintain continuous verbal contact with the patient in the absence of any other form of monitoring.

Having acquired the necessary knowledge through a specialist course and by means of refresher courses and the ability to manage the following techniques at BLS level:

- Techniques intended to guarantee an open airway
- Techniques to administer Bag-Valve-ventilation

For PS (deep or moderate sedation), PS should be conducted by a separate professional not involved in the actual procedure and who has the following competence and skills.

- The ability to assess and interpret the sedation depth.
- The ability to guarantee the necessary monitoring of vital parameters, including capnography, and being able to appraise and interpret the monitored information.

Having acquired the necessary knowledge during a specialist course and by means of refresher courses and ability to manage the following techniques at APLS (Advanced Paediatric Life Support) level:

- Techniques intended to guarantee an open airway, including skills to manage laryngospasm and to use Laryngeal Mask Airways
- Techniques to administer mask/valve ventilation
- The use of sedative antagonists
- Cardiac massage techniques

PS is to be considered as a separate medical act, provided by well trained, competent and skilled professionals only, working within a context of transparency, registration and ongoing quality control. Skills and competence, rather than professional title are determinants for safe and effective PS. We believe that these evidence-based recommendations regarding necessary skills and competence should be used to set up training programs and to define which professionals can and cannot be credentialed for PS in children. Much emphasis is needed for adequate and effective implementation strategies for these recommendations.

Michael Wood
In December 2010 NICE published the guideline “Sedation for diagnostic and therapeutic procedures in children and young people”. In the recommendations there were the strong underlying themes of the need for training and competency. It was explicit that the safety and efficacy of sedation was dependent on the ability to:

- assess the child
- make sure the sedation technique was safe and appropriate
- know the limitation of a technique
- monitor the patient
- manage unexpected anaesthesia, airway obstruction and respiratory depression.

NICE insisted that the term healthcare professional was used rather than doctor or dentist.

Full details of training could not be addressed in the guideline and it was expected that specialties would develop training programs suited to the types of patient, the procedures and the techniques needed. Training courses could be started locally or nationally. There are significant advantages of organizing local courses that can serve local needs and be subject to clinical governance, appraisal and incident reporting.

Credentialing of sedation practitioners could also be tailored to the individual needs of the practitioner and the service in question. I believe that the practical experience component of training is more feasible locally.

It is probably true that 90% of sedation of children in the UK is undertaken in the four scenarios of dentistry, emergency medicine, radiology and endoscopy. This article briefly describes the common sedation methods used by these specialties and considers the difficulties of training for safe practice. What is a “safe culture” and the concerns expressed by the Royal College of Anaesthetists are addressed and finally, I have reviewed some important new published evidence.

Emergency medicine
Ketamine is the mainstay drug for minor painful procedures and provides the unique state of dissociation. The true degree of depression of consciousness caused by ketamine will be dose-dependent and will vary between patients. In the scenario of suturing a wound or the manipulation of a fractured arm, effective doses of ketamine usually cause deep sedation or anaesthesia. The combination of midazolam and fentanyl causes a variable level of sedation and are capable of causing unintended deep sedation. It is a useful technique but may not be as safe or as effective as ketamine alone. Nitrous oxide alone also has a role and has been used in concentrations of 50% or more safely. The College of Emergency Medicine has decided upon a guideline for ketamine administration and training is embedded in their training curriculum. Resuscitation skills are likely to be taught and practiced regularly in this “front-line” specialty where dealing with many types of emergencies is to be expected. There are no national training courses for emergency physicians. Training is conducted locally within departments who may have local rules to ensure that trainees are adequately supervised. There is no data to show whether this is happening widely.

Radiology
Few Radiologists provide sedation. Paediatricians may be more involved and in some units specialist nurses provide a service. Children having painless imaging such as MR and CT scans have to be “asleep” in order to remain sufficiently immobile and although the true depth of sedation is unknown, it is probably “deep”. Full monitoring is necessary. Capnography is the best monitor to detect respiratory obstruction and depression and it should, if used correctly, prompt effective interventions before desaturation occurs. Anaesthetists know that the capnograph is the best monitor to watch – the saturations can be heard. In time other sedationists will want to monitor unconscious patients with capnography.

Chloral hydrate is a common and effective drug for small
children. Larger children are more difficult to sedate to a level that is deep enough but not too deep. Intravenous midazolam is said to be effective in older children but its true reliability and safety are unknown. Details of training of Paediatricians for sedation are not available although listed in the specialty training curriculum. Specialist nurses in the author's hospital receive personal tuition and are assessed over several months to ensure safe practice before they are allowed to sedate children alone.

Propofol or sevoflurane may be administered in a technique considered to be sedation. Whereas these drugs can provide sedation, it is more realistic to assume that at least for some of the time the children will be in an anaesthetized state. It is therefore widely recommended that only anaesthetists administer these drugs. In doing so, it is much easier for the anaesthetist to administer the drugs in doses that will cause anaesthesia and thereby ensure that the child has a successful image. Both drugs are sufficiently short acting to make the distinction between sedation and anaesthesia unimportant and for this reason, most anaesthetists are not interested in sedation in this scenario. Currently it is likely that the majority of children who are unable to lie still awake for a painless imaging procedure will be given a short acting anaesthetic.

Endoscopy
Large numbers of children are managed for endoscopy under conscious sedation using midazolam. It is probable that many of these are sedated deeply unintentionally. Many endoscopists have understood that a technique using propofol that does not involve insertion of an artificial airway provides a more reliable and efficient service, and is arguably safer than accidental excessive sedation by midazolam. Techniques involving propofol are classed as sedation by some endoscopists and, whether this is an accurate description or not, is not important if the drug is administered by an anaesthetist. To the author's knowledge endoscopists in the UK are not using propofol without an anaesthetist. Recovery times after propofol can be short and it is reasonable to tell parents that their child will be awake and eating within 15 minutes after the end of a 40-minute endoscopy. Parents and children should be told that they are not having sedation and that propofol is an anaesthetic but not a "full" anaesthetic; most people understand the meaning of light anaesthesia and this description may then lead to more detailed conversations about anaesthesia depth and the risk of post-operative recall. Few children in the UK request sedation for endoscopy when they are offered propofol anaesthesia; they want to be asleep and have no recall of an unpleasant experience. Target-controlled infusions and monitoring of processed EEG may help to avoid accidental awareness in the future although current supportive evidence is sparse. The 5th National Audit Project (NAP5) is on Accidental Awareness during General Anaesthesia is in progress – organized by the Royal College of Anaesthetists and the Association of Anaesthetists of Britain and Ireland (www.nationalauditprojects.org.uk). It aims to estimate the incidence of reports of awareness in a year in the NHS and how much distress awareness causes. Data collection ends in June 2013.

Dentistry
Nitrous oxide or midazolam are effective and safe for young children and adolescents respectively. Training for these techniques has been achieved, locally, because sufficient numbers of children are available for trainees to gain supervised practical experience. When these techniques are not effective enough the practitioner has two main choices: either add other sedation drugs, or refer to a specialist who may decide to use advanced sedation or anaesthesia. Some practitioners have used combinations of other drugs and they claim that these are effective and safe but sufficient data is unavailable to be sure that they are safe enough for widespread use, i.e. what is safe by an expert may not be safe when applied by others without training and with less experience. A crucial point for dentistry is the number of children requiring more than the basic sedation methods. If the number is too low, it will be too difficult to train dentists to use advanced techniques. Whether or not advanced techniques are better than conventional anaesthesia is not the most important question – it is, as the NICE guideline states, about who is trained to apply them safely.

The Intercollegiate Advisory Committee for Sedation in Dentistry (IACSD) ceased in 2011 in anticipation of new guidance on sedation being produced by the Academy of Medical Royal Colleges (AoMRC); this is in progress and one of the objectives is to recommend the competencies of practitioners for specified sedation techniques. In addition to the AoMRC an Independent Expert Group on Standards for Sedation in Dentistry
(IEGSSD) has formed and has published recommendations on training and competencies for sedation of both adults and children having advanced sedation (available on the SAAD website).

**Is sedation safe?**

Recently an international committee devised a system of reporting adverse events of sedation. Such a tool could be useful to practitioners to help them describe the safety profile of their sedation practice. An online database has been developed to enable the collection of a large data set that could help show that sedation is safe – or not. In the UK clinical governance, annual appraisal and revalidation should all help to encourage practitioners to take record keeping seriously. It should be possible to show patients, if they ask, the safety record within a practice. Another useful tool for audit can be found in the Royal College of Anaesthetists compendium of audit recipes.

James Reason, the renowned expert in medical safety, has said that the common factor in unsafe cultures is the denial of untoward incidents. With this in mind, a “safe culture” expects problems and takes measures to avoid them. To this aim, if problems are expected, training is vital. In healthcare our culture should allow honest reporting and sensible precautions against mishap.

**Royal College of Anaesthetists**

The College aspires to train anaesthetists in sedation of children. In the CCT curriculum, general training for sedation is an essential higher unit and training in conscious sedation in dentistry is a specified optional higher unit; sedation is also specified in the paediatric section of the curriculum. It is unfortunate that even in specialist hospitals, there are few training opportunities for sedation. In radiology and endoscopy, the techniques involving propofol may be considered to be both anaesthesia and sedation, and in these areas training is possible. Perhaps training opportunities for anaesthetists in dental sedation would be more likely if the demand was higher.

The anaesthesia curriculum states that trainees “understand the limitations of working in the isolation of the non-hospital environment” and this is a well-known concern of the College. Following the publication of the NICE guideline 112, the College wrote a letter that was supportive but expressing concerns about three points:

- the use of anaesthetic agents …… by practitioners without identified appropriate training and competencies
- the need to develop accredited training programs for the whole range of sedation practices …… with additional competencies being required for deep sedation
- the risks of deep sedation outside a hospital environment.

Ideally, anaesthetic drugs would be administered only by fully-trained anesthetists in hospitals. That this is not always readily available has created a middle ground of advanced sedation techniques administered in facilities that are not equivalent to hospitals. The crucial problem for these facilities is their ability to stay safe – without identifiable training they are vulnerable to criticism. Their sustainability depends on sufficient demand for advanced techniques; if demand falls, so does training opportunity.

**Research update**

NICE regularly update the evidence for their guidelines and earlier this year an advisory group reviewed recent publications. I have summarized four papers that are relevant to dentistry.

**Propofol combined with ketamine**

In the setting of minor procedures in an emergency department, Andolfatto and Willman reported their experience in 219 children with ketamine 10 mg/kg combined with propofol 10 mg/kg in a single syringe. This mixture was titrated in 0.5 mg/kg of each drug every 30-60 seconds. Two doctors were present at all times. Sedation was effective and safe. The median doses of ketamine and propofol were 0.8 mg/kg (range 0.2 to 3.0). Two children needed intervention for emergence reactions.

Shah and colleagues conducted a blinded and randomized clinical trial of ketamine and propofol versus ketamine alone for limb fracture manipulation in 136 children. In the combination group ketamine 0.5 mg/kg and propofol 0.5 mg/kg was followed by propofol 0.5 mg/kg and saline every two minutes until sedation was deep. Ketamine patients received intralipid and ketamine 1.0 mg/kg, followed by intralipid and ketamine 0.25 mg/kg. Propofol reduced recovery times and vomiting. Airway effects were similar. Sedation and recovery times were shorter with propofol.
Intranasal (IN) drugs

In a randomized crossover study, Bahetw ar and colleagues (2010), compared IN midazolam (0.3 mg/kg), IN ketamine (6 mg/kg), and an IN combination of midazolam with ketamine (0.2 mg/kg & 4 mg/kg) in 45 children having repeated dental procedures. The patients were 2-6 years old and received each regimen once in each of three visits. Midazolam was the least effective method and it had the longest induction time although with the shortest recovery. Ketamine alone was the most effective technique.

Wood (2011) reported his experience with IN midazolam for dental procedures in 114 anxious children. He used 0.25 mg/kg (using a concentrated formulation 40 mg/ml in 2% lidocaine). 104 completed the treatment without any other drugs and 10 needed intravenous sedation. One child only desaturated, briefly, in the recovery area. This technique could be useful to aid co-operation of children before distressing procedures such as intravenous cannulation.

References


As a Dental Therapist with many years of clinical experience, managing the anxious and phobic patient has become a major part of my work. When I qualified from New Cross Hospital, my clinical training had been solely with children. As with all therapists in those days, I went to work in the Community Dental Service (CDS) and treated children, some of whom were very young or anxious. Eventually the role of Community Dentistry expanded and encompassed adults with special needs. Those ‘special needs’ were not restricted to disabilities or patients with complex medical histories but included those patients who because of anxiety, fear or phobia could not receive treatment in General Dental Practice.

Nowadays the CDS is known as the Salaried Primary Dental Care Service (SPDCS) and accepts patients only on referral. The dentist assesses the patient and, dependent on treatment needs, either refers to a dental therapist for acclimatisation, confidence building and treatment using traditional behaviour management techniques or treats with relative analgesia, intravenous sedation or general anaesthetic.

A few years ago it became apparent to me that if I could not manage patients using traditional psychological approaches, many would ultimately receive intravenous sedation (not suitable for needle phobics or children) or inhalation sedation (not suitable for very young children) or general anaesthesia.

I felt that another option was needed. I began to research and then to train in Neuro Linguistic Programming and Hypnosis and since 2006 have incorporated both into my clinical practice.

Eventually, following the changes to the GDC Scope of Practice (2009) in which administering inhalation sedation was included as one of the additional duties Dental Therapists and Dental Hygienists may be trained. In May 2011, Dental Therapists working within the SPDCS in Northamptonshire were invited to attend an ‘in-house’ theoretical and practical training in Inhalation Sedation. Earlier this year Northamptonshire SPDCS achieved accreditation from SAAD.

What is the difference between Anxiety, Fear and Phobia?

Definitions
Anxiety – reaction to an unknown, ill-defined or not immediately present danger.
Fear – reaction to a known or perceived threat or danger. Leads to activation of the fight or flight response.
Phobia – marked and persistent fear of a specific situation or object that is excessive or unreasonable, leading to avoidance of the anxiety-producing situation, causing significant distress or interfering with normal functioning.

Recognition of Anxiety
It is not difficult to recognise the physiological signs of anxiety – sweating of the palms of the hands, forehead, upper lip, pulsation in the carotid and temporal arteries, and the rapid yet shallow depth of respiration. Similarly recognisable are the behavioural signs – fidgeting with hands or objects, sitting on the edge of a chair, leaning forwards, rapidly thumbing through magazines, changing position frequently, pacing around and taking frequent visits to the bathroom.

Recognition of Fear/Phobia
Fear leads to activation of fight or flight response. These
patients feel exhausted after the appointment, and may cry.

A true phobia on the other hand is a little more difficult to recognise. These patients tend to avoid attending the dentist at all costs. They will make appointments and then cancel or simply not turn up. They may lose sleep days before an appointment, have panic attacks or faint in the surgery, feel sick, and even behave in an aggressive, or violent manner.

**General factors involved in Dental Phobia**
- Emotional – guilt, shame, anxiety, embarrassment, fear of what the dentist might say about their teeth
- Procedural – invasion of body space, intimate examinations, loss of control (may stem from early abuse)
- Mistrust – fear of wrong treatment
- Catastrophe – gagging, choking, heart attack, tend to be hypersensitive about body sensations

**Specific Factors involved in Dental Phobia**
- General Needle Phobia
- Dental Needle Phobia
- Blood Phobia – typical response is a drop in blood pressure and heart rate - fainting. Approx 4% of normal population
- Pain, drill, extraction, smells, noises. Woolgrove et al. (1980) of 243 patients, 54% indicated fear of dentist, 30% of these expressed a fear of pain. Expectation of pain does not always relate to previous experience

**Theories of what causes Dental Phobia**
- De Silva (1988) suggested that certain fears such as heights, spiders, snakes, or indeed anything that could cause injury or loss of control may be evolutionary.

However the ‘Behavioural’ or ‘Learning’ theory offers a better explanation of dental phobia. The theory suggests that it is a previous bad/traumatic or painful experience that results in the most common cause of dental phobia. Having had a bad experience, if the patient ‘relives’ or ruminates on this experience they then expect the next dental experience to be the same. Their expectation increases their anxiety, and their anxiety and underlying tension increases the likelihood of the next experience being uncomfortable. Multiple exposures to traumatic experiences may be needed for the development of a true phobia.

The modelling theory suggests that fear may be transferred from one individual to another. By observing or hearing about another’s fearful response to an object or situation may be sufficient. If the other person is the mother she may, by ‘nurture’, transfer her fear to her child.

This ‘modelling’ theory also includes hearsay, stories, newspaper reports, TV programmes, even detrimental comments made by the parent or carer whilst the patient is in the chair receiving treatment.

There are also biological differences, and some individuals and ethnicities, have much lower pain thresholds than average.

**Managing Children with Behaviour Management Techniques**

With most children, uncertainty is the main cause of their anxiety – the fear of the unknown. Children need to be handled with care and understanding, and acclimatised gradually to the dental environment. It is important to give them full explanations using language suitable to their age and understanding. Providing plenty of time for the appointment is essential and in my experience if these guidelines are followed it is unlikely that even an unpleasant dental experience will develop into a phobia.

**Behaviour Shaping**
- Based on planned introduction of procedures so that the child is gradually trained to accept treatment in a relaxed and co-operative manner
  - Exam
  - Toothbrushing instruction
  - Prophylaxis and Fluoride Varnish application
  - Fissure sealants
  - Minimal occlusal restoration without LA
  - Restoration with LA (infiltration)
  - Restoration with LA (ID Block)

**Positive Reinforcement**
- Rewarding good behaviour in order to increase the likelihood of that behaviour being displayed in future
- Operator approval is essential to reinforce good behaviour and should be shown throughout treatment
- Smiling, nodding – does not have to be verbal reinforcement
- Never ignore good behaviour
Distraction
- Diverting the child's attention
- Breathing through nose
- Leg lifting during impression taking
- Pulling lip during LA administration (gate control theory) – stimulation of larger diameter nerve fibres such as pressure or vibration can close the neural 'gate' reducing the central perception of pain. Melzack and Wall 1965

Modelling
- Watching friends or an older sibling in the chair
- The relaxed co-operative behaviour of the 'model' will be imitated by the anxious child

Control
- Allowing the child some control
- 20% of dental needle phobia stems from being poor handing of prior needle procedures, being restrained or controlled with physical or emotional restraint
- Give child permission to signal by raising their left hand and you will stop, e.g. if a rest or a rinse is needed

Desensitisation
- Commonly used by psychologists dealing with phobias
- Classically involves three stages:
  - Teaching relaxation
  - Developing a hierarchy of fear-producing stimuli
  - Introducing each stimulus in hierarchy in turn to relaxed patient–hypnosis

Alternatives
NLP
Neuro Linguistic Programming (NLP), as the name suggests, refers to language (including non-verbal forms of communication) as a function of the nervous system and its transformation into 'subjective experience'. Put more simply, it focuses on the way we use our five senses to create a 'map' of 'reality' which we then use to navigate our way through the world.

Richard Bandler, one of the founders of NLP, spent a lot of time working with schizophrenic and psychotic patients believing and ultimately demonstrating that changing the 'map' could have a dramatic and immediate effect on changing behaviour and unresourceful emotions.

NLP is a tool box of techniques that we can use, so that if one technique doesn't work, you can try something else. It is important to understand this concept. We cannot rely on one or two techniques and expect them to 'fit all'.

I believe that the secret of managing anxious, fearful and phobic patients is flexibility. The ability and belief that 'If what you are doing isn't working ... try something else' is a core pillar of NLP.

I have found that using the NLP Communication Model and language patterns (especially the Meta model) have been extremely useful in building rapport with anxious, fearful and phobic patients.

Specific NLP techniques to deal with anxiety, fear and phobia include:
- Reframing
- The Fast Phobia cure
- Submodality change work
- Resource anchoring
- Neurological level alignment
- TimeLine work
- Change personal history

Milton Erickson’s expertise in gaining concordance with his patients was unparalleled. Erickson’s language patterns, known in NLP as the Milton Model, were elegant, persuasive and respectful of his subjects’ needs. Since his medium was hypnosis his language patterns were designed systematically to predispose the subject towards a more co-operative mindset.

Hypnosis
Definitions of hypnosis often vary according to theoretical perspective. According to the British Society of Clinical and Academic Hypnosis (BSCAH) hypnosis is an interaction between the hypnotist and the subject:

‘In this interaction the hypnotist attempts to influence the subjects’ perceptions, feelings, thinking and behaviour by asking them to concentrate on ideas and images that may evoke the intended effects. The verbal communications that the hypnotist uses to achieve these effects are termed ‘suggestions’. Suggestions differ from everyday kinds of instructions in that a successful response is experienced by the subject as having a quality of involuntariness or effortlessness.’ From Draft BPS statement prepared by BSECH, Sept 2000

Hypnosis and hypnotic procedures have two basic elements – trance and suggestion.
Cognitive Behavioural Therapy

CBT involves a structured way of talking to patients about thoughts, feelings and behaviours in order to identify unhelpful thoughts that can affect how they feel which in turn can affect behaviour. In many ways it is similar to NLP but is far more structured. A CBT session usually lasts an hour and it is not unusual for dental phobia to require ten sessions. At the core of CBT is building and maintaining rapport, teaching relaxation, distraction and breathing techniques, education and goal setting. Systematic desensitisation is also a part of the process. CBT follows a structured path and involves the patient writing down in record form at the triggering event, their thoughts and beliefs about the event, and the consequences that the unhelpful emotions or unwanted behaviours created. The patient is guided to attempt to identify how a more helpful thought might result in more appropriate emotions or more helpful behaviour. Because it is so structured, it is easy to evaluate and because of this there is much research its effectiveness.

Thought Field Therapy

Discovered and developed by Dr Roger Callahan PhD, a Californian clinical psychologist with over 40 years of experience, Thought Field Therapy (TFT) is a unique form of meridian therapy and has been shown to be extraordinarily effective in treating most psychological problems.

According to the theory, whenever we think of something we are tuning into a specific “Thought Field” in much the same way as a TV must be tuned in to receive a specific channel. Held within that energy field are the coded information patterns (essentially, a set of in-built programmes) used by the mind and body to generate the entire emotional experience associated with that thought.

This is why the experience (of fear, for example) is identical in all humans – the same ‘instructions’ are followed each time. Dr Callahan has named these information patterns ‘perturbations’, from the dictionary definition of the word – ‘a cause of mental disquietude’.

By tapping on the correct meridian points in a specific sequence (an algorithm), these perturbations, which are isolatable and are the ‘root cause’ of all negative emotions, can be deactivated, thereby effectively ‘switching off’ the emotional experience. The individual can now think about what troubled them as often as they want.
like as the memory of it remains unaffected, but the associated negative emotion (anxiety, anger, guilt) will no longer be present.

Using these skills

Using a CBT approach supplemented by Neuro-Linguistic Programming and hypnosis I have been successful in rehabilitating many anxious and phobic patients.

My criteria for accepting a referral for hypnosis is thus:

- The patient is willing to try hypnosis
- The patient is willing to overcome their problem
- They are not suffering from clinical depression or significant mental disorder
- There is no history of eating disorders, epilepsy, ADHD or autism
- The patient is over seven years of age
- They are not in pain or requiring urgent dental treatment
- Sedation or general anaesthetic not suitable/requested
- Does not have strong religious convictions, e.g. Jehovah's Witness

Dentists refer patients to me for alternative therapies because:

- The dentist feels it is worth a try
- The patient requests it
- The patient is extremely needle phobic
- The patient does not like being drugged, or is resistant to sedation drugs

The Consultation Visit

The first 30 seconds of a consultation can be critical. Research has shown that people make up their minds about each other almost instantaneously – the way we are dressed, posture, facial expression, eye contact and body movements.

‘Lack of warmth and friendliness has been found to be one of the most significant variables adversely affecting patient satisfaction and concordance.’

Garner Thomson ‘Magic in Practice’ 2008

My Tips

- Always collect phobic patients from the waiting room, building rapport can then begin whilst walking back to the surgery. Try not to keep them waiting (this is important for the first few sessions)
- Smile – full face, smiling with eyes and teeth – be genuinely pleased to see your patient
- Silently project a ‘message’ of goodwill. This subtly softens your facial expression, which the patient perceives at a subconscious level
- If the patient is very distressed NEVER touch them. This would create a negative kinaesthetic anchor to your touch. Only touch the patient when they feel relaxed thereby creating a positive and relaxing anchor to your touch.
- Be approachable – using a variable tone, pitch and eye contact, some physical movement, keep things light, and use appropriate humour
- Be credible—this means being authoritative but not overbearing. It means using vocal skills to ‘mark out’ important parts of what you are saying, but not by raising your voice
- Maintain good eye contact

The first visit is an opportunity to talk to the patient. I initially ask the patient to fill out a questionnaire based on the Modified Corah Questionnaire. I downloaded this from my UCL tutor Mike Gow’s website ‘WhatFear.com’. This version includes many extra questions that really help to ascertain where and when the patient’s fear began. It is usually, as mentioned earlier, a previous traumatic dental experience, although sometimes there are other underlying factors. The initial consultation is my opportunity to listen to the patient and encouraging them to describe and explain ‘feelings’. Sometimes I share my own childhood fear of the dentist. I explain about hypnosis and hopefully dispel any misconceptions they might have. I try to ascertain how motivated they are to overcome their fear – is it debilitating or are there any secondary gains?

I always tell patients that I do not expect them to trust me. I realise that I have to earn their trust. I also tell them that they can leave at any time. This gives the patient a sense of personal control. To date, no-one has asked to leave.

I have only refused to treat one patient so far. It became apparent to me during the consultation that the lady did not want to overcome her fear. She wanted a general anaesthetic and all the treatment done in one visit. She was also taking three different antidepressants and an antipsychotic drug for borderline personality disorder. Hypnosis was not for her. It is important that the referring dentist is fully aware of what can realistically be achieved with hypnosis.

The most important part of the consultation session is careful listening, questioning, and building rapport.
The next two visits
Over the first few visits I believe it is important to gain the trust of the patient, so I tend to avoid discussing dentistry. The first sessions are dedicated to teaching the patient breathing and relaxation techniques and encouraging them to practice at home.

Providing the patient is practicing at home, by the third visit hypnosis is working well. The patient is happier coming into the surgery, sitting in the chair and can even be left for five minutes in the waiting room, without fear of a panic attack. On visit three I usually elicit a hierarchy of fear-producing stimuli. Using a numerical scale (SUD – subjective unit of distress), I ask the patient to give a fear value to various dental procedures. This forms the basis of the desensitisation programme.

Session Four and Beyond
The next sessions are devoted to hypnosis and systematic desensitisation, working through the hierarchy. For needle phobics, a 'six stage' needle desensitisation is incorporated. Thought Field Therapy can be incorporated during these sessions to deal with emotional and psychological blockages if necessary.

Desensitisation takes place after hypnosis when the patient is fully relaxed. In collaboration with the patient, goals are then set for the next session.

Eventually when the patient is ready, dental treatment can commence, sometimes under Relative Analgesia, more often without. Gradually the patient can even be weaned off inhalation sedation.

Summary
Dental Therapists are in a prime position to be involved with the management of anxious and phobic patients. They earn less than dentists and are therefore a more cost-effective way of providing specialised care for anxious patients. Dental Therapists can spend more time educating and acclimatising these patients, do most if not all of the patient’s treatment, only referring back to the dentist for RCT, crown/bridgework/dentures and permanent extractions.

Ultimately this means that the patient receives high quality continuity of care. Treating anxious and phobic patients is time-consuming but ultimately very rewarding. If handled correctly and sensitively the anxious and phobic patient will not always be anxious or phobic, in the same way that children won’t always be children.

Dental Therapists can now extend their duties to include Relative Analgesia. This should enhance their employability and role within the dental team especially in the management of anxious and phobic patients.

Empowering a therapist with a toolbox of techniques at their disposal can be seen as part of a long term practice plan to ensure that anxious and phobic patients become rehabilitated, happy, compliant and loyal to the practice! In fact .... the sort of patients every dentist really wants to see.

The author would like to thank Mike Gow for his advice and guidance.

References


Pain is defined as ‘an unpleasant sensory and emotional experience, associated with actual or potential tissue damage’ (International Association for the Study of Pain. 2010). Invasive dental procedures induce tissue damage, thereby eliciting pain. Postoperative dental pain is commonly moderate to severe, presenting within the first three hours postoperatively, peaking at approximately six hours and lasting for up to five days (Mehlisch. 2002). Because of its duration and potential severity, postoperative dental pain often requires analgesia. This can be a minefield for the dental practitioner due to the vast array of analgesics available. Therefore the following essay considers the advantages and limitations of a few common analgesics, to aid the dentist in coming to an informed decision as to what should be prescribed for each individual patient.

**Background**

Invasive dental procedures cause trauma to the teeth and surrounding tissues, inducing pain by the activation of an inflammatory cascade (fig. 1). Inflammatory mediators are synthesised and released, which stimulate an increase in spontaneous activity and a decrease in pain threshold of nociceptive nerve endings.

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**Fig. 1: The inflammatory cascade induced following an invasive dental procedure**

- **Arachidonic acid**
- **COX-2**
- **COX-1**
- **Prostaglandins**
- **OEDEMA**
- **Histamine**
- **Mast cell**
- **Kininogen**
- **Substance P**
- **N-methyl-D Aspartate**
- **Nociceptive C fibre nerve ending**
- **PAIN**
- **Plasma extravasion**
- **Leucotrienes**
- **Prostaglandins and thromboxanes**
- **Haemostatic role in the stomach, kidneys and platelets**

Diagram displaying how trauma stimulates nociceptive nerve endings to elicit pain. Represents the therapeutic pathway which produces prostaglandins and thromboxanes. These do not induce pain, but play an important role in protection of the gastric mucosa, regulation of renal blood flow and initiation of platelet aggregation (Dionne et al. 2002)
afferent nociceptive C fibres (Dionne et al. 2002). This encourages depolarization and generation of an action potential which is relayed to dorsal horn neurons and subsequently to the brain, leading to pain perception (Mehlisch. 2002). Neuropeptides, such as substance P and N-methyl-D-aspartate, are released from nociceptive nerve endings and allow pain to continue long after trauma induction. They facilitate the formation of a positive feedback loop, which ensures repeated depolarization of the nerve until the wound has healed (Dionne et al. 2002).

Analgesics work by a variety of diverse mechanisms, but ultimately each intercept this inflammatory cascade to prevent an action potential being transmitted to the central nervous system.

**Paracetamol (Acetaminophen)**

Paracetamol is a renowned analgesic which has been available for over 40 years (Jung et al. 2004). The mechanism of action of paracetamol remains unclear. However current theories include that it inhibits N-methyl-D-aspartate or substance P production (Jung et al. 2004), interferes with the conversion of arachidonic acid to prostaglandins, or disrupts descending serotonergic pain pathways and cannabinoid receptor activity, to prevent pain transmission (Anderson. 2008).

Paracetamol has been proven to be effective at providing short-term analgesia for mild to moderate post-operative pain. In multiple studies paracetamol has been found to be superior to a placebo at providing pain relief. It exhibited rapid analgesic onset, with relief being maximal for up to six hours following oral surgery (Weil et al. 2012). Furthermore paracetamol is considered the analgesic with the fewest associated risks (table 1), being safe to prescribe to elderly, paediatric, pregnant and lactating patients. Consequently, due to its high benefit-low risk balance, paracetamol is considered as the analgesic of choice for mild to moderate post-operative dental pain (Haas. 2002).

However paracetamol does have its limitations, the most important being that it does not exhibit anti-inflammatory action and often provides inadequate analgesia. Barden et al. (2004) found that at doses of 600-1000mg, fewer than 40% of patients experienced at least half pain relief following dental surgery. This is thought to be due to paracetamol having a central mechanism of action, whereby it stimulates receptors involving N-Methyl-D-Aspartate and Substance P in the spinal cord to a greater extent than peripheral receptors to exhibit its anti-nociceptive effect. This is based upon the theory that paracetamol modulates nociceptive processes by affecting the descending serotonergic pathway from the raphe magnus nucleus to the spinal cord. Therefore it is perfectly adequate at providing analgesia for pain associated with the central nervous system, but is not as effective for blocking peripheral pain receptors (Anderson. 2008). This is further enhanced by the negligible protein binding and enhanced lipid solubility of paracetamol, producing greater concentrations within the cerebral spinal fluid than the plasma. The short acting nature of paracetamol and its ceiling dose effect further enhance its inadequacies by making it incapable of relieving pain for up to six hours, the time at which postoperative dental pain peaks (Mehlisch. 2002).

Table 1: The adverse effects associated with paracetamol

<table>
<thead>
<tr>
<th>Side effects (rare)</th>
<th>Contraindications</th>
<th>Use with caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rash</td>
<td>Alcohol dependence</td>
<td>Hepatocellular insufficiency</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td></td>
<td>Malnutrition</td>
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<tr>
<td>Leukopenia</td>
<td></td>
<td>Dehydration</td>
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<tr>
<td>Neutropenia</td>
<td></td>
<td></td>
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<tr>
<td>Anaphalactoid reactions</td>
<td></td>
<td></td>
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<tr>
<td>Hepatotoxicity following overdose</td>
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<td></td>
</tr>
</tbody>
</table>

(British National Formulary. 2012)
Table 2: The adverse effects associated with non selective NSAIDs

<table>
<thead>
<tr>
<th>Side effects</th>
<th>Contraindications</th>
<th>Use with caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspepsia *</td>
<td>Gastric ulceration</td>
<td>Elderly patients</td>
</tr>
<tr>
<td>Gastric mucosal damage</td>
<td>Gastrointestinal inflammatory disease</td>
<td>Coagulation defects</td>
</tr>
<tr>
<td>Impaired platelet function causing increased bleeding</td>
<td>NSAID induced hypersensitivity, asthma or nasal polyps</td>
<td>Cardiac impairment</td>
</tr>
<tr>
<td>Increased risk of thrombotic effects</td>
<td>Bleeding concerns</td>
<td>Renal impairment</td>
</tr>
<tr>
<td>Anaphalactoid reactions</td>
<td>Third trimester of pregnancy</td>
<td>Hepatic impairment</td>
</tr>
<tr>
<td>NSAID induced asthma</td>
<td>Renal disease</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Suppression of heterotrophic bone formation</td>
<td>Children under 16 years (Aspirin only)</td>
<td>Systemic lupus erythematosus</td>
</tr>
<tr>
<td>Bronchospasm</td>
<td>Concurent use of:</td>
<td>Crohn's disease</td>
</tr>
<tr>
<td>Hepatocellular injury</td>
<td>Antihypertensives (excluding calcium channel blockers)</td>
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<tr>
<td>Tinnitus</td>
<td>Lithium</td>
<td></td>
</tr>
<tr>
<td>Urticaria</td>
<td>Antineoplastic doses of methotrexate</td>
<td></td>
</tr>
<tr>
<td>Renal impairment</td>
<td>Alcohol</td>
<td></td>
</tr>
<tr>
<td>Discomfort</td>
<td>Digoxin if the patient is elderly or has renal disease</td>
<td></td>
</tr>
<tr>
<td>Nausea</td>
<td>Long term use of NSAIDS</td>
<td></td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>Long term use of acetaminophen</td>
<td></td>
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<tr>
<td>Headache and dizziness</td>
<td>Oral hypoglycaemics</td>
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<tr>
<td>Fluid retention leading to increased blood pressure</td>
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<tr>
<td>Depression</td>
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<tr>
<td>Insomnia</td>
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<tr>
<td>Vertigo</td>
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* Enteric–coated formulations can be prescribed which may reduce the likelihood of dyspepsia, but will not prevent gastric damage (Haas, D.A. 2002)
Non selective NSAID

Non selective, non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used in the management of post-operative dental pain (Chen et al. 2004). They reduce both spontaneous and movement-evoked pain by competing with arachidonic acid for the cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) enzyme active sites. This decreases pain by reducing the number of prostaglandins, particularly the pro-inflammatory prostaglandin E2, produced via the action of COX-2 (fig.1) (Gilron et al. 2003).

Non-selective NSAIDs are extremely effective at providing analgesia and are usually all that is required to manage any level of postoperative pain (Haas. 2002). However, due to suppression of both COX-1 and COX-2 enzyme activity, they are associated with many adverse effects (table 2). COX-1 is responsible for the synthesis of therapeutic prostaglandins and thromboxanes, required for protection of the gastric mucosa, regulation of renal blood flow and initiation of platelet aggregation (Moore et al. 2011a). Therefore frequent side-effects of non-selective NSAIDs include peptic ulceration and impaired platelet function, resulting in an increased bleeding time. In addition it has been observed that inhibition of the cyclooxygenase enzymes results in shunting of arachidonic acid to lipoxygenase pathways (Gilron et al. 2003). This produces increased leukotriene synthesis, thought to play an important role in the mechanism of NSAID-induced bronchospasm (Gilron. et al. 2003).

There are many non-selective NSAIDs available for prescription, due to considerable variation in individual responses and tolerances to each NSAID. About 60% of patients will respond to any NSAID and of those who don’t, they may well respond to a different NSAID (British National Formulary. 2012).

Fig. 2: Graph displaying the reduction in pain achieved with ibuprofen, paracetamol and a placebo, up to six hours following third molar extraction.
However aspirin has many more adverse effects than ibuprofen. Unlike other non-selective NSAIDs it irreversibly, rather than reversibly, damages cyclooxygenase enzymes, impairing platelet function for the life of the platelet (Haas. 2002). Aspirin is therefore contraindicated in patients with bleeding concerns, including those on warfarin (British National Formulary, 2012). Aspirin is also the only NSAID which can potentially induce Reye’s syndrome if given to paediatric patients. This is a severe condition which can result in multiple organ failure and coma, so aspirin should never be prescribed to patients less than 16 years of age (British National Formulary, 2012).

Diflunisal
The NSAID diflunisal offers similar properties to aspirin. It is an effective analgesic for use in adult patients, with a single dose of 1000mg diflunisal offering 50% pain relief over 4-6 hours for 62% of patients. This is comparable to ibuprofen, lumiracoxib and co-codamol and marginally superior to aspirin (Wasey et al., 2010). Furthermore diflunisal offers effective analgesia for a long duration, with it exhibiting a greater mean time to re-medication compared to all other NSAIDs (Moore et al., 2011a).

However diflunisal has many disadvantages to its prescription, most of which are similar to aspirin. Therefore lower doses of diflunisal (500mg) have been suggested, to reduce the risk of adverse events. This inevitably reduces its efficacy such that other NSAIDs usually offer superior analgesia (Wasey et al., 2010).

Diclofenac Sodium
Diclofenac sodium is a mid-potency NSAID which can be prescribed in dental practice and offers an alternative to aspirin, diflunisal and ibuprofen. It has been found to be comparable in efficacy to both ibuprofen and co-codamol and, of the three analgesics, diclofenac exhibits the longest duration of analgesic action (Joshi et al., 2004). Furthermore it exhibits a lower incidence of adverse effects in comparison to aspirin and diflunisal. Consequently it combines good efficacy with a low risk of side-effects (British National Formulary, 2012). It should therefore be considered for moderate dental pain if an individual fails to respond to another NSAID, or as a useful alternative to a higher-dose lower potency NSAID or opioid.

**Fig. 3: Graph comparing pain reduction scores achieved with four common analgesics**

![Graph displaying pain reduction over a period of two hours in 103 patients following third molar extraction. Aspirin+caffeine (600mg/60mg), paracetamol-codeine+caffeine (1000mg/16mg/60mg) and ibuprofen (400mg) show similar analgesic effect, with aspirin presenting slight superior efficacy. Dihydrocodeine tartrate (30mg) shows significantly reduced efficacy.](image-url)
Selective NSAIDs (Cyclo-oxygenase-2 selective inhibitors)
Selective NSAIDs, such as rofecoxib (now removed), celecoxib, parecoxib valdecoxib and etoricoxib are analgesics which can be prescribed for post-operative dental pain. They work by inhibiting COX-2 enzymes, but not the therapeutic COX-1 enzymes, to reduce prostaglandin production (Gilron, I. et al. 2003).

Selective NSAIDs have been proven to be effective analgesics for acute pain management. In 23 separate trials they were found to be comparable in efficacy to 13 non-selective NSAIDs and 1 opioid (Gilron et al. 2003). Furthermore, as they do not inhibit the COX-1 enzyme, selective NSAIDs have no effect on platelet function and are thought to exhibit fewer serious gastrointestinal adverse complications, when compared to non-selective NSAIDs (Chen et al. 2004).

However, despite these advantages, the British National Formulary (2012) states that ‘cyclo-oxygenase-2 selective inhibitors should not be used in preference to non-selective NSAIDs, except for patients at a particularly high risk of developing gastro-duodenal ulceration or bleeding’. This is because of the high number of adverse consequences associated with them (table 2), particularly concerning cardiovascular consequences.

In addition, selective NSAIDs appear to have high re-medication rates, with more than 50% of patients treated by COX-2 inhibitors requiring ‘rescue analgesia’ within 24 hours following dental surgery. This, combined with the higher cost of selective COX-2 inhibitors and the potential for severe adverse effects, appears to outweigh their advantages (Gilron et al. 2003).

Opioids
Opioid analgesics are capable of providing analgesia in more extreme pain, so can potentially be prescribed when other analgesics are ineffective. They work by binding to central μ-opioid receptors to obstruct the release of substance P, thus producing inhibition of nociception transmission (Haas. 2002).

Although opioids are extremely effective analgesics they are often accompanied by unacceptable side effects (Haas. 2002 and British National Formulary. 2012) (table 3). Consequently they should only be considered for prescription if other analgesics provide insufficient

### Table 2: The adverse effects of selective NSAIDs

<table>
<thead>
<tr>
<th>Side effects</th>
<th>Contraindications</th>
<th>Use with caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric mucosal damage</td>
<td>Active peptic ulceration</td>
<td>Elderly patients</td>
</tr>
<tr>
<td>Gastrointestinal upset</td>
<td>Ischemic heart disease</td>
<td>Cardiac failure</td>
</tr>
<tr>
<td>Increased risk of thrombotic effects</td>
<td>Cerebrovascular disease</td>
<td>Left ventricular dysfunction</td>
</tr>
<tr>
<td>Increased risk of cardiovascular events</td>
<td>Peripheral arterial disease</td>
<td>Risk factors for heart disease</td>
</tr>
<tr>
<td>Renal dysfunction</td>
<td>Third trimester of pregnancy</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Anaphylactoid reactions</td>
<td>Renal disease</td>
<td>Oedema</td>
</tr>
<tr>
<td>Post-dental extraction alveolitis</td>
<td>Moderate to severe heart failure</td>
<td>Pregnancy</td>
</tr>
<tr>
<td>Headache</td>
<td></td>
<td></td>
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<tr>
<td>Nausea</td>
<td></td>
<td></td>
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<tr>
<td>Vomiting</td>
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<td></td>
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<tr>
<td>Dizziness</td>
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</table>

(British National Formulary. 2012 and Mehlisch et al. 1990)
Table 3: The contraindications and potential side effects of opioid use

<table>
<thead>
<tr>
<th>Side effects (rare)</th>
<th>Contraindications</th>
<th>Use with caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>Severe chronic respiratory disease</td>
<td>Asthma</td>
</tr>
<tr>
<td>Vomiting</td>
<td>Acute respiratory depression</td>
<td>Myasthenia gravis</td>
</tr>
<tr>
<td>Constipation</td>
<td>Concurrent use of alcohol</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Xerostomia</td>
<td>Severe inflammatory bowel disease</td>
<td>Prostatic hypertrophy</td>
</tr>
<tr>
<td>Muscle rigidity</td>
<td>Paralytic ileus</td>
<td>Biliary tract diseases</td>
</tr>
<tr>
<td>Mood alteration (euphoria/dysphoria)</td>
<td>Raised intracranial pressure and head injury</td>
<td>Convulsive disorders</td>
</tr>
<tr>
<td>Hallucinations</td>
<td></td>
<td>Hypothyroidism</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td></td>
<td>Adrenocortical insufficiency</td>
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<tr>
<td>Drowsiness</td>
<td></td>
<td>Hepatic impairment</td>
</tr>
<tr>
<td>Headache</td>
<td></td>
<td>Renal impairment</td>
</tr>
<tr>
<td>Urticaria</td>
<td></td>
<td>History of drug dependence</td>
</tr>
<tr>
<td>Uretic spasm</td>
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<td>Elderly</td>
</tr>
<tr>
<td>Hypotension</td>
<td></td>
<td>Pregnancy</td>
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<tr>
<td>Respiratory depression</td>
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<td>Miosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coma</td>
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<td></td>
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<tr>
<td>Potential for addiction</td>
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</tr>
</tbody>
</table>

(Haas. 2002 and British National Formulary. 2012)

analgesia or are contra-indicated. When used for post-operative dental pain opioids must always be prescribed in combination with a non-opioid analgesic. This enables reduction of the opioid dose to diminish the associated risks, whilst producing an equivalent degree of analgesia (Fricke et al. 2004).

**Codeine**

For mild to moderate pain the opioid of choice is codeine, which is most commonly combined with other analgesics. Codeine provides pain relief as it is converted via hepatic O-demethylation to the active drug morphine, which is an incredibly effective analgesic (Macleod et al. 2002). However, despite being commonly used to control pain, the conversion pathway of codeine to morphine does not operate in approximately 6-10% of Caucasian individuals (British National Formulary. 2012). Therefore a significant proportion of the population receive no analgesic benefits from codeine. Furthermore there is much evidence displaying poor efficacy of codeine when used for post-operative dental pain, with NSAIDs and paracetamol offering superior analgesia and reduced re-medication rates (Mehlisch. 2002).

**Dihydrocodeine tartrate**

Dihydrocodeine tartrate can be offered as an alternative to codeine and is present within the Dental Practitioners
Formulary, so can be prescribed by the general dental practitioner. It demonstrates similar analgesic efficacy to codeine and can be prescribed for patients who lack the working conversion pathway mentioned above. However often Dihydrocodeine provides insufficient analgesia, with ibuprofen being found to display statistical superiority to Dihydrocodeine. Therefore its prescription is rarely warranted (Moore et al. 2011b).

Tramadol hydrochloride
If other opioids provide insufficient analgesia, tramadol can be considered. Tramadol not only binds to opioid receptors, but also inhibits norepinephrine and serotonin re-uptake within pain pathways of the central nervous system, to provide analgesia (Jung et al. 2004). It is incredibly effective and has been proven safe for post-operative dental pain in 18 placebo-controlled trials (Fricke et al. 2004), with side-effects commonly being mild and transient (Mehlisch 2002). Furthermore tramadol does not exhibit a sedative effect, so can be a particularly effective analgesic for severe post-operative pain following same-day dental surgery (Mehlisch 2002)

Combination analgesics
Combining analgesics with different mechanisms of action enables lower doses of the component analgesics to be prescribed, thus analgesia can be enhanced without increasing the risk of adverse events (Mehlisch. 2002). In dental practice the analgesics most commonly prescribed in combination are paracetamol and ibuprofen. These analgesics both demonstrate a ceiling dose effect (indicated by levelling out of the dose-response curve), whereby no additional analgesia is achieved beyond the recommended dose. By prescribing these analgesics in combination they work synergistically to diminish pain to a greater extent than either alone, thus preventing the ceiling dose of either analgesic to be reached (Mehlisch. 2002).

When used for post-operative dental pain opioids must always be prescribed in combination with a non-opioid analgesic to reduce the opioid dose (Fricke et al. 2004). Codeine is most commonly combined with paracetamol to form the drug co-codamol. Macleod et al. (2002) found that the combination of paracetamol 1000mg and codeine 30mg resulted in significantly better analgesia than 1000mg of paracetamol alone. Furthermore the synergistic action of the two analgesics has been shown to extend the duration of analgesia by one hour compared to paracetamol alone (Toms. et al. 2011). However, ibuprofen has been found to be an equal, if not superior, analgesic to co-codamol, with fewer associated adverse effects (Modares. et al. 2006; Mitchell. et al. 2008). Therefore ibuprofen should always be prescribed in preference to co-codamol. In severe pain ibuprofen can be prescribed with codeine, with their synergistic action further reducing pain.

Tramadol can be prescribed in combination with paracetamol, where it demonstrates a more rapid onset of action compared to either of the analgesics alone, with onset of analgesia occurring within 17 minutes (compared to 51 minutes for tramadol and 18 for paracetamol). Additionally it displays a longer duration of analgesia of 5 hours, compared to 2 hours for tramadol and 3.1 for paracetamol (Mehlisch. 2002). Therefore it should be considered for more severe pain when an opioid is warranted. Tramadol can also be prescribed with NSAIDs to further increase its efficacy. However differing outcomes have been demonstrated, with only the tramadol-ibuprofen combination displaying some positive results (Mehlisch. 2002).

Discussion
The most important feature of an analgesic is to provide adequate pain relief and each of the analgesics discussed above have been proven in their respective studies to provide this. However pain is subjective and individual studies use different methods to measure pain relief. Therefore it is difficult to determine which analgesic has the best efficacy, thus which to prescribe for post-operative dental pain.

Despite this, many review articles appear to come to similar conclusions over the effectiveness of different analgesics, with selective and non-selective NSAIDs showing superior efficacy. A diagram from a Cochrane review on oral analgesics can be seen in fig.4. It has amalgamated the results from 35 reviews of randomised trials testing the analgesic efficacy of individual drug interventions in acute postoperative dental pain (Moore et al. 2011a).
Fig. 4 presents Etoricoxib as the optimum analgesic to prescribe for post-operative dental pain, closely followed by the non-selective NSAIDs. However, it must be remembered that when prescribing it is imperative that the safest analgesic should always be prescribed first. Therefore, fig. 5 combines both of these factors to offer a model of analgesic prescription. The patient should always begin on the lowest practicable dose, which can be titrated upwards if required. If an adverse reaction is experienced with any analgesic, then it should be immediately withdrawn and substituted (British National Formulary, 2012).
Fig. 5: Flow diagram combining safety and efficacy to display the order of analgesic prescription in dental practice


If mild to moderate postoperative dental pain is expected

Paracetamol

If 1000mg paracetamol is sufficient (i.e. moderate to severe pain) or contra-indicated

If no contraindication

Add Non-selective NSAID

If insufficient

Add opioid to Paracetamol

If insufficient

Add opioid to NSAID

High risk of developing gastro-duodenal ulceration or bleeding

Add Selective COX-2 inhibitor

If insufficient

Add codeine to Paracetamol

If NSAID contraindicated

If insufficient

Tramadol and Paracetamol
The dental practitioner should also give consideration to preoperative dosing of the chosen analgesic, or at least beginning the dose immediately following surgery, before the offset of local anaesthesia. This is thought to reduce the need for analgesia post-operatively by preventing nociceptive sensitization, to inhibit pain pathway induction (Haas, 2002). The patient will experience reduced pain intensity at a lower analgesic dose, reducing the risk of an adverse event. Preoperative dosing may not be prudent in cases where bleeding is a concern and is probably best reserved for analgesics other than aspirin (Haas 2002).

**Conclusion**

Before prescription of any analgesic the dental practitioner should give careful consideration to its advantages and disadvantages, in relation to that individual patient. By following prescription models, such as fig.5 outlined above, all levels of post-operative dental pain can be managed, whilst reducing the risk of an adverse reaction. The patient should be advised to take analgesia before, or as soon as possible after the procedure to ensure minimum discomfort.

**Bibliography**


Mehlisch, D.R. et al. 1990. Multicenter clinical trial of


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Contact - fiona@saad.org.uk
Introduction

A variety of distraction techniques may be utilized in modern-day dental practice to help reduce patient’s dental anxiety. This topic is vital to good dental care provision as a lot of patients have mild, moderate or high forms of dental anxiety.

Anxiety refers to a “hypothetical psychological construct which is: anticipatory, associated to a specific event, aversive, unpleasant to experience, and takes time to dissipate”. (G. Humphris, 2000). Dental anxiety usually develops due to the patient having had a past traumatic experience during dental visits (De Jongh, 2006) or indirectly, when they hear other people’s unpleasant experiences, which they believe will happen to them. Patients, who were “betrayed” by dentists they had faith in, were more likely to be careful about trusting future dentists. (E. J. Kay, 2004). Family attitudes are also believed to have an effect on a patient’s level of anxiety – if a parent is afraid of the dentist, it is more likely the child will also experience dental anxiety. (Forgione, 1974). It was estimated that up to a third of the UK population were dentally anxious (Todd 1991) and 58% reported this was partly due to being afraid. (Todd 1982). Female patients tend to have higher anxiety levels (Peretz 1998) and anxiety appears to decrease with older patients. (Locker, 1991).

Psychosomatic reactions can be triggered by stimuli such as the sound of a drill, the smell of a dental practice or the feeling of looming pain, therefore if these stimuli are present preceding a pain stimulus such as an injection, the patient may respond by avoiding future dental appointments – because of fear. This is known as Mowrer’s Two-factor Theory. (D. I. Mostofsky, 2006).

Kleinknecht and Bernstein (1978) proposed that anxiety causes more pain and lowers the pain threshold, resulting in further increase in anxiety. Furthermore, patients may fear the unknown as they do not know what to expect during a dental treatment, which may heighten anxiety. Children normally show anxiety by being non-compliant on the dental chair, whereas adults may miss appointments or not attend at all. (G. Kent, 1998).

The dental injection was found to be the stimulus which caused the greatest anxiety, followed by the drill. (Wardle, 1982). If people are afraid of the dentists, it will lead to greater dental problems which may result in avoiding the dentists even more – essentially a vicious cycle. (Berghgen, Linde 1984).

Various distraction techniques trialed and tested on dental-anxious patients are described below. These methods include cognitive and behavioural methods, desensitization and hypnosis.

1. Cognitive and behavioural methods
Cognitive and behavioural methods have demonstrated to be very effective in combating dental anxiety. Many studies have shown that when patients with high dental anxiety undergo cognitive and behaviour therapy, it encouraged them to attend future appointments and reduced their anxiety at the dentist.

Cognitive restructuring is a technique used to replace negative feelings which cause anxiety, with positive thoughts. This results in the patient feeling calmer when receiving dental treatment. (Levitt, McGoldrick et al. 2000).
A study by Johren (2000) showed that the group who had midazolam did show an initial decrease in dental-anxiety, however, after two months, they had returned to being fearful. Conversely, 20 patients who successfully completed cognitive and behaviour therapy had further improvement and sustained reduction in dental-anxiety, one year after the treatment.

Berggren (2000) showed that the treatment of cognitive therapy was effective when 58 dental-phobic patients were shown video-recorded dental scenes and then discussed each scene with the therapist, explaining why they felt scared and their thoughts on the scene. The therapist replaced the negative feelings with positive and appropriate thoughts. This resulted in a reduction in anxiety as patients felt calmer and more relaxed. The Dental Anxiety Scale (DAS) score fell from 17.6 before treatment to 13.4 after phobia therapy, and then decreased further to 9.8 after dental treatment.

2. Physiologically-focused method

Breathing relaxation

Breathing relaxation is a simple and effective way of dealing with dental anxiety. Lähmann (2008) studied 29 patients who were successfully taught to slightly move their joints as they expired, focusing their attention to the changes they felt within their bodies, hence diverting their attention away from the dental treatment they were receiving. (Lähmann, Schoen et al. 2008).

Another method of breath control to reduce anxiety, described by Mostofsky (D. I. Mostofsky, 2006) allows a physical distraction in order to divert the patient’s attention away from the procedure, as well as encourages deep breathing which is related with relaxation.

Breath control instructions (D. I. Mostofsky, 2006)
1. Take a deep breath, hold it briefly and then let it out slowly
2. Take a normal slow breath
3. Take another deep breath, hold it briefly, then let half out, then let the rest out
4. Take a normal breath
5. For successive breaths, let breath out a third at a time, a quarter at a time, a fifth at a time, etc

Muscle relaxation

Anxious patients can be taught to relax as soon as they feel their muscles becoming tense. Patients can practise these relaxation exercises at home by tensing and then relaxing their facial muscles, therefore they can relax when cued on the dental chair. (R. A. Dionne et al., 2002).

In a study by Jeremalm (1986), 37 patients underwent relaxation training where they relaxed their tense muscles in order to cope with painful treatments. It was found to be an effective way of relieving stress during procedures and it reduced patients’ fear at the dental chair. This is known as applied relaxation where relaxation techniques were taught to the patients when they were imagining the dental treatments. This helped them relax when they noticed the first signs of dental anxiety, during a real dental treatment.

Thom et al. (2000) used audio cassettes to teach patients relaxation techniques, which were applied during dental treatments. The audio cassettes instruct patients to relax their muscles and breathe slowly using the abdominal muscles.

Another study by Berggren et al. (2000) in which 54 patients learnt how to relax their muscles and then practiced these relaxation techniques whilst watching videos of different dental situations at their own pace, was found to be a very effective way of reducing anxiety. Patients were able to monitor their progress by recording their own electromyography (EMG) whilst watching the videos, in order to refine their relaxation skills. Patients reported that they felt “less trapped” and more comfortable during dental treatments. Their DAS scores fell from 17 before treatment to 8.6 after dental treatment. (Berggren, Hakeberg et al. 2000).

3. Desensitization

Another method used to reduce dental anxiety is desensitization. It works by exposing patients to scenes of different dental treatments in video, which can be interrupted by patients in order to practise relaxation exercises such as breathing exercises taught by the therapist beforehand. (D. I. Mostofsky, 2006). Another method is to make a hierarchy of the fearful stimuli. The patient must look composed before moving onto the next step, which can involve a few visits. The clinician can
observe the patient’s behaviour, as well as monitor the heart rate; this is a useful indicator for showing anxiety because patients may say they feel calm when they have an accelerated heart rate. (R. A. Dionne et al., 2002).

In the study by Moore (2002), this was one of the methods which successfully helped reduce dental anxiety. He also used direct clinical rehearsals where the patient was exposed to different dental instruments or situations gradually. Here the patient was able to practise hand signal pausing, breathing exercises and tension-awareness training, with the therapist.

Desensitization is a time-consuming procedure; therefore it should be used for extremely anxious or phobic patients, who would normally have been referred to a mental health practitioner. (D. I. Mostofsky, 2006).

4. Hypnosis
Hypnosis is a different non-invasive method of reducing dental anxiety and promoting relaxation during dental treatments. Hypnosis has been considered in dental practices because it has few side-effects as well as being cost-effective.

Hypnosis requires formal training and is time-consuming. (D. I. Mostofsky et al., 2006), however, there is a beginner's course which enables the clinician to practise basic hypnosis skills. (R. A. Dionne et al., 2002).

A study by Al-Harasi et al. (2010) carried out three randomized controlled trials with 69 young participants, where the age ranged from 4.5 to 15 years. It was found that there was only a significant decrease in crying if hypnosis was used; “17% crying if hypnosis was used and 41% crying if non-hypnosis”, (P = 0.02). Al-Harasi et al. (2010), however, concluded that not enough evidence had been gathered to state that hypnosis had useful effects.

Gow (2006a) was able to demonstrate that hypnosis could be effective with a blind dental-phobic patient, who had a score of 20/20 on the Corah Dental Anxiety Score at the first dental treatment and by the end of her third treatment it had reduced to 10/20.

The patient was put into a trance as she was asked to imagine herself in a special place where she could use her sense of smell, hearing, touch and taste to help herself immerse into the imaginary place. At the next appointment, she was able to return to her special place by the count of 1 to 7 and the trance was ended by reverse counting.

The dentist was able to successfully complete the periodontal treatment and extraction using hypnosis as an adjunct.

5. Sound and music
Music has been used commonly in dental practices to relax patients and divert their attention away from the thoughts of being treated and drilling noises produced during treatment. A study by Lahmann (2008) compared a music distraction group with a brief relaxation and control group. It explained that music was a non-invasive technique which decreased pain and anxiety, especially when the patients had moderate anxiety. He used the State-Trait Anxiety Inventory and the Hierarchical Anxiety Questionnaire to measure the patient's anxiety level, and the music distraction group showed mild improvement, with the measurements decreasing from 41.3 to 36.8.

In a study by Lee et al. (2004), 58 patients listened to music before their treatment, which showed a reduction in nervousness. Allowing the patients to select the music they enjoy was important in decreasing physiological parameters, because some music which is comforting to one person may seem fear-provoking to another. Such autonomy is vital to produce the most advantageous effect of relaxation and anxiety-levels reduction.

A new device which removes the sound of the dental drill was recently developed by Professor Brian Miller from King's College London. It works by detecting the high-pitched sound of the dental drill and producing an inverted wave, thereby cancelling out the unwanted noise. This is a potential method in reducing dental anxiety and is cost-effective, as the patient can plug their earphones into the device and then continue listening to the dentist, whilst being muted from the frightening dental drill sounds.

6. Audiovisual distraction
A modern and interesting method of reducing dental
anxiety is by using audiovisual distraction, where the patient wears a pair of goggles-like glasses. Earphones are connected to the glasses and within the glasses is a built-in television monitor. (Frere et al. 2001). Satoh et al. (1995) showed that using audiovisual glasses during scaling resulted in a reduction in dental anxiety. Also Sullivan et al. (2000) demonstrated that children who used audiovisual (A/V) glasses during dental treatment had lower pulse rates, which may suggest they felt calmer during the procedure. Frere et al. (2001) demonstrated that using audiovisual glasses helped patients feel more comfortable, and less pain was reported during the treatment. In addition, the duration of treatment was shorter when audiovisual glasses were used, as patients were relaxed and more compliant. Using A/V glasses on 25 patients, Frere showed that there was a positive correlation between A/V glasses use and reduction in Dental Fear Survey (DFS) score. It demonstrated that audiovisual glasses are useful for distracting patients, especially if they are mildly to moderately anxious.

It showed that highly anxious patients had faster treatment time when the glasses were not used. In addition, if the audiovisual glasses are used with new patients, it may harm the dentist-patient relationship and may also hinder treatment time.

7. Scent

Since the smell of a dental clinic can trigger dental anxiety (D. I. Mostofsky, 2006), a study by Kritsidima et al. demonstrated that the use of lavender scent in the waiting room reduced the levels of anxiety. It explained that although lavender scent could reduce immediate anxiety, it would not reduce the patient's anxiety for future dental treatments; therefore, lavender scent is suitable for instant relaxation rather than for long-term anxiety therapy.

Scent therapy is for patients who have mild to moderate dental anxiety rather than those with high dental anxiety as lavender oil will not affect the cognitive aspects of dental anxiety.

“Spa Dentistry” is a modern way of dental practices offering an environment where patients are encouraged to relax prior to dental treatments, in order to calm their nerves. They offer music, blankets and, sometimes, the smell of freshly-baked cookies. (D. I. Mostofsky, 2006).

8. Communication

To increase dentist-patient trust, simple pre-arranged communicating methods, such as hand-raising as a signal to stop treatment, can relax patients and make them feel less helpless at the dental chair.

Distraction can reduce a patient's anxiety. For example, when a local anaesthetic is being administered, the patient can be asked to lift a leg up in order to distract him/her from the procedure. This is a physical type of distraction. The other type – mental distraction – includes listening to music or watching movies. (D. I. Mostofsky, 2006).

Conclusions

The cheapest and least time-consuming methods in practice to reduce dental anxiety are the use of lavender scent and music distraction. To maximize the effect, patients should select the music they are familiar with. However, neither method provides any long-term effects in anxiety reduction.

Methods such as cognitive therapy, breathing relaxation training and desensitization are long and expensive processes, as many sessions are needed to lower anxiety; however they are very effective in the long term.

Studies have demonstrated that cognitive and behavioural methods have a significant effect in reducing dental anxiety, and are recommended for reducing dental fear in the long term. There are a few disadvantages: it takes a long period of time to reduce anxiety, and it is difficult to use for emergency treatments.

Breathing relaxation techniques are another valuable way of comforting patients. The effect of reducing anxiety can be long lasting as patients are trained to practise breathing exercises as soon as they recognize anxiety. These exercises can again be used in future appointments.

Hypnosis may be of limited availability and time-
Audiovisual glasses are also a prospective and interesting technique for reducing dental anxiety. Perhaps, future research could look at what types of video clips are more effective and whether the duration it is played for has any effect on the maximal dental anxiety reduction.

Distraction techniques are vital in modern-day dentistry as clinicians will be able to offer a larger range of treatments to soothe dental-phobic patients. At the population scale, dental health may improve if patients know there are different effective methods in reducing their anxiety and attend dental appointments more regularly.

References


Bibliography:


Websites used:

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Abstract

The monitoring and assessment of the degree of conscious sedation experienced by patients is important for both clinical practice and in research. Whereas clinical monitoring remains the gold standard for safety in patient care, numerous measures are available to supplement this and to provide quantitative data on level of sedation. This manuscript provides an overview of existing measures of the degree of sedation. Scales that have been used in published research were identified from a search of Medline and Google Scholar, and for each scale we identified the characteristics of the scale and degree to which the reliability and validity of the scale had been measured.

A total of 35 different measures of degree of sedation were identified. Data on reliability and/or validity were unavailable for many. The Ramsay Sedation Scale emerged as a brief measure with good psychometric and which has been widely used. It is recommended as an adjunct to practitioner assessment in clinical care. For research purposes the Sedation Agitation Scale for adult patients and the Observer’s Assessment of Alertness/Sedation Scale for adults or children showed promise.

Introduction

Administration of conscious sedation requires constant monitoring of the sedated patient. Accordingly, clinicians require tools that measure the effectiveness of sedation in individual patients in relation to the objectives of sedation. Instruments such as sedation scales or scoring systems should ideally be simple and user-friendly, yet should have also undergone rigorous development and appropriate testing to demonstrate validity, reliability and responsiveness.

Management of analgesia and sedation in dentistry and medicine requires evaluation and monitoring of key parameters such as operative conditions, patient comfort and satisfaction, in order to detect and quantify pain and agitation, and to quantify sedation. The routine use of subjective scales for pain, agitation, and sedation promotes more effective management. The need for frequent measurement reflects the dynamic nature of pain, agitation, and sedation. Further, close monitoring helps to avoid over-sedation and to eliminate pain and agitation. Pain assessment tools include self-report (often using a numeric pain scale) for communicative patients and pain scales that incorporate observed behaviours and physiologic measures for non-communicative patients.\(^1\)

A key component of this approach is the use of a sedation scale or scoring systems, a tool that can enhance accurate and consistent medication titration by clinicians, improve understanding and communication, and reduce the incidence of excessive drug-induced complications.\(^2\)
The ideal sedation assessment tool would be, as follows:
• Inexpensive and easy to use.
• Highly reproducible, reliable and valid.
• Provide an objective target for the depth of sedation and reduces the risk of over - or undersedation.
• Minimize the amount of drug required to obtain the sedation goal.
• Optimize patient comfort and safety.
• Facilitate communication among providers.
• Chart a patient’s arousal state over time in the medical record.
• Minimize length of mechanical ventilation and decrease hospital length of stay (ICU).
• Permit accurate titration of sedative agents toward established goals of therapy (unpleasant procedure, agitation, anxiety, mechanical ventilation, level of consciousness, etc.).
• Detect changes in the level of sedation.
• Combine both patient assessment and operative conditions.
• Assess both subjective and objective measures.
• Provide direction to clinicians for clinical management.

One of the most challenging finding in the designing, testing and the use of any scale or measurement constitutes assessing the data on reliability and validity of the scale. Reliability refers to the reproducibility and consistency of the instrument and also to the homogeneity and the degree to which it is free from random error. There are certain parameters, such as test–retest, inter–rater reliability and internal consistency that need to be assessed before an instrument can be judged to be reliable, as outlined below:
• Internal consistency is defined as the extent to which items correlated with one another. Ideally, internal consistency is measured using Cronbach’s alpha.
• Inter-rater reliability, is reflected by the extent of similarity between ratings by different people.
• Test–retest represents the stability of the scale, over a period of time in which it is not expected to change, by making repeated administrations of it.

Validity is an assessment of whether an instrument measures what it aims to measure. It should have face, content, criterion and construct (convergent and discriminant) validity. It should also be responsive to actual changes.
• Face validity refers to investigators’ subjective assessment of the scale and the relevance of the assessment tool (e.g. Questionnaire – do the questions appear to be relevant, reasonable, unambiguous and clear?).
• Content validity refers to judgments (usually by a panel) about the extent to which the content of the scale appears logically to examine and comprehensively include, in a balanced way, the full scope of the characteristic or domain it is intended to measure.
• Criterion validity covers the correlations of the scale with another criterion scale, which is accepted as valid.
• Construct validity is corroborations that the scale is measuring the underlying concept it is supposed to measure. It comprises two elements – convergent (requires that the scale should correlate with similar variables) validity and discriminant (requires that the scale should not correlate with dissimilar variables) validity.

The aim of this project is to perform a systematic review of the literature in order to summarize the available sedation scales, to highlight the domains that they explore, to present their clinical properties, and to consider the implications of these findings for clinical practice and research.

Method
For this project a review of the literature was performed by means of computerized and manual searches.

Search Strategy
Medline and Google Scholar databases were searched using the following key words combined with the ‘OR’ logical operator: scales, index, measurements, test, scores systems and indicators. These were then combined with the search term ‘Conscious sedation’ using ‘AND’. The computerized databases were searched over a 20-year period from 1991 to 2011, as well as manual searching of articles, books and grey literature. The articles containing data regarding sedation scales and their reliability and validity tests were identified, examined and used for the purpose of this project.

A total of 113 articles were identified in the search but only 45 articles were included in this study since only those articles contained information on the reliability and validity of the scale used.

Procedure
The information collected on each scale was as follows:
• The length of the scale (the number of domains or items).
Results

A total of 35 sedation scales and indexes were identified. Table 1 lists the sedation scales/scores found.

Table 1 – Scales of degree of Conscious Sedation identified from literature search.

<table>
<thead>
<tr>
<th>Scale No</th>
<th>Scale Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Adaptation to Intensive Care Environment Scale (ATICE) (13)</td>
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<td>2</td>
<td>Addenbrookes/Cambridge Sedation Scale (A/CSS) (14)</td>
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<td>3</td>
<td>American Association of Critical-Care Nurses' Sedation Assessment Scale (AACCNSAS) (15)</td>
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<td>Avipas Sedation Scale (16) (17)</td>
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<td>Bloomsbury Sedation Scale (BSS) (14) (18)</td>
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<td>Brussels Sedation Scale (BSS) (19) (20)</td>
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<td>Cohen and Kelly Sedation Scale (CKSS) (14)</td>
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<td>Comfort Scale (CS) (21) (25)</td>
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<td>Dartmouth Operative Conditions Scale (DOCS) (22)</td>
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<td>Ellis Sedation Scale (ESS) (23)</td>
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<td>Glasgow Coma Sedation Scale (GCSS) (24)</td>
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</table>
For each scale the properties of the scale as determined in the studies was summarised (see Table 2). A brief description of each scale is given below.

Table 2: Summary of characteristics of scales identified in the literature search

<table>
<thead>
<tr>
<th>Scale</th>
<th>No of items</th>
<th>No of articles</th>
<th>Dentistry/ Medical Specialities</th>
<th>Target population</th>
<th>Reliability</th>
<th>Validity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptation to Intensive Care Environment (ATICE)</td>
<td>7</td>
<td>4</td>
<td>Medical ICU</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Strong correlations with Ramsay, Riker, Glasgow Coma and Comfort Scale (1)</td>
</tr>
<tr>
<td>Addenbrookes/Cambridge (A/CSS)</td>
<td>6</td>
<td>1</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Derived from Ramsay Scale</td>
</tr>
<tr>
<td>American Association of Critical-Care Nurses’ Sedation Assessment (AACCNSAS)</td>
<td>15</td>
<td>1</td>
<td>Medical ICU</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Comprehensive but complex-to-to-use scoring system</td>
</tr>
<tr>
<td>Avripas Sedation Scale</td>
<td>15</td>
<td>1</td>
<td>Medical ICU</td>
<td>Adult/pediatric</td>
<td>x</td>
<td>x</td>
<td>Not widely used.</td>
</tr>
<tr>
<td>Bion and Ledingham Sedation Scale (BSS)</td>
<td>3</td>
<td>2</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Not widely used. Cumber some to use in practice</td>
</tr>
<tr>
<td>Bloomsbury Sedation Scale (BSS)</td>
<td>8</td>
<td>3</td>
<td>Medical ICU</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>High association with Ramsay Scale</td>
</tr>
<tr>
<td>Brussels Sedation Scale (BBS)</td>
<td>5</td>
<td>2</td>
<td>Medical</td>
<td>Adult ICU</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>The Cohen and Kelly Sedation Scale (CKSS)</td>
<td>5</td>
<td>1</td>
<td>Medical ICU</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Devised for drug research</td>
</tr>
<tr>
<td>The Comfort Scale (CS)</td>
<td>40</td>
<td>3</td>
<td>Medical PICU</td>
<td>Pediatric</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The Dartmouth Operative Conditions Scale (DOCS)</td>
<td>4</td>
<td>2</td>
<td>Medical</td>
<td>Pediatric</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>The Ellis Sedation Scale (ESS)</td>
<td>5</td>
<td>2</td>
<td>Dental</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Devised for use in dental settings</td>
</tr>
<tr>
<td>Glasgow Coma Sedation Scale (GCSS)</td>
<td>18</td>
<td>6</td>
<td>Medical/Dental</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Adapted by Cook from the Glasgow Coma Scale</td>
</tr>
<tr>
<td>Harris Scale (HS)</td>
<td>14</td>
<td>1</td>
<td>Medical/ICU</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Correlations with Ramsay and Sedation Agitation Scales</td>
</tr>
<tr>
<td>Hartwig Sedation Scale (HSS)</td>
<td>5</td>
<td>1</td>
<td>Medical/PICU</td>
<td>Adult/pediatric</td>
<td>✓</td>
<td>x</td>
<td>Correlations with the Comfort Scale</td>
</tr>
<tr>
<td>Inova Health System Sedation Scale (ISS)</td>
<td>6</td>
<td>1</td>
<td>Medical/ICU</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlations with Ramsay and POSS</td>
</tr>
<tr>
<td>Luer Sedation Scale (LSS)</td>
<td>–</td>
<td>2</td>
<td>Medical/ICU</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlations with MAAS</td>
</tr>
<tr>
<td>Minnesota Sedation Assessment Tool (MSAT)</td>
<td>16</td>
<td>2</td>
<td>Medical/Dental</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlations with the Motor Activity and Visual Analog Scales</td>
</tr>
<tr>
<td>Modified Observer’s Assessment of Alertness/ Sedation Scale (MOAA/S)</td>
<td>7</td>
<td>20</td>
<td>Medical/Dental</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlations with Bispectral Index, Ramsay Scale</td>
</tr>
</tbody>
</table>
The Ramsay Sedation scale is among the oldest and most widely used of the scales that were identified in the literature search. Many of the scales identified in the search were based on this original. The system was described by Ramsay (4) for the evaluation of alphaxalone–alphadolone as a sedative. Six levels of sedation are identified: three for patients who are awake and three for those who are asleep. In a review of monitoring in intensive care unit sedation, Carrasco et al. (5) conclude that the RSS has good reliability and inter-observer agreement. Sessler et al. (6) tested different sedation scales against clinical observation of sedation and concluded that the RSS has excellent inter-rater reliability and validity. Some researchers have commented that the RSS is excessively subjective and the level of sedation as identified by this scale is poorly defined (7). Some problems were found to be associated

<table>
<thead>
<tr>
<th>Scale</th>
<th>No of items</th>
<th>No of articles</th>
<th>Dentistry/ Medical Specialties</th>
<th>Target population</th>
<th>Reliability</th>
<th>Validity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified Wilson Sedation Scale (MWSS)</td>
<td>4</td>
<td>2</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlations with Wilson Scale</td>
</tr>
<tr>
<td>Modified Steward Coma Scale (MSCS)</td>
<td>12</td>
<td>3</td>
<td>Medical</td>
<td>Adult/Pediatric</td>
<td>x</td>
<td>x</td>
<td>Correlations with Ramsay, GCS, LSs Scale</td>
</tr>
<tr>
<td>The Motor Activity Assessment Scale (MAAS)</td>
<td>7</td>
<td>4</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlations with Ramsay, GCS, LSs Scale</td>
</tr>
<tr>
<td>Newcastle Sedation Scale (NGSS)</td>
<td>–</td>
<td>1</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Adapted from the GCS</td>
</tr>
<tr>
<td>New Sheffield Sedation Scale (NSSS)</td>
<td>5</td>
<td>1</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlated with the VAS and UMSS Scales</td>
</tr>
<tr>
<td>Observer’s Assessment of Alertness/Sedation Scale (OAS)</td>
<td>5</td>
<td>4</td>
<td>Medical/Pediatric</td>
<td>Adult/Pediatric</td>
<td>✓</td>
<td>✓</td>
<td>iPad</td>
</tr>
<tr>
<td>Pasero Opioid-induced Sedation Scale (P OSS)</td>
<td>5</td>
<td>1</td>
<td>Medical</td>
<td>Adult</td>
<td>✓</td>
<td>✓</td>
<td>Correlated with RASS and ISS Scales</td>
</tr>
<tr>
<td>Ramsay Sedation Scale (RSS)</td>
<td>6</td>
<td>6</td>
<td>Medical/Pediatric</td>
<td>Adult/Pediatric</td>
<td>✓</td>
<td>✓</td>
<td>One of the most tested and used sedation scale in the clinical settings</td>
</tr>
<tr>
<td>Richmond Agitation Sedation Scale (RASS)</td>
<td>10</td>
<td>7</td>
<td>Medical/Pediatric</td>
<td>Adult/Pediatric</td>
<td>✓</td>
<td>x</td>
<td>Correlated with Ramsay, GCS, VAS Scales</td>
</tr>
<tr>
<td>Reaction Level Scale (RLSS)</td>
<td>8</td>
<td>6</td>
<td>Medical</td>
<td>Adult</td>
<td>✓</td>
<td>x</td>
<td>Correlated with GCS</td>
</tr>
<tr>
<td>Sedation Agitation Scale (SAS)</td>
<td>7</td>
<td>12</td>
<td>Medical</td>
<td>Adult</td>
<td>✓</td>
<td>✓</td>
<td>Correlated with Ramsay Scale</td>
</tr>
<tr>
<td>Sedic Score (SSC)</td>
<td>5</td>
<td>1</td>
<td>Medical</td>
<td>Adult</td>
<td>✓</td>
<td>x</td>
<td>Correlated with Ramsay Scale</td>
</tr>
<tr>
<td>University of Michigan Sedation Score (UMSS)</td>
<td>5</td>
<td>5</td>
<td>Medical</td>
<td>Pediatric</td>
<td>✓</td>
<td>x</td>
<td>Correlated with VAS, Ramsay and OAAS Scales</td>
</tr>
<tr>
<td>UK Intensive Care Society Sedation Score (UKICSS)</td>
<td>7</td>
<td>1</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td>Correlated with MSAT Scale</td>
</tr>
<tr>
<td>Vancouver Interaction and Calmness Scale (VICSS)</td>
<td>10</td>
<td>2</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Correlated with the Modified Wilson Scale</td>
</tr>
<tr>
<td>Wilson Sedation Scale (WSS)</td>
<td>4</td>
<td>2</td>
<td>Medical</td>
<td>Adult</td>
<td>x</td>
<td>✓</td>
<td>Derived from the Ellis Sedation Score</td>
</tr>
<tr>
<td>The Wraith Sedation Scale (WSS)</td>
<td>5</td>
<td>0</td>
<td>Dental</td>
<td>Adult</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
with the Ramsay scale, because only one of the six levels addresses agitation, the levels on the scale are not evenly distributed, rendering it impossible to obtain a meaningful average for multiple readings from one patient and making it difficult to analyze the data statistically. Furthermore, the scale’s various levels are not mutually exclusive, thwarting the ability to obtain an accurate reading. It also fails to provide a target level for sedation. (7)

**Adaptation to Intensive Care Environment Scale (ATICE)**

The ATICE scale was developed by De Jonghe et al. (8) as a bedside instrument assessing Adaptation to the Intensive Care Environment (ATICE) in mechanically ventilated adult intensive care unit (ICU) patients. The scale has good reliability and correlates well with the relevant domains of the Ramsay Scale, Riker Scale, Glasgow Coma Scale, Comfort Scale, clinician’s rating of sedation using Visual Analogue Scales, and the amount of sedatives and analgesics administered.

**Addenbrookes/Cambridge Sedation Scale (A/CSS)**

Developed in 1990 by O’Sullivan and Park on the basis of substantial clinical experience and drawing on items the Ramsay scale. The scale has not been widely used and there is no published data on reliability and validity of the scale.

**American Association of Critical-Care Nurses’ Sedation Assessment Scale (AACCNSAS)**

The American Association of Critical-Care Nurses’ Sedation Assessment Scale consists of 5 domains: consciousness, agitation, anxiety, sleep, and patient-ventilator synchrony. A major advantage of the scale is that its domains are based on common clinical observations used in sedation therapy for critically ill patients. The proposed measurements for each domain are based on a comprehensive evaluation of the science and expert recommendations. While this suggests some face validity, there is no data available on the reliability of assessments performed by this scale nor on how it relates to other measures of sedation. (10)

**Avripas Sedation Scale**

This scale comprises four components: (a) agitation; (b) alertness; (c) heart rate; and (d) respiration. Agitation, alertness, and respiration are measured on a 5-point scoring system. Heart rate is measured on a 4-point scale. The overall sedation score for this system is a sum of each component, with sedation scores ranging from 1 (sedated) to 19 (need for more sedation). Watson and Kane-Gill (12) cited six sedation scales that are referred to as valid and reliable and amongst them is the Avripas sedation scale, however no data was cited to support this conclusion.

**Bion and Ledingham Sedation Scale (BLSS)**

This score uses three linear analogue scales (depth of sedation, degree of distress, level of comprehension) Bion suggests that patients should be observed for 10–5 minutes before assessment. This scale has been criticised for being cumbersome to use in clinical settings. No data on reliability or validity was located.

**Bloomsbury Sedation Scale (BSS)**

Also known as the University College London Hospitals sedation protocol, scores on this scale range from -3 (unarousable) to +3 (agitated and restless). There is also a category for natural sleep. The Bloomsbury scale appears to have a high association with the Ramsay Sedation scale.

**Brussels Sedation Scale (BSS)**

This scale was originally developed by Detriche et al. (14) to avoid excessive sedation in patients undergoing mechanical ventilation in the intensive care unit and its clinical impact was tested. The conclusion was that use of the tool significantly reduced the number of patients with excessive sedation. However the overall impact of this on clinical outcome is unclear. (15).

**Cohen and Kelly Sedation Scale (CKSS)**

Like the Ramsay scale the Cohen and Kelly scale was devised for drugs research and uses a similar numerical scale. Although this makes it relatively easy to use, this scale is not widely used.

**Comfort Scale (CS)**

The Comfort Scale was developed at the Medical College of Wisconsin for children aged from birth to 18 years of age in the paediatric intensive care unit (PICU). Using both behavioural and physiological items the scale consists of eight dimensions, which allow for non-intrusive measurement of distress in PICU patients. Each of the eight dimensions has five response categories (1 to 5), allowing assessment of subtle changes. Ambuel et al. (16) reported that both inter-rater agreement and internal consistency were high.

**Dartmouth Operative Conditions Scale (DOCS)**

The Dartmouth Operative Conditions Scale (DOCS)
assesses the patient’s status during a procedure in terms of pain, sedation, movement, and the presence of side effects from sedation. In this way the scale is designed to be simple and flexible enough to allow for comparisons among different providers, pharmacological interventions, and non-pharmacological techniques. Cravero et al. (18) in a study evaluating paediatric patients undergoing sedation for diagnostic and therapeutic procedures, concluded that this scale, DOCS, was shown to be a valid measure for qualifying the state of a patient during a sedation or distraction intervention, correlating well with clinical impression.

Ellis Sedation Scale (ESS) (19)
The Ellis sedation scoring system was first introduced in 1996 for grading the response of patients undergoing a variety of dental procedures with the aid of intravenous midazolam sedation in general dental practice. Although the system is widely used in dentistry (20) and some sedation scales have been derived from it (21) there is no published literature or specific studies designed to test the reliability and the validity of the scale.

Glasgow Coma Sedation Scale (GCSS) (20)
The Glasgow Coma Scale provides a score of the response of the patient to external stimuli. Opening of the eyes is considered to be indicative of higher functioning, and motor response is evaluated on the basis of somatic stimulation. It causes minimal additional discomfort to the patient. Carrasco et al. (5) confirmed the reproducibility of this scale, with good agreement between observers.

Harris Scale (HS) (22)
This scale was originally developed specifically for patients receiving mechanical ventilation in intensive care units and consists of three sub-categories: (a) general condition; (b) compliance with mechanical ventilation; (c) response to endotracheal suctioning. It has good criterion related validity – correlating well with the Ramsay and Sedation Agitation Scales. No data on reproducibility is available.

Hartwig Sedation Scale (HSS) (17)
The Hartwig scale is based on five behavioural criteria. Developed from surveys of experienced paediatric intensive care unit (PICU) nurses, it was devised to quantify the effect of sedation during routine procedures such as tracheal aspiration. The validity and reliability of the scale in the clinical assessment of the degree of sedation in patient populations has already been demonstrated. Brunow de Carvalho et al. (17) compared the Comfort and Hartwig sedation scales in paediatric patients undergoing mechanical lung ventilation and concluded that both scales gave similar results despite the Hartwig being easier to use.

Inova Health System Sedation Scale (ISS) (23)
The Inova Health System Sedation Scale was devised to assess sedation during opioid administration for pain management. Nisbet et al. (23) described the reliability and validity of the ISS. The ISS correlated well with other measures of sedation depth and with nurse ratings of depth of sedation.

Luer Sedation Scale (LSS) (21, 24)
The Luer scale was devised for use with patients in critical care. It has published reliability data (11) and criterion related validity. However it is not widely used.

Minnesota Sedation Assessment Tool (MSAT) (25)
The Minnesota Sedation Assessment Tool (MSAT) has two domains: arousal and motor activity. Arousal is a six-level scale (1 = deeply sedated to 6 = alert) based on eye opening or movement responses to verbal then physical stimulation. The motor scale has four levels (1 = no movement to 4 = central muscle group movement). Weinert et al. (25) demonstrated that MSAT had very good overall reliability between raters, with the arousal scale having slightly better agreement than the motor activity scale. The instrument correlated well with visual analogue scales of clinician’s rating of level of sedation. The MSAT arousal scale had moderate correlation with the analogous scale of a previously validated sedation instrument, the Vancouver Interaction and Calmness Scale. The correlation was weaker between the MSAT motor activity scale and the calmness subscale, probably because they are measuring different constructs. Both MSAT scales demonstrated convergent validity, whereas predictive validity was demonstrated in both a hypothetical scenario and in actual clinical practice for the MSAT arousal scale only. Therefore the MSAT combines the efficiency of a single-item response format while permitting the separate reliable measurement of distinct observable characteristics of intubated patients.

Modified Observer’s Assessment of Alertness/Sedation Scale (MOAA/S) (26)
The MOAA/S is used widely in clinical research (27). It is derived from the original Observer’s Assessment of Alertness/Sedation scale, which was originally validated for use with midazolam. The observer rates patient
responsiveness, speech and facial expression/eye movements. The modified form uses only the responsiveness component of the original scale [Awake (5) –Unresponsive (1)]. However, a study by Kowalsky et al. showed that MOAA/S failed to identify sedation (as defined by EEG) in 41% of ASA I patients receiving low dose propofol sedation.

Modified Wilson Sedation Scale (MWSS) Nemethy et al. examined the inter-rater reliability of the Wilson sedation scale in 100 patients undergoing surgical procedures with regional anaesthesia. On the basis of their findings, the scale was modified, and shown to be both reliable and valid.

Modified Steward Coma Scale (MSCS) The Modified Steward Coma Scale (MSCS) has only been used in a small number of studies and there is no data on reliability and validity available.

Motor Activity Assessment Scale (MAAS) The Motor Activity Assessment Scale (MAAS) is an entirely observational assessment scale validated for use in the mechanically ventilated patients. It is a 0–6 scale ranging from unresponsive to dangerously agitated and unco-operative. The MAAS was tested for reliability and validity by Devlin et al. and found to be valid and reliable.

Newcastle Sedation Scale (NCSS) Adapted from the Glasgow Coma Scale by Viney in 1996, this scale was developed to evaluate propofol, although descriptors are applicable for any sedated patient. Being based on a tried and trusted neurological assessment tool, it has proved reliable. The scoring system is more complex than Ramsay and Ramsay-like scales, which can make it time consuming, but makes it more comprehensive.

New Sheffield Sedation Scale (NSSS) This scale, which was developed for ICU nursing practice, also adapts the Ramsay Scale. However, the subjectivity of the Ramsay Scale is replaced by description of each level, enabling greater objectivity. The reliability of the scale has been demonstrated.

Observer’s Assessment of Alertness/Sedation Scale (OAA/S) This scale was developed to measure the level of alertness in subjects who are sedated for clinical procedures. In a study carried out by Chernik et al., this scale was tested for its reliability and validity. High inter-rater correlations were reported, as well as high correlations between the OAA/S scale and two of the three standard tests of depth of sedation used in the study. In addition, the authors comment that scorers can be easily trained on using the scale, administration of the scale is simple, takes very little time (approximately one minute), and the scale is a useful tool in measuring degree of sedation over time.

Pasero Opioid-induced Sedation Scale (POSS) The POSS was introduced to assess sedation during opioid administration for pain management. Nisbet et al. tested the validity and reliability of three scales: the Inova Health System Sedation Scale (ISS), the Richmond Agitation Sedation Scale (RASS), and the Pasero Opioid-induced Sedation Scale (POSS). Both the RASS and the POSS demonstrated adequate degrees of reliability and validity in this situation. However, the POSS scored higher in combined measures of ease of use and the usefulness of information provided to make clinical decisions. These results have clinical significance for the accuracy of clinical assessments and subsequent actions on behalf of patients experiencing advancing sedation during opioid analgesia. The POSS can be recommended as a superior sedation scale for the measurement of sedation during opioid administration for pain management.

Richmond Agitation Sedation Scale (RASS) The Richmond Agitation Sedation Scale (RASS) was created by Sessler et al. for use in intensive care units (ICU). It consists of a scale ranging from +4 to -5. A score of 0 is equated with a patient who is alert and calm. In the same study the RASS demonstrated excellent inter-rater reliability and criterion, construct, and face validity. This is the first sedation scale to be validated for its ability to detect changes in sedation status over consecutive days of ICU care, against constructs of level of consciousness and delirium, and correlated with the administered dose of sedative and analgesic medications. However in a UK survey of ICU units the uptake of the RASS was found to be slow. The most widely used scale remains the Ramsay Sedation Scale or the UK modified version, the UK Intensive Care Society sedation scale.

Reaction Level Scale (RLS85) The Reaction Level Scale (RLS85) was developed in Sweden for use in ICU settings. The RLS85 is an
8-level ordinal scale used to measure responsiveness to stimuli. Its anchors are "alert with no delay in response" and "unconscious with no responses". Levels 2 to 7 of the RLS85 correspond to linear declines from conscious to lethargic/confused, stuporous, and unconscious. Unlike the GCS, the RLS85 can be used with patients who are intubated or have ocular swelling. Starmark suggests that the RLS85 is superior to the GCS, because any change in the RLS85 score signifies a significant change in a patient’s status, and furthermore inter-observer agreement is better with the RLS85 than with the GCS.

Sedation Agitation Scale (SAS) The Sedation Agitation Scale (SAS) is again aimed at assessing the level of sedation/agitation mainly in intensive care units. It has been extensively tested for validity and reliability by Riker et al. who concluded that SAS is both reliable (high inter-rater agreement) and valid (high correlation with the Harris and Ramsay scales) in assessing agitation and sedation in adult ICU patients. Since the SAS stratifies agitation into three categories it provides additional information in comparison to the Ramsay scale without sacrificing validity or reliability.

Sedec Score (SSC) The Sedec score (the Sedation Intensive Care score) was developed by Binnekade et al. to detect sedation depth of patients in the ICU and in particular to detect and prevent oversedation. It demonstrates sufficient reliability and validity, and correlates well with wake-up time.

University of Michigan Sedation Scale (UMSS) The UMSS is a simple, valid and reliable tool that facilitates rapid and frequent assessment and documentation of depth of sedation in children aged 6 months to 12 years. It is an observational tool that scores the patient’s responsiveness to stimuli.

UK Intensive Care Society Sedation Score (UKICSS) This scale is derived from the Ramsay sedation scale and is widely used as a bedside tool for assessing levels of sedation in ICU. No data is available on reliability or validity.

Vancouver Interaction and Calmness Scale (VICS) Designed to measure the quality of sedation in the critically ill patients in ICU, this scale comprises two domains (‘interaction’ and ‘calmness’). Each domain has five questions, and each question has six responses from ‘strongly agree’ to ‘strongly disagree’. Patient stimulation is required for some questions. Scores are summed (maximum 30/domain), with higher scores indicating greater degrees of calmness and interaction. The VICS scale was tested for validity and reliability by De Lemos et al. who concluded that the scale is a valid and reliable. In addition the minimal clinically important difference (MCID) for the scale has been defined thus demonstrating the scale’s responsiveness to change.

Wilson Sedation Scale (WSS) In their 1990 study comparing the sedative effects of propofol and midazolam during spinal anaesthesia for orthopaedic surgeries, Wilson et al. devised a categorical scale based upon the Ramsay scale in which an observer rated the degree of sedation. There is no published data regarding the reliability and validity of this scale.

Wraith Sedation Scale (WSS) The Wraith sedation scale was developed and introduced in a sedation clinic and has been in use since 2003. It is comparable to the Ellis sedation scoring system but there is no data available on its reliability or validity.

Discussion A search of computerised databases and ‘grey’ literature revealed a total of 35 scales that have been used to measure the depth of sedation. Many of the scales are based on the Ramsay scale or the Glasgow coma scale. The central domain of most scales is consciousness, typically ranging from alert to comatose, with a sub-domain of arousal or awareness, often in response to stimuli of increasing intensity. In addition, higher states of consciousness may be further defined by testing cognition, comprehension or sustainability. These instruments rely upon noting a simple response (movement, eye opening, or following a command such as 'look at me’) spontaneously or responses to simple cues (speaking to the patient or physically stimulating the patient) that proceed in a logical progression reflecting progressively deeper sedation. This structure produces little overlap in levels of consciousness because of the step-wise approach, but the assessment can be quickly performed and the results easily recalled. In contrast, the structure of some instruments is to sum multiple subscales or to test multiple criteria for each
sedation level, thus adding complexity and potentially impairing ease of use.

There is surprisingly little information available on the reliability and validity of the scales. Where such information is available it has generally focussed on inter-rater reliability. Validity is typically defined in terms of correlations with other, similar, measures of the construct rather than measures such as time to wake or clinical judgement. There is very little comparative research whereby two or more scales have been applied to the same patients to determine the clinical ease of use and utility of the measures in comparison to each other. Future research in scale development should focus on the careful appraisal of the properties of the scales, as well as comparison of the utility of different measures in comparison to each other.

Only two of the scales were used exclusively in dentistry: the Ellis Sedation Score and the Wraith Sedation Scale, which is largely based on the Ellis Sedation Scoring system. Other sedation scales were primarily developed for use in medical settings (mainly intensive care settings) and have been adapted in some cases for use in the dental setting.

Most of the sedation instruments in this review are constituted by one item with a categorical grading. Such an instrument can be simple to use at the bedside. However, the use of a one-item instrument might not be appropriate when different conditions (e.g. consciousness and agitation) are assessed in the same item. For example, a patient can be concomitantly agitated (level 1 on the Ramsay Scale) and exhibit only a brisk response to a light glabellar tap (level 4 on the Ramsay Scale). Thus, the use of a single item to assess two or more different aspects of sedation can lead to loss of clinically important information and systematic or random measurement error. Evaluation of sedation in the paediatric intensive care units (PICU) patient population is challenging. Many scales measure sedation and analgesia in critical care patients, but they are not useful for the neuromuscular blocked patient. No single validated assessment tool has been recommended over another.

The findings of this research should be tempered by consideration of the limitations of the method. It is probable that much of the literature concerning the well established sedation scales which has been developed and published prior to the search period might have been missed. Furthermore in some cases it was not possible to obtain complete information from the published paper. Lastly publication bias whereby negative findings are less likely to be published may have inflated the evidence suggesting good reliability and validity of the scales.

Conclusions
A number of scales exist to measure depth of sedation in patients. The choice of measure which is recommended will be a function of the target population: adult or child, and the purpose to which the measure will be used: clinical assessment or research. For the assessment of adults sedated in clinical settings, the Ramsay Sedation Scale provides a brief scale which is reliable and correlates well with clinical judgement. In the case of children, the Dartmouth Sedation Scale or the University of Michigan Sedation Scale both have good psychometric properties and again are short.

For research purposes while reliability and validity are clearly important, in addition a scale which potentially yields a wide range of scores is also useful as it will allow the scale to be sensitive to changes in clinical status as the result of intervention. Furthermore a multi-dimensional scale will also allow researchers to determine the nature of the impact of the intervention. In adult populations the Sedation Agitation Scale is recommended, whereas the Observer’s Assessment of Alertness/Sedation Scale for adults or children has good properties.

References


41. Davidson D. Prospective audit of sedation techniques at the Cedar clinic: Guy’s, King’s and St. Thomas’ Dental Institute; 2004.
SAAD graciously supported my position as part-time Visiting Professor of Anxiety and Pain Management in the Department of Sedation and Special Care Dentistry at the King’s College Dental Institute from 2006 until early in 2012. I am grateful to SAAD, and of course to Dr David Craig and his colleagues at the Department for their warm welcome and hospitable setting in which to work. Dr Carole Boyle and Professor Tim Newton were especially good to work with. The contributions of SAAD to clinical education and research are important and should be an example to emulate in other countries, including my own.

My full-time job is at the University of Washington in Seattle where I am professor of Oral Health Sciences and Pediatric Dentistry and the emeritus director of the Dental Fears Research Clinic. I recently reduced my commitment at the University but still am caring for patients, especially those who require sedation, once per week. My focus continues to be on research and advanced teaching, and this year I was awarded the American Dental Association Norton M. Ross Award for Excellence in Clinical Research in recognition of these efforts.

During the period of my Visiting Professorship I made wonderful twice per year visits, usually staying in a tiny garret at Goodenough College in Mecklenburgh Square, becoming expert at using my Oyster and learning about the Tube and the buses, and attempting to master a new dialect of the language I thought I spoke well. I gained lots of experience with overcoats and umbrellas, which is saying something for someone from rainy Seattle.

I brought to this position experience both with pharmacological and psychological approaches to patients with dental anxiety and avoidance. David asked me to offer tutorials for the Diploma and MSc students on
behavioural aspects of dental fears to enrich the in-depth experiences of the students with the pharmacological approaches used in Dentistry. I particularly recall the shock of a couple of students when I asked them to give me an inferior dental block so we could talk about how best to approach patients about this. These particular students did especially well. Tim Newton has taken over these tutorials and will do a fine job. I was glad also to have the honour of presenting my own work on benzodiazepines at the Annual Meeting and to do some teaching across the Thames at Barts and The London. I wish I had had the opportunity to do some lectures at some of the other institutions in the UK as well.

The Diploma and MSc students have continued to make contributions through their research. I enjoyed the opportunities to hear about their work and to aid them when I could in designing their research. During my tenure at the Department I think the research projects have become more rigorous and the research better organised. I know this is being carried on.

With Carole’s leadership, we were able to collect data on patients seeking care in the Department. It is well known that patients may express preferences about the way they are treated and bring with them an array of other problems. The data collected included information on their background, dental anxiety, mental and general health, as well as about substance use. This data, published in the British Dental Journal and Community Dentistry and Oral Epidemiology, provided the basis for the development of psychological services within the Department. Thus, we were able enhance the services available and better meet the needs of the patients being served. As Carole and Tim have carried on, they have recruited others to become clinically active. They have published further and have made presentations at the SAAD annual meeting. Tim and I, along with my Seattle colleague Lisa Heaton, wrote a chapter for a fine new textbook on Cognitive Behavioural Therapy for Dental Phobia and Anxiety, to be published by Wiley-Blackwell this year.

As part of the effort in the new service within the Department, efforts were made to adapt a computer-based self-training program for dental anxiety patients. We had developed this program (CARL - computer assisted relaxation learning) first in Seattle and were eager for it to be updated and validated. We had hoped to go further still - linking up with FearFighter, a web-based self-training program for panic and anxiety - but were never able to raise the funds needed to bring this to fruition. No doubt the current economic climate has made this situation even more difficult. However, along the way we created some valuable new teaching materials and had the opportunity to work with psychiatric colleagues, especially Professor Emeritus Isaac Marks, who exposed us to new ideas and enriched the work we did in the Department. We also gained experience with the National Institute of Health Research program. Carole and Tim have presented some of the work at the Annual Meeting and we also had the opportunity at one time to hear Professor Marks as well.

I thank you for the opportunity to serve as a Visiting Professor and wish SAAD well in the future. It continues to be a vibrant and important organisation serving the dental profession. I hope it will create enhanced standards for the teaching of the behavioural and psychological aspects of patient care and recruit more psychology colleagues to work alongside. I hope it will also continue to support research and recognise students and new investigators who are contributing our understanding of this complex subject, especially at the intersection where our pharmacological skills and the patient psyche meet up.

David Craig writes…

When Nairn Wilson (Dean, KCL Dental Institute), Douglas Pike (Honorary Secretary, SAAD) and I met nearly ten years ago to discuss the possibility of SAAD funding a Visiting Professor in the Department of Sedation and Special Care Dentistry none of us knew how it would turn out. We had no idea what contribution they might make, nor who might apply. It was Nairn who suggested Peter – and what a fine choice it was.

Peter has made an enormous contribution to clinical research in this department. But, perhaps more importantly, he has enthused both academic and NHS staff to become involved in research activities. Peter’s knowledge, international perspective and drive always made him a difficult person to say ‘no’ to! I’m delighted that he enjoyed his time at KCL – we shall always be grateful to him for sharing his time and expertise and to SAAD for making this appointment possible.

David Craig
Consultant – Head of Sedation & Special Care Dentistry, KCL. ■
This pilot course which took place on 13th September 2012 was the first of its kind in advanced conscious sedation techniques for adult patients. Alongside Dr Nigel Robb, Reader / Honorary Consultant at the School of Oral and Dental Sciences, University of Bristol, who organised and led the day, were Dr David Craig, Head of Sedation and Special Care Dentistry at KCLDI, and Dr Chris Holden, Past President SAAD.

I was fortunate to have the course held on my doorstep whereas other participants travelled from around the country, from Edinburgh, London and the Midlands. There were a variety of professional backgrounds in the group including hospital-based special care dentistry, general dental practice, community dental services and a couple of us from oral surgery. All participants are currently actively practicing standard conscious sedation techniques for adult patients on a regular basis, as is the requirement for enrolment onto the course.

The aim of the course was ‘to provide the didactic, practical and clinical training to allow candidates to practice advanced conscious sedation techniques in dentistry consistent with the IEGTSSD syllabus for advanced sedation techniques in adult patients’ and this was outlined in pre-course information. Specific learning objectives, guidance on self-directed learning, recommended reading and relevant guidelines were also forwarded to us in advance. This gave us forewarning of topics to be covered and enabled us to achieve the most out of the day. We were also asked to prepare presentations in advance as two groups on ‘a review of indications for midazolam/opioid/propofol’ and ‘team training and responsibilities’. Although planning a presentation with colleagues you have never met who reside at separate ends of the country can be challenging, I found this process to be engaging and it certainly offered an ice-breaker when we eventually came face-to-face!

In the morning, Dr Holden covered the range of options available in advanced sedation techniques and shared some of his own experiences in these different techniques with the group. Dr Robb gave a lecture on the clinical application of using midazolam with an opioid, and Dr Craig a lecture on clinical techniques using propofol. It was clear that there was a wealth of experience from these speakers and discussions of how conscious sedation for dentistry has advanced and continues to develop with time was an underlying theme throughout. One team delivered their presentation and considering preparation took place over the internet, it was pretty slick.

After a bite to eat, we transferred up the road from the dental school to the Centre for Medical Education. ‘Stan’ resides in this building, a human patient simulator who would be the subject of clinical scenarios later in the afternoon. After demonstrations of different models of TCI pumps we had an opportunity to play with the equipment and familiarise ourselves with the systems. Most of us had never operated one of these machines before so getting hands-on was much appreciated.

The second group presentation was delivered very smoothly (bias – my group!), after which came the highlight of the day. We were separated into two groups and each group was given a clinical case scenario relating to ‘Stan’. We were informed that this exercise was to role-play complications of advanced sedation and to practice managing these situations. Although the words...
‘role-play’ have a tendency to make me shudder, the set was very realistic as Stan was sat in a dental chair with many familiar items of dental equipment surrounding him. Physiologically he had simulated breathing, a palpable pulse, moving eyelids and reactive pupils. He also had a voice that was controlled by a nearby simulator technician and so could respond to questions and demands. Both groups were given a few minutes of preparation time and then asked to manage their case. We took it upon ourselves to decide who would act as the dentist, dental assistant and other staff member and the scenarios were then acted out accordingly. The self-consciousness from knowing that the activity was being recorded and watched by colleagues in a neighbouring room was short-lived! Without giving too much away to those who may enrol in future, each scenario set up was true to life and represented realistic situations that clinicians may face in the dental setting. Group reflection and feedback on management of the cases from the trainers and the other group provided a memorable and valuable way to learn.

The day was rounded off with a short debrief and an MCQ assessment relating to the learning points of the course and other sedation topics. Also, a discussion of next steps in relation to mentored cases clarified how we can proceed with putting our newly gained knowledge and skills into practice.

All in all, the pilot advanced sedation techniques course was interesting academically and very useful practically. Applying techniques in a safe manner for appropriate cases in mentored conditions is something everyone in the group was keen to pursue to provide dental care for those patients that are not amenable to standard conscious sedation techniques. This course offers an ideal foundation with which to start.
2012 CONFERENCE

WHO NEEDS SEDATION?

SAAD ANNUAL CONFERENCE 2012

Cornelius Yap

The RSM is always a wonderful venue to start the 2012 SAAD Conference. We were welcomed by RSM renovations and the usual efficient Fiona and her team, at the registration desk.

The luminous RSM atrium is always a wonderful setting to have coffee/tea and tête-à-tête pleasantries with other dental colleagues.

Dr Nigel Robb introduced the day and we were pleasantly surprised to hear that SAAD was such a large voluntary dental professional organisation, and it was second only to the BDA in terms of the number of registered members.

We, the assembled 217 delegates, were surely in for a very interesting day.

Paul Averley (Queensway Dental, Billingham) was introduced to chair the morning session.

There could not be a more eminent speaker to start the first lecture than Professor Steele who gave us his interpretation on “Who does difficult dentistry?” The amusing but almost cynical jibes at the DOH and dental politicians of creating a climate of “difficult dentistry” within the NHS brought many bemused nodding of heads. We were given good clinical examples of wear cases, molar endo and complete denture prosthetics, which we all know are technically challenging. Professor Steele’s insight on the state of undergraduate education in complete denture prosthetics in the UK and his allusion to “Complete dentures are black magic” and the figure that currently only 5% of the general population are edentate will raise questions about the problems all dentists will have in this sector of dentistry. Professor Steele summarised cause and effects of the topic, within the fields of Conscious Sedation, NHS policy making, the responsibilities of dentists, and the role of Consultants in Secondary Care, team working and demonstration of post graduate competencies. Key criteria of reassurance, formation, choice, market needs, and efficient service were emphasised. I couldn't help but think that we were “technically challenged” individuals (perhaps defined by our family, and surgery staff) doing difficult things.

Dr Richard Hayward, a Specialist Oral Surgeon then brought us up to speed on what the Royal Colleges were going to do about Conscious Sedation. We were
After a short coffee break, we were treated to an insight to an almost Utopian Paediatric Dental Practice (in the Private sector). The Toothbeary philosophy, expounded by Dr. Nicole Sturzenbaum and Dr Will Botha, left us encouraged and stimulated, as to the good use of child-friendly colour, lighting, furniture position and dental chair layout, all helping to promote a non-threatening/relaxing dental environment for children. Dr Will Botha also demonstrated the facility of Paediatric IV sedation available to those children that did not respond well to RA. The excellent short digital recording of an anxious child undergoing paediatric IV sedation was informative and enlightening.

Liz McAthur then described to us the scenario of sedation choices for children at The Alder Hey Hospital Trust. She also elucidated the National Paediatric Toolkit and pain control programme for children, such that specific child pain assessment and education under the above programme led to, for example, a reduction of cardiac drains from 3 per week to one per month in the Cardiac Dept. The clever use of Touch Screen technology for the collection of data from children appears to be the way forward, and we were told that certain software providers are now able to provide “live” counting and feedback.

The annual SAAD Prize presentation followed. The SAAD prize for the highest score in the NEBDN Sedation nurses exams during the academic year 2011/12 was awarded to Stephanie Reed, in absentia. The SAAD Dental Student Essay Prize to Jasmin Davey, from the
seeking dental care may have experienced CSA and that dental phobia induces post-traumatic stress or flashback behaviour, (Lewis et al., J. of Psychosomatic Research, 2007). Some of the long term symptomatic effects of CSA were anxiety, obesity, self harm, poor coping skills, compulsive behaviour, substance abuse and addiction. Female CSA victims preferred women dentists for dental treatment. We were advised on management strategies and care when considering sedation for these individuals.

The SAAD day was rounded off by a top table “Hot potato” debate on the topic “Paediatric General Anaesthesia is better than Advanced Conscious Sedation for Dentistry”. We had Consultant Anaesthetists Dr Simon Bricker and Dr Anil Sharma for the above point and Dr Will Botha and Dr Michael Wood (Luton, SAAD Council Member) against the motion. Before the debate started there was the handset (live) polling that saw the delegates voting; 49% in favour and 51% against the motion, an almost evenly decided response from the SAAD delegates. Dr Simon Bricker kick-started the debate with data (access, efficiency, costs) from his GA experience in the North East, mainly on exodontias. We were even highlighted to the fact that mortality figures were higher in accidents involving Venetian blinds in contrasts to Paediatric Dental General Anaesthesia, and that there was no high quality data for mortality figures in dental conscious sedation.

Dr Will Botha then gave us favourable data on cost savings, time savings, and lack of long DGA waiting lists, lower incidences of headaches, nausea, vomiting and pain from the use of Paediatric Advanced Conscious Sedation.

University of Cardiff on her essay titled “The Advantages and Limitations of the Analgesics available for Control of Post-operative Pain after a Dental Procedure”. The essay can be found on page 70 of this Digest.

Thereby followed the excellent luncheon of braised lamb, vegetarian gnocchi à la Bolognese and a dessert of cheesecake and lemon tart, fortifying our low sugar levels before the pm session.

Was it my imagination or was it post-luncheon melancholia that brought a lecture theatre hush, when Dr Alison Dougall spoke about CSA (Child Sexual Abuse)? Always a taboo subject in society. Her lecture on Sedation and the Vulnerable Adult and Child was always going to raise eyebrows... We were refreshed upon signs of CSA and were told that incidences seemed to be similar in the UK (NSPCC), Ireland (SAVVI), Spain and the USA, that 20% of females
Dr Anil Sharma (Consultant Anaesthetist) quoted the Cochrane review in regard to Sedation or GA for treating children, by saying that there were no RCT (randomly controlled trials), so the study was dropped, hence defeating his own argument. However, in another Cochrane review on extractions and fillings, deep sedation was not reported, papoose boards were used, and there was very weak evidence of midazolam usage.

Dr Michael Wood, then closed the debate with illustrations of his Luton Paediatric Advanced Conscious Sedation Surgeries showing us long term volume data, successful at the very best (high patient satisfaction and acceptance at this practice).

Some excerpts, before the final vote...

“£720 (CDS), £145 (Paediatric Advanced Conscious Sedation), £1450 (Hospital GA) as to costs per head of sedation/GA in the various sectors of dentistry.” M. Wood.

“Walk in/walk out DGA lists... to ambulatory in such a short time, is insulting!” Comment from a SAAD delegate.

“A lot of dental phobia was initiated by a previous GA visit. In the 1950–1960s, traumatised by restraint, black mask...modern GA is more friendly.” S. Bricker.

“We are dentists trying to save teeth. Techniques which encourage patients to attend i.e. Conscious Sedation are the way forward, not extractions!” Comment from a SAAD delegate.

“Advanced Conscious Sedation techniques (with restorative dentistry) are not available in my hospital, but I would use them if they were!” A. Sharma.

The overall conclusion was that sedation provision seemed better in the South East compared to the North West. There should be a Care Pathway for DGA and Advanced Conscious Techniques for children. Dental General Anaesthesia and Paediatric Advanced Conscious Sedation should be available nationally.

The final vote from the floor at 4pm: 31% for the motion and 69% against the motion, i.e. SAAD Conference delegates of 2012 vote for SEDATION in dentistry!

We offer our thanks to Michael Wood for chairing the pm session, to Dr Chris Holden for chairing the debate and for organising the day’s events, and to the SAAD Board of Trustees for encouraging another wonderful and thought-provoking Conference day.

We are also very grateful for the continuing sponsorship and trade stands from McKesson, MedLab and RA Medical Services.

What a day!

Cornelius Yap
BDS, LDSRCS (Eng), Diploma in Conscious Sedation (University of Newcastle)
SAAD Member since 1986
WHO DOES DIFFICULT DENTISTRY?

Jimmy Steele

Potential contractual changes in the NHS provide an opportunity to ensure that services are commissioned to be appropriate to population needs. The priority of the service should be to improve oral health through managing risk and treating disease. However, there will still be a range of important services that are more complex, including those that are technically demanding, those that are only performed rarely, those that are made difficult by the medical conditions of the patient and those that are multidisciplinary. These need special consideration as they lie beyond the competence of the recent graduate. Sedation services are an important example. The most complex multidisciplinary cases and care for the most unwell patients may need to be managed in secondary care, but a range of other services, including sedation services are better, and probably more efficiently, provided in primary care. However, there is a lack of clarity about the specific training required for dentists to be commissioned such services. In the private sector there are no limitations except those determined by the law, but in the state sector the taxpayer will want to be reassured about the appropriateness of training. However, training may not be enough to demonstrate that services are effective and a demonstration of the quality of services, including outcomes of care may also be required. Professional organisations, such as SAAD, have a key role in determining the minimum standards of training and the structure of services.

UNDERSTANDING FAILURE

Raj Rattan

All clinicians, regardless of their knowledge, skills, experience, and expertise are fallible. There are ways of moderating this, but we can never eliminate the possibility. Alexander Pope’s maxim *To Err is human, to forgive divine* holds true.

Professor James Reason is a leading authority on human error. He likens this potential for failure to resident pathogens in the human body. In the presence of local trigger factors like stress, they are able to overcome the immune system and produce disease. He suggests that as with the human body, susceptibility arises when work...
conditions are sub-optimal and the risk of error increases. The conditions are so-called latent factors. They are organisational and usually relate to systems and processes within the work environment and can lie dormant for many years and only come to light when they combine with factors.

Reason defines error as ‘the failure of a planned sequence of mental or physical activities to achieve its intended outcome when these failures cannot be attributed to chance’. Planned clinical interventions may fail to achieve the desired outcome because our actions did not go as planned or because the plan itself was inadequate. In other words, we are prone to slips, lapses and mistakes.

Slips and lapses are error-types that result from a failure in execution regardless of whether the plan was adequate or not. The term lapse relates to covert forms of error like a failure in memory, and mistakes are failures in clinical judgemental and inferential findings.

Risk management strategies should take into account all these variables into account if they are to be effective. All errors create opportunities – for changes to systems and processes and for learning. In clinical practice, investigations into errors often focus on proximate causes – the event that is closest to the incident. The ultimate cause or root cause is often further downstream and can be assessed by asking the question why? 3–5 times to identify the underlying reasons. Root cause analyses will often be more revealing and help to create safer workplace environments than assigning blame on front line operators or team members.

PAEDIATRIC DENTAL SEDATION: A NEW APPROACH

Nicole Sturzenbaum and Will Botha

Sedation in children is a controversial topic, but that does not mean we should ignore or try to avoid it. We only have to look at what is happening in the rest of the world in the fast growing field of paediatric sedation to know that this will become ever more important as a choice for treating children in the United Kingdom as well.

At the Toothbeary Dental Practice, a children-only dentist, the main focus is to make the whole dental experience as child-friendly as possible. In order to provide the best possible dental treatment, we employ many different approaches ranging from behavioural management to treatment under regional and local anaesthesia to advanced multdrug sedation. During this presentation, we would like to demonstrate how this can be done effectively but also safely, using the UK and international guidelines on paediatric sedation and following a specialized team approach to advanced paediatric sedation.

CHILDREN MAKING CHOICES: A RIGHT OR A PRIVILEGE?

Liz McArthur

Sedation in children and young people has been for many years a hit and miss exercise. Although a well trodden path exists in dentistry and the use of agents such as Entonox is accepted as routine / good practice the evidence for the use of sedation is not so well established.

NICE commissioned a guideline to investigate the use of sedation for procedures in children and young people undergoing procedures and the evidence to support the practices that were currently in use.

The interesting part of the guideline, and where it departed from the usual remit, was in its emphasis on the need for education and the commissioning of a survey asking children and young people what their thoughts...
were about the process. It was a pilot survey to see how the process worked using a new electronic method of administering the questions.

Work carried out in Alder Hey was very interesting in a number of areas. The main one for the people who carried out the survey was how informed and inquisitive the participants were and they were very keen to take part in changes if required.

The partnership with Investing in Children enabled us to take many of the changes forward in a meaningful way.

SEDATION AND THE VULNERABLE ADULT AND CHILD

According to recent studies carried out by the NSPCC, nearly a quarter of young adults have experienced some form of abuse by an adult or a peer during childhood. A history of childhood trauma and abuse has been associated with elevated levels of dental anxiety in adults and it is one of the most significant predictors and positive diagnostic screens for dental anxiety and phobia. Previous abuse which involved the oral cavity is the most reliable predictor of persistent dental anxiety, with 94% of survivors reporting fear of choking or gagging and often reacting with intense negative emotions to lying back in the dental chair and having things placed in their mouth.

Due to its high prevalence, members of the dental team are likely to see in their clinics significant numbers of people who have undergone abuse and can pick up key clues and signs from characteristic patient behaviours which suggest different strategies for successful facilitation of dental treatment. Solutions may include treating the patient as a partner and sharing control by identifying and removing particular triggers in the dental environment and responding appropriately and sensitively to seemingly unprovoked emotional episodes.

Many studies report that survivors will deliberately avoid healthcare services where some aspect is likely to result in terror, anxiety or grief and it has been long hypothesized that dental treatment provokes memories and flashbacks. The requirement for treatment under sedation is not uncommon as patients often present in pain with advanced stages of neglect, not having been able to undergo treatment using conventional behavioural facilitation techniques. Some patients are wary of being sedated without an escort present throughout the procedure due to trust issues and may report distress regarding childcare issues post-operatively.

In addition to restoring and maintaining better oral health, a successful outcome for team and patient can have a huge positive effect on the self-esteem of survivors of childhood abuse. It is suggested by the author that due to its prevalence in society this subject is included in the routine teaching of anxiety management techniques within dentistry. With the required knowledge and insight, dental teams can act appropriately, sensitively and effectively and show flexibility in approach to make the small changes required to allow the dental experience to be less traumatic for this group of patients.
The Annual General Meeting of SAAD was held on Saturday 22nd September 2012, after the Annual Conference, which had been attended by a record-breaking number of 217 delegates.

Following the adoption of the minutes of the last AGM (2011), the President (Dr Nigel Robb) gave his final report at the end of his term of office, drawing attention to the number of tasks the Board has undertaken, the speed with which we have responded to events and the fact that a number of Trustees have represented SAAD on different committees. He alluded to the great honour of serving as SAAD President for the past three years, and thanked all the Trustees who have served on the Board during this period, with individual mention of the late Derek Debuse, Francis Collier, Steve Jones and David Craig. He paid tribute to the dedication of our Executive Secretary, Fiona Wraith. He wished Carole Boyle every success during her Presidency.

The Secretary (Dr Francis Collier) reported a busy year for correspondence, with requests for advice on a wide range of issues related to sedation practice. He reported that the website was being restructured, and an online CPD facility would be included in the new format. SAAD’s relationship with AAGBI remained cordial, and he thanked Busola and Laura for their support. He also paid tribute to the tremendous work done by Fiona Wraith.

The Treasurer (Dr Stephen Jones) reported that there had been a slight reduction in the assets of the Society due to a net reduction of incoming funds and a loss in the value of investments. The main source of the Society’s income was from the National Courses, for which he gave thanks to the Course Director (Dr David Craig) and the Teaching Faculty. Despite the reduction in its assets, SAAD has continued to use its resources to fulfil its charitable aims.

Dr Nigel Robb handed the Presidency over to Dr Carole Boyle. Dr Boyle thanked Dr Robb for his work for SAAD as President, and presented him with his Past President’s badge and a bottle of whisky. Dr Robb will continue to Chair the Editorial Board.

Dr Stephen Jones will continue as Treasurer for another term. Dr Boyle thanked him for his conscientious work.

Dr Chris Mercer and Dr Peter Walker were due to retire from the Board by rotation, and both had indicated that they were not intending to stand for re-election, although Dr Mercer will continue to serve on the Editorial Board.

There were two nominations to the Board Dr Paul Howlett, nominated by Dr Paul Averley and seconded by Dr Peter Walker, and Dr Sadie Hughes, nominated by Dr Carole Boyle and seconded by Dr David Craig. As there were two vacancies and two nominations there was no need for a ballot. Dr Boyle welcomed Dr Howlett and Dr Hughes to the Board.

There was no other business to discuss. Dr Boyle closed the meeting and thanked members for attending. The next AGM will take place on Saturday 21 September 2013.

Francis I Collier
Honorary Secretary SAAD
This year we were in Sheffield: ‘A destination famed for hosting world class events, Sheffield is a popular choice for conference organisers. With dazzling venues, plentiful accommodation and jaw-dropping attractions, this international city is one of the UK’s top conference capitals.’ Well, that is what I read on their web site and with DSTG, the National Union of Students (NUS) and the National Ice Skating Association Coaches Convention all taking place in Sheffield this year it must be true!

The day started really well as the sun shone for the first time in months. We were given a warm welcome by Dr Sheelah Harrison who introduced Paul Speight, the Dean of the School of Clinical Dentistry, University of Sheffield, and Chairman of the Dental Schools Council. Not only did he congratulate us on organising perfect weather, but he congratulated the Group on its role in promoting the provision of sedation within the undergraduate dental programme, ensuring high quality education and an excellent student experience.

The first session of the day was then opened by the chair, Dr Mary Clarke. I am repeating this from last year, so having Mary as Chairman of the first session must be a DSTG tradition by now. Mary, DSTG’s hardworking secretary, went on to introduce Claire Stevens who is a Consultant in Paediatric Dentistry, University Dental Hospital of Manchester. Claire describes her special interests as dental sedation for children and young people, non-pharmacological behaviour management, adolescent dental care and transition, engagement and involvement of young people and quality of care and patient experience. And if that isn’t enough she has managed to obtain a Research for Patient Benefit Grant, which for those of you who don’t know isn’t the easiest thing in the world to do!

Claire explained that she was able to use University of Manchester Dental Hospital Charity money to establish the case of need for a sedation service dedicated to adolescents. She explained the need for this service because, although the majority of anxious children can be treated with careful behavioural management, inhalation sedation with nitrous oxide is currently the mainstay of paediatric dental conscious sedation. However IHS may be less successful when used on severely anxious children and adolescents and the usual alternative of treatment under GA may contribute to rather than alleviate dental anxiety, and serves no purpose in acclimatising a young person to dental treatment. Claire went on to explain that their aim was to develop an adolescent-specific service for fit and well but dentally anxious young people which would improve the current quality of service, reduce pressure on GA waiting lists and allow opportunity for research and development of evidence base for sedation in young people.

They chose to use propofol rather than midazolam because it has a rapid induction and recovery (half life 20–40 minutes) and therefore allows the level of sedation to be varied during treatment. The downside of this is that there is a narrow therapeutic margin between sedation and general anaesthesia and thus you need a specialist team, making this a more expensive service to run compared with one using intravenous midazolam. However the advantage of this is that you can then more easily tailor the sedation to meet the patient’s needs. Claire also pointed out that there is currently little in the literature regarding the success of propofol sedation in the adolescent population, so this was an ideal area for research.

Claire then explained how she and the team set up the service and the research programme, which aimed to evaluate the safety and patient acceptability of intravenous propofol sedation in adolescent patients requiring dental care. They looked at levels of anxiety, side effects, patient satisfaction and effect on memory. They also set up their own web link (http://www.cmft.nhs.uk/young-personzone/our-services/paediatric-dentistry/adolescent-intravenous-sedation-service.aspx).

Claire’s results showed that propofol conscious sedation was a safe technique for anxious young people when carried out in a hospital setting by a consultant anaesthetist. This facilitated acceptance of dental treatment and acclimatised
anxious young people to dental care. There were only minor side effects reported and patient satisfaction was excellent which has not been demonstrated previously in other studies. Finally it offered an alternative comprehensive treatment option for this cohort of anxious patients where IHS is less successful.

This highly informative presentation was very well received and produced lots of interesting questions which Claire answered thoroughly, giving us details of the young people's forum which was set up to ascertain their needs and wishes, and details of how talkative usually non-communicative teenagers became under the influence of propofol (and tips on how to control this)!

I am sure this proved a hard act to follow, but the next presentation by David Craig covered an equally important but completely different aspect of sedation, that of guidance and regulation and the work of IEGTSSD. The first thing I learned was that IEGTSSD was the abbreviated form for the Independent Expert Group on Training & Standards for Sedation in Dentistry, but then I am not good at abbreviations.

David Craig is, I am sure, familiar to us all (who hasn’t studied his book?), he is Consultant and Head of Sedation & Special Care Dentistry at Guy’s & St Thomas’ NHS Foundation Trust. He is Chairman of the Independent Expert Group on Standards for Sedation in Dentistry and a Committee Member of the Dental Sedation Teachers Group. David is a past President and National Course Director of The Society for the Advancement of Anaesthesia in Dentistry and also a past Chairman of the National Examining Board for Dental Nurses. Thus it can come as no surprise that David has a vast experience and expertise in the area of dental sedation.

David very knowledgeably led us through a history of guidance and regulation relating to sedation, and the bodies who had influenced and produced many of the documents we used today. Having had my eyes opened by a long list of associations, each with their own acronym, my understanding of the complexity of the process of achieving any consensus amongst the numerous groups and interested parties increased no end.

David described all the documents relating to guidance in sedation from 1990 to the present day, pointing out how they had influenced each other and developed as the service we provided adapted to changing regulation and patient need. He chose not to go through each of the 3 documents, pointing out that they were obtainable via the DSTG website (http://www.dstg.co.uk/documents/326;  http://www.dstg.co.uk/documents/327;  http://www.dstg.co.uk/documents/328) but rather to explain the reasoning behind their decision-making. He also drew our attention to future plans in this area, with information about forthcoming pilot courses in advanced sedation techniques.

David’s insight into this area is truly amazing and all of us who use the resulting publications should be very grateful to those who took the time, trouble and effort to produce them. Furthermore this insight and expertise was evident in the way he replied to the many interesting questions, about age definitions and the future likelihood (or otherwise) of compulsory CDP in sedation.

Finally David’s recommendation of a trip to the industrial museum in Kelham Island was really appreciated by the locals; pity he didn’t mention the microbrewery, as Kelham Island brewery is recognised by CAMRA and has a host of awards.

With this the session came to an end and we all adjourned for a well earned cup of coffee or tea, a look at the trade stands and posters, or a quick stroll outside to ensure that the sun continued to shine.

After a well earned break the session was chaired by DSTG Treasurer, Chris Dickinson who as we all know is a Consultant at Guy’s & St Thomas’ NHS Foundation Trust, Department of Sedation & Special Care Dentistry. Chris is also famous for asking for your subs and updating the DSTG database. Chris explained that we had a slight change in the programme as very unfortunately Kirsty Hill couldn’t be with us and that Jacqueline Bowers had kindly agreed to present her paper at the end of the morning, instead of in the afternoon session.

Chris went on to introduce Simon Utting, Simon is one of the Consultants in Special Care Dentistry working within the Sheffield Salaried Dental Services and Sheffield Teaching Hospitals Foundation Trust. His background is in both salaried services and general dental services and his special interests lie in the provision of dental care to dentally anxious patients with particular emphasis on the use of alternative and behavioural techniques alongside conscious sedation. Simon trained in hypnosis in the early 1990s through the British Society for Medical and Dental Hypnosis and he started using the technique in general practice. He has gone on to use hypnosis to provide care...
for special care patients and also practices dental acupuncture. What I don’t understand is why the programme doesn’t mention Simon’s expertise in karaoke, but you can’t have everything!

Simon enthralled us all with his entertaining but thorough explanation of the clinical applications of hypnosis. He led us seamlessly through the history of clinical hypnosis, what it is, and what it isn’t, how to do it, and even where and how to train in hypnosis.

Simon explained how hypnosis was nothing new, there are written details going back to Egyptian hieroglyphics, how the image of hypnosis had its ups and downs over the eras since then, being both applauded and condemned, and how various religious groups approached hypnosis. He went on to explain the techniques he employed, the preparation, practicalities and principles of providing hypnosis and how these often related to the TLC we regularly provide for our anxious patients. He explained the importance of vocal delivery and how this could be modified, changing timbre, cadence and timing (a theme our first speaker co-incidentally also broached).

Simon then went on to give details of the situation in which hypnosis has been used in dentistry, not only with anxious and phobic patients but also to reduce salivation and treat atypical facial pain, TMD and trigeminal neuralgia.

Simon further demonstrated his depth of expertise by recommending various textbooks on the subject and explaining the availability of both ‘taster’ and full training courses, details of some of these can be found at http://www.bscach.com/training_and_events/

Finally Simon pointed out that you did need to exercise caution when using hypnosis and always needed to remember to awaken the patient at the end of a session, even though they might appear perfectly normal.

Anyone who can combine Kenny Craig, Paul McKenna, Derren Brown, Pope Pius XII and Freud in one presentation without getting us all to “Look into my eyes, not around the eyes, but into the eyes” needs to be congratulated, and Simon did this in spades. Far from sending us to sleep, Simon left many of us inspired and wanting more on this topic, especially its use as an adjunct when treating anxious patients.

Our final speaker of the morning was Jacqueline Bowers who presented her paper on the ‘Evaluation of Current Fasting in Patients with Additional Needs Receiving Sedation in anaesthetist-administered or Shared-care Sedation Service’ on behalf of the team from Liverpool University Dental Hospital. The aim of the study was to identify the current fasting practice of patients with additional needs and assess patients'/carers’ attitudes to fasting, still a controversial topic in sedation.

Jacqueline explained the situation in which the study was carried out and that all the patients had severe special needs and how communication with these patients was often exceedingly difficult, before you started treatment, thus assessing the levels of communication and depth of sedation can be especially difficult in this specific group of patients.

Her results demonstrated that the attitudes of patients/carers to possible fasting prior to sedation were generally favourable, however she felt that further research/audit was needed in this area, more specifically an audit of sedation-related complications and of patient compliance with fasting guidelines/reasons for non-compliance. She also felt that research into how we could more easily identify patients who should be fasted, for example by discussion with staff in department, would be useful and would enable the production of a new patient information leaflet, the effects of which could then also be audited. Lots more work to be done there then.

I think the lack of questions demonstrated how well Jacqueline had covered the topic, rather than, as she suggested, that everyone was hungry and wanted lunch, particularly as many DSTG members had to attend the AGM before they would be allowed to eat!

Lunchtime was a chance not only to eat, but to visit the trade stands and the posters which were varied and again highly informative. They covered the following topics:

A Completed Audit of Discharge Documentation following IV sedation at the Eastman Dental Hospital Oral Surgery. From Bambury A, Long J, Patel J, Eghtessad M.

The suitability of paediatric new patient referrals for IV sedation. From Fiona Gilchrist, Chris Deery, Sheelah Harrison at Sheffield.

Clinicians knowledge of titration dose sequence of intravenous Midazolam. Priya Karia, Aneesha Shah, Max Chauhan.
Assessing the completion of the request form and the waiting time for the sedation waiting list within the paediatric dentistry department at the Leeds Dental Institute: Clinical audit report. Madouh M, Tahmassebi J.

Compliance with NICE Sedation Guidance for Pre-sedation Assessment. Soldani FA, McKay A.

The need for conscious sedation for dental treatment in head and neck oncology patients and challenges faced in its provision. Victoria Swan, Mary Burke.

Those of us with more time on our hands also took a stroll in the Peace Gardens, admiring both the fountains and the weather.

The afternoon session was opened by David Craig, who had just been elected Chairman, during the AGM. David’s first duty was to present Lesley Longman with a bouquet, thanking her for her work on behalf of DSTG and presenting another bouquet to Sheelah Harrison for organising the Symposium. He also mentioned SAAD’s upcoming symposium on the 22nd of September.

Lesley then took the chair for the next session and introduced us to Professor Andrew Linn, who is Professor of the History of Linguistics, Director of Research and Innovation - Faculty of Arts and Humanities, University of Sheffield. Andrew graduated in English from Emmanuel College, Cambridge where he was also an organ scholar. After a year in Norway he returned to Cambridge for a Master’s degree in General Linguistics and a PhD in the History of Linguistics. Andrew explained that he began his teaching career in Luton and had no teaching qualifications whatsoever, thus he would present the musings of an enthusiastic amateur and any criticism we had would therefore not have any effect on his professional career!

His musings began when he realised that he had to deliver academic material to non-interested undergraduate students and whilst the tendency amongst academics is to concentrate on the content, students nowadays can get as much, if not more, content from other, usually online, sources. This led him to question the value of lectures as a medium for delivering information and his central question, “What do lectures add to the learning experience?” He pointed out that in essence a lecture theatre has many similarities to a dramatic theatre, the lecturer frequently stands above the audience separated from them as though on a stage and you have projectors to provide the scenery. So maybe we should think of a lecture as a performance. Having drawn parallels with stage performance, cinema, concerts and sporting events to the extent of comparing the performance to Bernard Manning type stand-up and the Full Monty he pointed out that students these days had very high expectations and also needed to be entertained. Whilst as a lecturer you were often protected from heckling and booing, you weren’t immune to the evaluation, student surveys or Facebook.

He then provided some practical advice, using the voice to create excitement, light and shade and using the situation to manipulate context share knowledge in the here and now, maybe referring to the weather or a common political moment.

He pointed out that good preparation far from hampering and containing lectures it actually left us with the freedom to express ourselves fully and share our enthusiasm and love of whatever subject we lectured in.

I was left comparing many of the suggestions with those on communication and the effect of the voice described by Simon Utting in the morning session and I wondered if we couldn’t also use advice on ‘performance’ when treating our patients. After all, how many of us deliberately take on a ‘dentist persona’ when we enter our practices?

Lesley Longman then introduced the final speaker of the session, Peter Bateman. Peter is Clinical Director of Dental Services for Sheffield Salaried Primary Dental Care Services and Honorary Clinical Lecturer at Sheffield Dental School (CCDH). As part of his role he continues in clinical practice, with a special interest in adults with learning disabilities or dental anxiety.

Peter introduced his presentation by saying that he felt like he was walking into the lion’s den and then proceeded to fulfil this prophesy by providing a very controversial discourse. His first statement was that sedation is no cure for dental anxiety (well, we all knew that) but he then went on to explain the problem in terms of access to services, time and cost implications.

He explained that the situation became worse in Sheffield in 2006 when funding was withdrawn from general practice and waiting lists soon became full. This resulted in a service review which recommended improvements in the referral guidelines including clear referral criteria, assessment of anxiety prior to referral and discussion of treatment options with patient by the GDP. It also recommended a self-referral entry route for highly phobic...
patients, full utilisation of alternative methods of anxiety management, making psychological interventions accessible, increasing resources for IV sedation. This resulted in a plan to offer psychological support from within SPDCS to patients throughout their care, a formal arrangement and referral pathways between specialist dental services and specialist psychotherapy services, arrange more training for GDPs in management of anxious patients and implementation of a shared care approach with a network of GDPs, who would accept referrals from specialist services.

The service would be based on the principle that CBT is the first choice response for dental phobia/anxiety. There would be strict entry criteria and referrals for sedation to manage phobia/anxiety would not be permitted, but that sedation would only be available after CBT failed, unless the patient had acute pain. Only one course of treatment would be provided before discharge back to GDS, but that where appropriate shared care would be possible. It was arranged so that CBT would be delivered by trained dental nurses with specialist psychotherapist support and regular clinical supervision and that treatment without sedation would be provided by dedicated 'TLC' dentists.

Strict criteria were drawn up and all referrals were triaged by a dental nurse to check that these were adhered to. The system demonstrated early success with 75% of referrals deemed suitable for nurse-led CBT. The CBT worked well, and those who dropped out early did not take up resources needed by others. The message that no referrals could be taken directly for sedation was heard and the transition from CBT to TLC treatment worked well. Furthermore the specially trained dental nurses enjoyed the challenge.

However, looking back at the initial recommendation, whilst the service meets the proposals to provide clear referral criteria, and assessment of anxiety prior to referral, use alternative methods of anxiety management, makes psychological interventions more accessible and increases the resources for IV sedation, work still needs to be done to encourage GDPs to discuss treatment options with patients before referral, provide more training for GDPs in management of anxious patients and implementation of a shared care approach with a network of GDPs, who would accept referrals from specialist services. There is also no self-referral entry route for highly phobic patients.

Peter concluded by saying that for the majority, dental anxiety can be treated using CBT and that non-pharmacological interventions should be first line treatment of choice, but acknowledged that there was still a role for sedation in managing anxiety for the minority for whom CBT alone is insufficient.

Lesley rounded off this session by recommending a short break, and pointed out that Peter would be available for discussions later.

On a personal note, I spoke to Peter afterwards as he had stated that CCDH did not provide any restorative treatment under sedation, and I felt compelled to point out that we did. However we agreed that, just like the exceptional service provided by my colleagues under private provision in general practice, our provision, being training, and not NHS service, was not measurable within the service capacity plan, which is why Peter had to exclude it from the service provision. So could you all please note that we in South Yorkshire have not abandoned patients that need restorative sedation!

The final session of free papers was ably chaired by Professor Paul Coulthard. Paul, as we all know, is Professor of Oral and Maxillofacial Surgery at the School of Dentistry, The University of Manchester and a past Chairman of DSTG.

First was Eleftherios Martinis from King’s who investigated the degree of amnesia experienced by patients undergoing exodontia with intravenous midazolam sedation. He concluded that the development of amnesia following intravenous sedation with midazolam is not a dose-dependent effect and is not influenced by surgical complexity.

He was then followed by his King’s colleague, Luca Licheri, whose study aimed to create a practical algorithm using age and ASA to plan titration rate harmonizing with NPSA recommendations. He concludes that individualizing midazolam titration is of crucial importance in sedation, and that it is important to identify patients requiring slow titration during the planning phase. He goes on to suggest a practical algorithm to select the titration rate by multiplying age by ASA score for older patients.

Paul then introduced Lucy Wray who presented her study on the use of flumazenil for patients with learning disability undergoing sedation for dental treatment. Lucy, who came on behalf of the team from Dorset, Hampshire and Surrey Dental Sedation Group, explained that their
Aim was to investigate the use of flumazenil for people with learning disability during conscious sedation for dental treatment. 116 patients were treated during the 6-month audit period and of these there were 21 cases of delayed recovery that required reversal with flumazenil. She concluded that, of the patients in this survey, 21 (17%) required flumazenil following conscious sedation for dental treatment. No patient treated during the audit required flumazenil for a medical emergency. This led to a discussion on the role of flumazenil for this particular group of patients during which Lucy was congratulated for shedding light on this area and encouraged to publish her results to try and increase awareness and acceptability of the regimen the team had developed.

We then moved on to a couple of paediatric related topics: firstly Suzi Carew O’Donnell ably presented a study into both the parent’s, and in particular, the child’s viewpoint of sedation carried out in Sheffield. During her very clear presentation she reported that the majority (86%) of patients liked ‘the gas’ and were glad to have had it (92%). All parents felt that the procedure had been explained well and understood the pre-operative instructions. Despite this 10% still had concerns regarding the treatment. Key themes revealed by the children’s narratives related to physical sensations, emotional impact and the distraction provided by IS. She concluded that IS was viewed as a positive experience by the majority of patients and carers. She also demonstrated how children’s narratives gave a valuable insight into their perspectives of this treatment modality and how this would aid production of child-centred information leaflets.

Secondly Urshla Chaudhry from the Eastman asked “Are we now a NICE paediatric dental IV sedation department?” She presented an audit which had compared the clinical practice at the Eastman to the National Institute for Health and Clinical Excellence (NICE) guidance, ‘Sedation in children and young people – Sedation for diagnostic and therapeutic procedures in children and young people’. During her beautifully clear presentation she led us through the NICE guidelines and provided clear illustrations of the targets and degree of compliance achieved in her department when providing IV sedation service over 12 months. The patients’ ranged from 12 years to 19 years of age. 100% of attendances had a pre-assessment prior to the day of the sedation. 86% of patients were ASA grade I, with 14% grade II. Treatment varied from simple extractions (30%) to surgical procedures (62%). 100% of patients had an uneventful recovery and were monitored until vital signs were normal prior to discharge.

She concluded that intravenous midazolam had proved to be a well accepted and successful mode of sedation for the paediatric patients. Presently, we are meeting best practice in the majority of categories according to NICE guidance.

Finally Will Thompson from Newcastle got his Mac book working and entertained us with his audit on intravenous sedation patient escort knowledge and understanding of their duty to the patient following IV sedation. His conclusion was that escorts have a general knowledge of their responsibilities, however there is still room for improvement. The information provided to the escorts needs to be delivered in a more effective way. Thus he went on to recommend improving the process by which information is delivered to escorts including having a sole escort information sheet, posters in the waiting room, instructions available via a web link, information sheets available in different languages, transport guidance and car parking information in the appointment letter.

Thus ended another highly successful DSTG symposium. Sheelah Harrison then concluded proceedings by thanking all the speakers and her team for their hard work. She also thanked our sponsors and the venue staff for their contribution. Finally she invited us to partake in the tea and coffee which was available before we made our return journeys, thus allowing more time to catch up with friends, until next year when we could all meet again in Cardiff.

For most of us this allowed time to take another stroll in Sheffield’s sunshine and make the most of an enjoyable, entertaining, but most of all informative day.

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EFAAD organised a session at the Dental Expo in Moscow on Monday 17th September. Dental Expo is a huge annual event – kind of the Russian BDA Annual Conference equivalent, but on a much larger scale. The trade exhibition was the largest I have ever seen, with previously unheard-of companies exhibiting a vast range of equipment and material.

The participation in this event marked the end of the Presidency of Professor Solomon Rabinovich. The official date for the transfer is the 1st January 2013, with the actual handover of the badge of office taking place at the first Council Meeting of 2013.

Professor Rabinovich is the first President of EFAAD to have come from the former Eastern European area. The Russian representatives have been enthusiastic contributors to the work of EFAAD since we first met them at the IFDAS congress in Jerusalem back in 2000. The greater freedom that we now have to travel and meet has allowed an increasing opportunity for an exchange of knowledge between countries that have historically had little or no contact. At the Council Meeting held on the Sunday afternoon an application from a Ukrainian specialist society to join the federation was approved.

EFAAD has always viewed Europe more like the Eurovision Song Contest rather than the European Union! We are happy to welcome those who wish to join, either with a desire to share knowledge or from a need to further their understanding of pain and anxiety control in dentistry.

As everyone will be aware, reaching agreement across Europe and between the different nationalities is extremely difficult! There are a number of differences in the practice of sedation between the member countries. An example of this is that in France and Italy the use of midazolam outside a hospital setting is prohibited. Thus in these settings diazepam is still the IV sedative of choice.

In France dentists are not allowed to use equipment that
titrates nitrous oxide in oxygen, they are restricted to using premixed entonox as this is viewed by the anaesthetists as being safer.

In Spain one of our members Angel Alcaide has established a course on inhalation sedation. This has been a major undertaking as for those in the UK who get frustrated trying to deal with a single regulator, each region of Spain has its own dental regulator – and thus their own rules of practice!

EFAAD with the help of SAAD Board of Trustees responded to a document entitled The Use of Nitrous Oxide Inhalation Sedation in Dentistry produced by an organisation called the Council of European Dentists. The international collaboration resulted in a much improved document emerging that we could all work with, even if not agreeing with every word – a huge step forward from the start point.

Returning to the meeting in Russia, we had an excellent session with speakers from France, Italy and the United Kingdom as well as from Russia. The topics were wide ranging, from John Meechan informing and entertaining with an update on local anaesthesia through to a description of xenon anaesthesia in a dental practice in Russia.

All of the visitors are indebted to Christine Stein from 3M for her continued support of EFAAD. This included organising a dinner for the “foreign” speakers after our session on Monday.

On the Tuesday morning we were taken for a tour of the Dental School where Professor Rabinovich works. The standard of the equipment and facilities had improved markedly since my previous visit in 2005. The main difference between the clinics in Moscow and clinics I am more familiar with in the UK is that there is less privacy between the dental units. I was reminded of the way clinics used to be set out in the UK. Undoubtedly the equipment was modern and the students seemed happy and engaged in their work.

The social programme included a visit to the Kremlin and surrounding area. The Armoury was a fascinating visit. The description is misleading as it is a museum of life in pre-revolution Russia. It also includes the gifts that were given to the Russian Royal Family. One of the collections is about the finest collection of pre-Cromwellian English Silver. Most of the English silver that was in this country at the time that Cromwell came to power was melted down and used for other things, whilst the collection in the Russian Royal Family’s hands survived the revolution of 1917.

The other highlight of the social programme was a visit to the Tretjakov Gallery, where there is an amazing collection of Russian artists work. Tretjakov was a wealthy Russian Merchant who in the 19th century started to collect works by Russian artists, which he displayed in his house. On his death the collection was donated to the state, and can still be visited in his former home.

The next President of EFAAD is Dr Enrico Facco from the University of Padova (Padua) in Italy. He already has plans for the next EFAAD conference which will be in Padova in 2014. Further details will follow.
T he Congress was held at the Fairmont Orchid resort on Kona (Big Island) Hawaii from 28 February to 2 March 2012. The American Dental Society of Anesthesiology hosted this meeting with Dr Peter Tan welcoming us all to this beautiful venue. The meeting started with the devastating news of the sudden passing of a legend in our field, Professor John Yagiela, only a week prior to the meeting. Tributes were paid to him throughout the meeting and we will always remember him fondly as he has made a massive contribution to pain and anxiety control in dentistry.

Professor Stanley Malamed started the educational program with two important issues which were addressed: new developments in the field of local anaesthesia and also paediatric emergency medicine relative to sedation and anaesthesia. Updates in computer controlled LA delivery was discussed and we were introduced to the advantages of 'Buffered Local Anaesthetics' providing a faster onset of pulpal anaesthesia. One future development that needle phobic patients will definitely be interested in is the use of intranasal local anaesthetic for the maxillary teeth. He stressed the point that local anaesthetics remain the safest and most effective drugs in medicine for the prevention and management of pain. Paediatric basic life support was stressed as the single most important aspect of child rescue. The drug kit was analysed as to the usefulness of the different drugs in medical emergencies. Automatic external defibrillators were discussed as was
the recognition and management of local anaesthetic overdose.

Dr Richard Cook from Cognitive Technologies Laboratories gave an interesting presentation on ‘Risk, and the Dynamics of Patient Safety’. Our president, Dr Nigel Robb, gave a presentation on ‘Training in Conscious Sedation in Dentistry – the UK experience’. Professor Quirino Piazza, president of World SIVA, presented on: ‘World Safety Initiatives’ – developing an effective reporting system for adverse events in sedation. Dr Don Macalister, an oral surgeon from Auckland, New Zealand, gave an interesting presentation of the use of BIS guided target-controlled infusion sedation by operator-sedationist in both adults and children. He uses a combination of propofol and remifentanil with two dedicated nurses while treating his patients. He has been using this technique for 8 years and has found it to be consistent, safe and effective.

In the afternoon there were lectures on facial pain: ‘Pain Research in Japan’, one on ‘Chronic Facial Pain’ and one on TMJ Pain. This was followed by the President’s Luau where old friendships were rekindled and we enjoyed the Hawaiian hospitality.

As is always the case with these conferences, one has to choose between the free papers, the main session and the beach. There were many interesting presentations at the free papers including presentations on ‘needle deflection’ by Dr John Meechan and articaine infiltration by Dr Ian Lane. Dr Carolyn Yarascavitch, an operator-anaesthetist from Toronto, Canada, gave a presentation on safety considerations and evidence for the operator-anaesthetist in the office model of service provision. Dr Andrew Herlich continued on from his earlier lecture on ‘Systemic Factors of Patient Safety’ and focussed on the pre-operative evaluation of the patient. Professor Monika Daubländer presented an interesting talk on ‘Safety Considerations in Local Anaesthesia’ and Dr Paul Moore informed us about a problem which we in the UK are not familiar with: ‘the abuse of prescription opioids in the youth’ and responsible pain management in dentistry. The formal awards dinner took place that evening and a wonderful time was had by all those who attended.

On the final morning, Dr Keira Mason gave two excellent presentations, one on ‘Paediatric Anaesthesia and Sedation: Safety Issues’ and the other lecture on a drug which we are bound to hear a lot about in the future of sedation – dexmedetomidine. Dr Jim Grainger gave us an overview of the history of IFDAS and then there was a lively panel discussion on safety issues in anaesthesia, sedation and local anaesthesia.

The next IFDAS meeting will be in Berlin in 2015 and I would encourage everyone who is passionate about pain and anxiety control in dentistry to make the effort to meet with the world leaders in this field in dentistry.
Francis Collier: Carole, let me first congratulate you on your recent appointment as President of SAAD.

Carole Boyle: Thank you very much for inviting me to take part in this interview with you.

It's an exciting time to become President of SAAD and be only the second woman to take on this role. It is going to be difficult following in Nigel's footsteps although I know I will have the support of the board.

FC: How long have you been associated with the Society?

CB: I guess I was always aware of SAAD but became actively involved in 1996 when Ian Bret invited me to teach on a dental nurse course. Of course the courses were very different then, running over three days and much smaller numbers with only about twenty nurses and forty dentists. So a different undertaking from the big courses we have now with eighty dentists, sixty dental nurses and now with hygienists/therapists taking part as well.

From being a member of the teaching faculty I then joined the board in 2003. Thanks to the encouragement of Chris Holden and again Ian Bret.

Since being a member of the board I have organised conferences, judged the SAAD essay prizes and more recently set up the SAAD PhD studentship. This idea came during the conference two years ago when we were discussing paediatric sedation and the need for good research in this area. We were very fortunate in having a number of top rate applications for this funding: the award was made to the University of Sheffield.

FC: I know you are London based at present, but I wouldn't need to be a linguistic guru to realise that you come from north of the border. Where did you grow up and study dentistry?

CB: I grew up in the East End of Glasgow and like many Scots stayed at home and went to my local university. I qualified in 1985 and left Scotland for a six month sojourn down South working in oral surgery: it turned out to be a lot longer than that. I had a number of hospital jobs, worked general practice and then was a lecturer at Manchester University before coming down to London in 1997 to take up a part-time post at Guy's which came together into a consultant post in 2008.

FC: Did your interest in sedation techniques stem from an introduction at dental school, and if not, when did it capture your interest?

CB: We were very fortunate to be taught by a very
enthusiastic anaesthetist, Donald Braid. I can still remember his lecture about this very new exciting drug, midazolam in 1983, well at least he thought it was exciting, I wasn't quite so convinced. I still have my anaesthetic notes and in those days we weren't taught to administer sedation we were taught anaesthetics. I remember observing sedation as a dental student and carrying out extraction of deciduous teeth including dental clearances for children under general anaesthesia.

From there I left to take up a house job in Manchester and was fortunate to work in a department where a lot of sedation was carried out and work with some very experienced clinicians who really gave me the chance to develop the competencies I needed to become a sedationist. I also spent 6 months as an SHO in anaesthetics giving me the opportunity to administer anaesthesia for both dental and general surgery which was great fun. I also gave dental chair anaesthetics in the dental school with the anaesthetist in the recovery room – fantastic hands-on experience.

During my time in Manchester I commuted to Sheffield to complete an MMedSci – the Scientific Basis of Anaesthesia in Relation to Dentistry.

Of course in those days there was no such thing as qualifications in sedation or NHS contracts, it was very much an apprenticeship. So when I went into practice as an associate I was able to offer sedation to my patients.

FC: Although you are a Consultant in Special Care Dentistry at Guy's Hospital just now, you have a broad range of clinical experience. Please tell me about that, and what led you into Special Care Dentistry?

CB: Well I guess I really fell into Special Care. In Manchester I treated a number of medically compromised patients and then when I came to Guy's I was working initially on the sedation side but gradually more sessions became available in Special Care. I started seeing patients with learning disabilities, challenging behaviour, mental health problems and realised what fun it was to treat these patients. At that time the department had really just come together so the Sedation stream ran separately from Special Care but it was good to be involved in the transition to a more integrated service. We now use sedation techniques for a variety of special care patients which is probably the most interesting part of my job.

FC: The Sedation & Special Care Dentistry Department at Guy's and St Thomas' NHS Foundation Trust in which you work has a diverse range of activities. Broadly, how is your week divided between patient care, teaching, research and administration?

CB: One of the good things about working here is that we have different timetables throughout the year depending on our student requirements.

I organise the undergraduate course in Special Care Dentistry which runs at the beginning of the year and teach on the undergraduate sedation course. We have postgraduate students on a nine-month Diploma course – most recently 12 enrolled students. There is a Masters degree which has become part of the specialist training programme for Special Care Dentistry. This has been the most challenging part of my job in recent years, being an educational supervisor for the first trainees in Special Care Dentistry.

I also treat my own patients: I feel it's important to have hands-on experience, both under sedation, particularly using intranasal sedation for challenging patients, and under GA. I enjoy the GA lists because it gives me a chance to carry out a lot of dentistry and keep up my oral surgery skills. I have access to in-patient beds, and can admit patients who present complex anaesthetic challenges.

My research involvement is supervising postgraduate projects and writing up papers usually based on this research or teaching.

I enjoy administration although it is difficult to find time for this. I lead the undergraduate courses in cardiopulmonary resuscitation and in Special Care Dentistry and am programme director for the Masters programme in Special Care Dentistry. The department timetables are my responsibility which are a complex puzzle to juggle resources and personalities.

FC: I know you have been involved in the development
of a Cognitive Behavioural Therapy programme within your department. Do you ever see a time when such Behavioural Management Therapies will make us sedationists redundant?

CB: I do not think sedations will ever become redundant but I do think that working closely with the Health Psychologist who can provide Cognitive Behavioural Therapy is a really useful adjunct to sedation. With Professor Tim Newton we often use both CBT and sedation techniques to manage more challenging patients.

FC: Some colleagues seem to regard sedation and Special Care Dentistry in a very compartmentalised way? How important are your sedation skills to your Special Care Dentistry practice?

CB: I find it hard to understand how anyone can provide Special Care Dentistry without having access to sedation. Sedation means that patients with special needs can be seen on a regular basis for recall, for preventative treatment and for routine dental care in a safe and easy way for them.

Unfortunately a large number of my referrals are from specialist services around London where they do not have access to sedation. One of my remits is to help such areas set up services where patients can be treated closer to home.

Of course there will always be patients who are not suitable for treatment in primary care and thats when the hospital services should come in – to provide treatment under sedation for patients who are high risk due to medical problems or who have large dental needs.

So in answer to your question, I do not think I could provide Special Care Dentistry without being able to offer sedation.

FC: In what ways would you like to see SAAD develop and change during your term as President?

CB: This is a difficult question: SAAD has a strong foundation and is recognised as the leading provider of postgraduate education in sedation. It is important that we continue to lead and to set the standards for such education and for the practice of dental sedation.

I also think it is important we encourage young people to join SAAD. Certainly looking around the board we do need some young blood there. I would urge members to think about coming forward in the next couple of years to join the SAAD board.

It’s important we get our message out to undergraduate students. The Dental Sedation Teachers Group does a great job in supporting undergraduate sedation teachers but I think we should also think about those students as future practitioners and the role that SAAD can play in their future careers.

We also need to embrace modern methods of communication: the website has been relaunched and increasing the use of social media can only help us to involve younger dentists.

FC: Tell me about your interests outside your sphere of work? I understand that your interest in running very much pre-dated the recent London Olympics?

CB: My interests are quite complementary. One is running but not just for myself but also coaching others. I am a level two athletics coach (endurance) and coach a group of women locally, helping beginner runners and experienced runners. Seeing others get so much fun and enjoyment out of running is very satisfying. I organise a local parkrun which is a free 5K every Saturday morning. Through that I get to meet many other local runners.

My other main interest is wine tasting and I have completed the Wine & Spirits Educational Trust Level 3 certificate. Wine tasting makes for interesting holidays and I have enjoyed visiting vineyards in South Africa and California. You will note, Francis, I say wine tasting and not wine drinking which are two very different things.

FC: Thank you, Carole. I wish you much success during your three-year term of office.

CB: Thank you.
I decided that I wanted to be a dentist at three years old and never wavered from that aspiration throughout my childhood. I realised my ambition when I was lucky enough to study at Newcastle Dental School and, following a fantastic five years, qualified in 2001.

Following general professional training at Newcastle Dental Hospital and completion of my MFDS, I worked in a busy NHS practice in Sunderland for five years and was awarded my Diploma in Conscious Sedation in 2005. During this time, I developed my interest and skills in standard conscious sedation techniques and accepted referrals for both anxious children and adults. I also worked closely with the local community dental services to develop a practice-based inhalation sedation service within South Tyneside providing care for anxious children referred from their own GDPs.

In 2008, following a family move to North Yorkshire, I transferred to Queensway Dental Clinic and further developed my skills and knowledge as part of a large, dedicated team managing a considerable number of anxious patients employing a variety of techniques. As well as consolidating my skills in standard conscious sedation techniques, I have relished the opportunity to develop my knowledge of alternative conscious sedation techniques along with our excellent team of consultant anaesthetists. I continue to work at Queensway and gain enjoyment and fulfilment from looking after and caring for anxious adults and children as part of our committed and enthusiastic team.

I am an active member of Tees LDC and currently hold the position of treasurer. I am also a member of the Teesside Sedation Network Group which works with local sedation providers to develop patient care pathways and provide advice and guidance on sedation protocols and governance.

Through my involvement with Dental Foundation Training, I have delivered sedation study days and practical sessions for both foundation dentists and more experienced practitioners and really enjoy and relish the educational aspect of dentistry. Recently, I have been appointed as a Quality Assurance of Education Inspector for the General Dental Council and will be taking up this role in 2013. I am looking forward to this fresh challenge and hope to have the opportunity to raise the profile of pain and anxiety control within the undergraduate curriculum.

I have been a member of SAAD since 2006 and look forward to working with the other trustees to further develop and advance the society both nationally and further afield.

Away from work, I am married to Anthea and we have a two-year-old son, George. I enjoy the outdoors and like to spend my free time playing golf, trail running and going for walks with our labrador, Rosie.
I was born in Bristol and, as a child, spent a reasonable amount of time at the dentist. At 8 years old I had decided on a career in dentistry. In 1997, I received my BDS from Cardiff Dental School, University of Wales College of Medicine. It was here that I developed my interest in sedation and was fortunate to complete my elective with Dr Stanley Malamed, at the University of Southern California in Los Angeles, studying pain and anxiety management in dentistry.

I returned to Bristol to complete my Vocational Training and was lucky to have a great trainer who provided sedation for anxious patients and fuelled my interest in sedation. From Bristol I went further west to Exeter and took up a Senior House Officer post and later a Trust Fellow position within the Oral and Maxillofacial Department at the Royal Devon and Exeter Hospital. I spent a couple of enjoyable years under the instruction of a very experienced associate specialist and staff grade whose great skill and enthusiasm for teaching all things surgical proved quite infectious. In 2000 I became a Member of the Faculty of Dental Surgery.

After deciding to try my hand at another branch of dentistry, I took a Community Dental Officer position within the Community Dental Service in Devon leading the paediatric dental day case list and providing general dental care to patients unable to find an NHS dentist. It was within this job that I took an excursion to the SAAD course in London where I met a well known sedationist and life was never quite the same again.

In 2001 I moved to London to take up my place on the MSc in Sedation and Special Care course at Guy’s Hospital. I also started working part time as a Dental Officer for Herts Special Care Dental Service. Alongside this I carried out peripatetic sedation, mostly for implant cases, at a specialist dental practice in Bedford. I completed my MSc in 2003 and spent a year in the Department of Sedation and Special Care Dentistry teaching students and developing the Dental Oncology service. After which I returned to Hertfordshire as a Senior Dental Officer, Sedation Lead and Specialist in Special Care Dentistry, predominantly providing sedation for special care adults and teenagers. The job is often challenging, sometimes difficult but always interesting. I still enjoy teaching, providing in-house sedation training and medical emergency management training.

In addition to my work within special care, I work part-time in practice providing dental treatment under sedation and have a sedation advisory role to NHS Hertfordshire.

Last year I finally persuaded my long-suffering partner to marry me and our two lovely young children keep us busy. In the free time I have, I enjoy running, hill and mountain walking, reading and playing the violin. I have also been known to dabble in a bit of Tae Kwon Do.
Q. What size of oxygen cylinder should be available for the administration of supplemental oxygen, how many should be available and how should they be stored?

A. It is mandatory to have a source of supplemental oxygen available for administration during episodes of intravenous sedation. It is usually administered through a nasal cannula via an oxygen regulator valve attached to an ‘E’ sized oxygen cylinder, housed in a suitable cylinder trolley. Whilst one such cylinder should be immediately available for use, it would be wise to have ready access to a spare one, especially when the original falls below half full. Ideally, medical gases should be stored in a gas cage outside the building in which the surgery is located, although compromises sometimes have to be made where this facility cannot be accommodated.

Q. I have been asked to provide the sedation at a dental colleague’s practice. Do I need to take my sedation nurse with me?

A. A dentist who is taking responsibility for providing both the conscious sedation as well as the operative dentistry must be supported by an appropriately trained dental sedation nurse. If you are providing the sedation alone for another dentist to provide the operative dental treatment it is not a requirement to be supported by a dental sedation nurse. If you are going to provide such a sedation service in an unfamiliar location I would suggest that you undertake a risk assessment to ensure that the premises, facilities, drugs, etc. are satisfactory for the purpose. If you are sedating the patients within the context of an unfamiliar dental team who do not undertake sedation themselves, I would suggest that you ensure that the team is capable of supporting you in the unlikely event of a sedation-related emergency arising.

Q. How much sedation-related CPD am I expected to undertake each year?

A. If you are carrying out sedation as part of your clinical practice, then this should be reflected in your CPD activities each year. Until recently, any specified number of hours in any five-year CPD cycle was entirely a matter of opinion. However, a document ‘A Guide to Maintaining Professional Standards in Conscious Sedation for Dentistry’ published by the Independent Expert Group on Training Standards for Sedation in Dentistry in 2011 indicates that 12 hours of verifiable CPD should be attained by dental sedationists within each five-year period. This should be in addition to other non-verifiable CPD activities, clinical audit, team training, etc. all of which are outlined in this guidance, which may be accessed on the SAAD website.

Q. Does the escort for the sedation patient have to wait on the premises while the patient receives their treatment?

A. Not necessarily, although it would be wise to have had sight of the prospective escort before they leave your surgery to ensure that they actually exist, with an agreed time for their return plus specific contact details to enable you to recall them if the patient is ready to depart from your care earlier than anticipated. There is nothing worse, particularly when you are in a primary care location, than being left with a recovering sedation patient and no escort to take them home at the end of the session!
Q. I have attended a SAAD weekend course, but have been told that I need to be mentored through my first sedation cases. Why is this and for how many cases do I require such mentoring?

A. Whilst the SAAD weekend course provides excellent theoretical and practical training for sedation, you are required to carry out a certain amount of supervised clinical practice, or mentored practice, in each sedation technique you intend to carry out independently later on. Advice on this aspect of sedation training is quite specific and may be found in ‘Training for Conscious Sedation’ a 2005 document published by the Dental Sedation Teachers Group. This may be accessed in the Documents section of the SAAD website. It is advised that clinicians undertake a minimum of 10 satisfactory inhalation sedation administrations, 20 satisfactory intravenous sedation administrations as well as 5 sedation assessments before embarking upon independent clinical practice in inhalation and intravenous sedation.

Q. I am considering the use of oral premedication for a new patient who has received this prior to operative dental appointments at their previous practice.

A. Oral premedication is the prescribing of a small dose of a sedative agent (usually a benzodiazepine) to be taken by the patient at home to allay their anxiety and/or to promote a better night’s sleep before a dental appointment. No specific training is required for its use, as it is not considered to be a definitive sedation technique. The dose prescribed should be small enough not to be hazardous to the patient on their journey to the surgery, but they should be escorted to and from the surgery and they should receive appropriate written pre- and post-operative instructions. A short section related to this subject may be found in the 2006 SDCEP Conscious Sedation Guidance.
william (bill) wilkinson passed away suddenly on June 5th in Hamilton, on his way to the local swimming pool. an adventurer, dentist, anaesthetist, pilot, and inventor, bill was one of the most colourful yet unassuming people i have known. no ordinary dentist, his life was the stuff of legend. he also provided the impetus which later took my own career far from "conventional" dentistry.

bill was born in 1933, the son of guilbert (bert) and Shirley Wilkinson. his younger brother, barry, also a dentist, died in 1982. their father bert was a pioneer in the use of GA in dentistry, an interest he passed on to his sons. bill is survived by his wife inga, his two boys gustav and nicholas, and four grandchildren, Jake, sam, William and Caitlin.

bill's early education was at Hamilton boys' High School. he then went on to graduate from the otago university school of dentistry in 1958. as much a dare-devil pilot as a dental student during those days of compulsory military training, bill had joined the territorial air force, and trained as a pilot. on one occasion he nearly broke the sound barrier over Taieri in an out-of-control P-51 Mustang, and almost became history. after many years and adventures, some of which are briefly noted below, bill finally retired in Hamilton. to his great annoyance, they would not re-licence him as a pilot, so he went ahead and continued to fly microlights around the Waikato.

i got to know bill in the UK in 1962 after graduation, when i was a very green young dentist. he offered me a job in his practices in Balham Hill and Knightsbridge when rex neels, a fellow Kiwi, was about to return home. i had no idea what i was getting into. the concept of dentists administering GAs was not encouraged at the dental school. all i recalled was the "black gas" and vomiting sessions in the oral surgery department, which terrified most students. Perhaps the resident medical anaesthetist wanted to discourage dental students from becoming too interested in his subject, as adjuvants like halothane were then available which would have prevented hypoxia.

after graduating and working in his father's practice in Hamilton, bill decided to head for the UK in 1960, the year before my own graduation. He had by then become familiar with the new Eli Lilly drug methohexitone sodium (Brietal, Brevital). so after arrival in the UK he decided to set up one of the first GA dental practices in London, using incremental dosage Brietal. Unlike thiopentone, Brietal was safer, lighter, and much less cumulative, which also meant faster recovery times (see ref).

His practice boomed due to the large numbers of fearful NHS patients. Bill was an excellent tutor. I still find it hard to believe my records show more than 3,000 brief and extended GAs in less than two years. My fears had obviously been totally dispelled! Bill's practice was also where IV conscious sedation, using Roche's diazepam (Valium), was first used in dentistry in the UK.

Growing numbers of dentists began attending meetings of the newly formed society for the advancement of anaesthesia in dentistry (sAAD) at stanley Drummond Jackson's practice in wimpole street. there, we also received further tuition from Britain's leading medical
anaesthetists of the day. These included Kiwi expatriate Professor Sir Robert Macintosh, Head of Anaesthesia at Oxford University; James Bourne of St Thomas's Hospital, Henry Mandiwall, Donald Blatchley and several others who were more than happy to share their knowledge with dentists.

During this time, Bill also invented an anaesthesia armboard which could be readily attached to a dental chair. For this he received the Richardson Gold Medal in 1968, the Medaille d’Or in Brussels, and two gold medals in New York at exhibitions of new medical equipment.

But life wasn’t all work. Bill was also a pilot, so he decided to buy an old Percival Prencice post-war trainer aircraft, which cost about 1,200 British pounds. Understandably, it was not always as airworthy as it might have been, but he was undaunted. Aborted take-offs from Biggin Hill due to cracked cylinder heads meant nothing to Bill, who was also an expert on aircraft repairs and maintenance. We had many exciting (and sometimes scary) trips to places such as Stockholm, Paris and other European destinations; as well as short flights across the Channel to Le Touquet to refuel the aircraft with duty free petrol and the crew with French coffee.

As the Prencice had few navigation aids, flying in those days was mostly VFR. In other words, following the railway lines on a road map and being on the lookout for other aircraft! The passenger in the co-pilot’s seat was sometimes asked to figure out where we were. I remember an occasion when flying over Holland en route to Sweden, Bill asked me to call out the sign on the railway station platform below. He put the Prencice into a hair-raising Stuka dive and levelled out about 100 metres above the heads of several dozen petrified passengers on the platform, whilst his white-faced passenger called out “Groningen, Bill!” . Bill’s wife-to-be, Inga, lived in Stockholm, which was the main reason for frequent trips to Sweden. These were sometimes punctuated with weather-related stops en route in Copenhagen and Malmo. There are many more tales to tell, but one of the best follows.

Several years after I returned home, Bill and Inga moved to Jersey in the Channel Islands. Much later I learned he was asked to fly some people in a twin Aero Commander to Portugal. Inga was invited to join them. At the airport, one of the passengers introduced himself as Alfie Hinds, the other was Tony Maffia. In Bill’s words, “the hairs on the back of my neck were now standing at attention as both were notorious criminals”. They loaded several heavy cases into the baggage compartment and flew non-stop for seven hours to Faro, a small airport in Portugal. Tony Maffia panicked as it was bumpy due to thunderstorms, but all landed safely. After a nice all expenses paid weekend, Bill and Inga then flew back to Jersey.

Two months later Tony Maffia, known to the police as “the UK’s number one fence” was murdered. Police investigations showed Bill had been an innocent party who had unwittingly transported the bulk of the “Great Train Robbery” money to Portugal. The reason for the non-stop flight was to avoid inspection, and they were waved through with no questions after a suitable quantity of Scotch had been handed to the solitary official on duty at Faro.

This true story was published in the Waikato Times on May 12, 2001. Bill and Inga were helicoptered to Auckland and interviewed by Paul Holmes on TV.

But this wasn’t to be the end of their experiences. He and Inga later moved to the Bahamas. They then returned to the UK, where Bill gained his UK oral surgery credentials and Inga became a qualified dental hygienist. Bill then accepted a job as an oral surgeon at the Jeddah Hospital, Saudi Arabia. Among their patients were members of the Saudi royal family, whom they treated while overseen by armed guards, including a certain gentleman by the name of Osama Bin Laden.

Bill’s last big adventure was a feat which would have daunted even Charles Lindburgh. He decided to fly his single-engined Prencice from the UK to New Zealand. Unsurprisingly, it was a very eventful trip. The now sparkling and repainted Prencice is now in Sir Tim Wallis’s collection in Wanaka.

These stories and many others can be accessed on the Internet. Just Google www.bugeikan.com/wilco Prepare to be amazed!

What a full and exciting life. Thanks Bill, it was a pleasure and an honour to have spent some of it with you. Fly safely, my friend.

Reference

The entire dental profession mourns the loss of John A. Yagiela, DDS, PhD, an internationally recognised authority on pain and anxiety control in dentistry, who died suddenly on 22 February 2012. John was one of the most brilliant men I have ever known. We first met soon after the Journal of the American Dental Association published my review of his first pharmacology textbook in 1980, and we subsequently became life-long friends. We travelled with our spouses all over the world to places including Scotland, Germany, France, Israel, New Zealand, Japan, Australia and South Africa. John was a caring, selfless, soft-spoken gentleman who did not have a huge ego to feed. John was devoted to improving patient comfort, safety, dental education and anaesthesia training. He not only possessed tremendous expertise in pharmacology and anaesthesiology, but he also had in-depth knowledge of a wide variety of non-dental subjects, from the courtship rituals of grasshoppers to the differences among the various types of rocket fuel. He was a walking Wikipedia. He had a boundless enthusiasm for life and nature. John kept pet snakes and for a while even had an iguana living in his bathtub before eventually donating it to the zoo. John had an unquenchable thirst for new knowledge and had a mind like a super computer that could save it all for instant retrieval. He loved photography, woodworking, and his loving family. He was not afraid to tackle major home remodeling projects. He was a perfectionist, a trait that is universally present among mobile providers of office general anaesthesia like John. When professional painters did a less than perfect painting in his high-ceiling dining room, John built his own scaffolding and redid the entire paint job himself. He was an erudite communicator, educator, textbook author, editor, researcher, consultant and clinical dentist anaesthesiologist. During his lifetime John got up early and worked late in order to accomplish everything that he wanted to do. He could create on his computer a new lecture while flying to a meeting and minutes later could present such a highly polished program that he would receive a standing ovation. John was totally honest, a trait that brought about tremendous frustration when he was dealing with individuals who were disingenuous. He was a great humanitarian with a heart of gold, especially when providing office general anaesthesia for small children and for those with special needs so they could have full mouth restorative dentistry completed without physical restraint or antiquated procedures like “hand-over-mouth” control. John received his DDS degree from the UCLA School of Dentistry in 1971 and earned his PhD in pharmacology from the University of Utah in 1975. From 1975 to 1981, John taught dental therapeutics and pain control at Emory University. He came back to UCLA in 1982 and enrolled as an anaesthesiology resident at the School of Medicine. John became Professor and Chair of the Division of Diagnostic and Surgical Sciences, Coordinator of Pain and Anxiety Control, and Head of the Dental Anaesthesiology
Residency Program at the UCLA School of Dentistry until he retired in 2011 as a Distinguished Emeritus Professor of Dental Anaesthesiology after 29 years of devoted service. He was also Professor of Anaesthesiology at the David Geffen School of School of Medicine at UCLA and an attending at the UCLA Center for the Health Sciences. He was an in-office examiner for the State of California for both moderate sedation and general anaesthesia. His former positions include chairman of the Fellowship Committee of the American Dental Society of Anaesthesiology (ADSA), editor of Anaesthesia Progress, and editor of The Pulse. John also served previously as president of the American Society of Dentist Anaesthesiologists (ASDA), president of the American Dental Board of Anaesthesiology and was the North American representative to the International Federation of Dental Anaesthesiology Societies (IFDAS). He was a member of the American Dental Association's Anaesthesia Steering Committee and a consultant to the Council on Scientific Affairs and Commission on Dental Accreditation. He was, in addition, lead editor of the textbook, Pharmacology and Therapeutics for Dentistry, (Mosby), the standard reference for all dental students, now in its 6th edition, and co-author of Local Anaesthesia of the Oral Cavity. His teachings gave countless dentists a sound foundation in dental pharmacology and control of anxiety and pain. He was a frequent lecturer at dental meetings both nationally and internationally. His lectures were evidence-based long before that term became popular, and his slides were replete with the most current references from peer-reviewed journals. He had a wonderful ability to make complicated things simple, but could provide complicated details for anyone interested after his lecture. He served as past president of the Pharmacology, Therapeutics and Toxicology Group and the Anaesthesia Research Group of the International Association for Dental Research and was actively engaged in research on pain and anxiety control that resulted in numerous highly regarded peer-reviewed publications. Over the course of his career, John received many awards for his contributions to the field of anaesthesia, including the highest award from each of the three leading dental anaesthesia organizations: the Leonard M. Monheim Distinguished Service Award from the ASDA, the Heidbrink Award from the ADSA and the Horace Wells Award from the IFDAS. In 2004, he was also named the UCLA School of Dentistry’s Alumnus of the Year.

John had a significant role in the final editing of the 2007 ADA “Guidelines for the Use of Sedation and General Anaesthesia by Dentists” and the “Guidelines for Teaching Pain Control and Sedation to Dentists and Dental Students”, as well as the ASDA’s 2011 “Parameters of Care” and the Commission on Dental Accreditation’s “Standards for Advanced Dental Education Programs in Dental Anaesthesiology”. John’s dedication to his field drove him to be such a passionate advocate for dental anaesthesiology becoming an ADA-recognised specialty that he authored the first three ASDA specialty applications and helped edit the current application that will be voted upon by the ADA House of Delegates this fall in San Francisco. He was a staunch advocate for maintaining the opportunity for all dentists and dental specialties to determine their own parameters of care for sedation and anaesthesia while working within the framework of the ADA community. He believed that the specialty would enhance the sedation training and practice opportunities for all dentists and would permanently carve out dental anaesthesiology as being within the scope of dental practice.

The American Society of Dentist Anaesthesiologists, California Dental Society of Anaesthesiology, and the California Society of Periodontists have dedicated their 2012 meetings in John’s memory and certainly additional tributes to this giant in dental education will follow. His life’s work will be a source of inspiration for generations to come. John will be greatly missed by the entire dental community, but his legacy will be the well-trained residents who graduated from his CODA-accredited 2-year dental anaesthesiology residency programme, tens of thousands of dentists across the USA who have a sound foundation of pharmacology and the global community of clinicians, teachers and researchers who care about advancing anaesthesia knowledge and skills for all dentists and keeping dental anaesthesiology in all of its many forms within the independent control of our profession.

In addition to his 102 year old father, Stanley, John is survived by a son and a daughter, Greg and Leanne, five grandchildren, and was preceded in death in 2011 by his devoted wife, Dolores.
In response to customer demand, R A Medical Services have developed a range of disposable, single patient use scavenger breathing system products. These are designed for a ‘mix and match’ approach so that one or more components can be used in conjunction with autoclavable breathing system items. The range includes: disposable tubings, connectors, nasal masks and slide adjusters. These are proving extremely popular with dental staff looking for a cost effective method of infection control. The most recent addition to this collection is the Clearview™ single-use nasal hood in a double mask style. The clear outer hood shows ‘breathing through nose’ respiration and the coloured scented inner hood gives patient appeal to engage and relax. It can be used with a variety of available breathing systems and is available in adult & paediatric sizes. Scents include orange, strawberry, bubblegum and vanilla. For further information, please contact 01535 652444 or email info@ramedical.com.
Patients appreciate being offered sedation for their dental treatment, whether they are fearful, phobic or simply have a long and tedious procedure in prospect.

The SAAD course provides underpinning knowledge and training in the clinical skills required to provide the basic sedation techniques. Alternative sedation techniques are introduced and discussed.

It is designed both as an introduction and as an update for more experienced sedationists. Guidance is given regarding further training and the acquisition of clinical experience.

Dentists are encouraged to enrol their dental nurses on the parallel course as successful sedation depends on effective team work.

SAAD’s teaching is provided by a faculty that includes some of the best-known names in conscious sedation in the UK. The courses are ‘busy’ but fun with many opportunities for hands-on sessions.

Quotes from recent evaluation forms:
‘A lively weekend with friendly and approachable lectures.’
‘I am now confident that I can provide a better service to my patients.’

The course is held at
Mile End Road Campus, Queen Mary, University of London.
It is registered with the FGDP and the KSS deanery for 12 hours CPD.
### SAAD Supplies

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*If four or more items are ordered together, the postage and packing will not be more than £15.60.

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<td>UK members subscription fee</td>
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Annual Conference and AGM

Saturday 21 September 2013

The Royal Society of Medicine
1 Wimpole Street, London W1G 0AE

Enquiries:
Details will be posted on the SAAD website and included in the SAAD Newsletter Email
You are invited to express your views on any subject related to CONSCIOUS SEDATION, ANALGESIA OR DENTAL ANAESTHESIA

• Write an essay on one topic in ENGLISH in A4 format with double spacing, as a Microsoft word document. Dental Nurses not exceeding 2,500 words, Dental Students not exceeding 3,000 words.

• Entries must be received and acknowledged by 31st March 2013.

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• Entries, accompanied by name, address and telephone number, should be emailed to fiona@saad.org.uk

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The SAAD Digest accepts manuscripts either by email or mail.

Manuscripts should be word-processed in Microsoft Word format and double-spaced with a margin of at least 4 cm on the left-hand side. The pages should be numbered consecutively with numbers centred at the bottom of each page. The first page of the manuscript should give only the title of the article, and the author’s/author’s name(s), qualifications and address(es).

Submission: in the case of paper submission, authors should send two copies of their paper to: Fiona Wraith, Executive Secretary, SAAD, 21 Portland Place, London, W1B 1PY. A copy of the paper on disc should also be submitted. Authors are also encouraged to submit their manuscripts via email to fiona@saad.org.uk.

In both cases the submission should be accompanied by a covering letter signed by all of the authors and received by the submission deadline of 15 August.

Peer review is by at least two referees and the Chairman of the Editorial Board. Statistical advice may be sought if felt appropriate.

Length of contributions: ideally, contributions should be no more than 3,000 words, including tables and figures. Tables and figures will count as 100 words. Case reports may be submitted, but should be no more than 750 words in length.

Titles must be descriptive of the contents of the article, but yet concise. Papers should be introduced with a short abstract.

Abstracts should be able to stand alone. The abstract should not contain references or abbreviations, and should be no longer than 200 words.

Data or tables may be submitted in Microsoft Excel format or embedded in the text of the Word document. Figures or images should be submitted as external files in TIFF, JPEG or EPS format. The SAAD Digest is published in colour and colour illustrations are preferred.

Illustrations. If a person is recognisable from a photograph, written consent must be obtained prior to publication, and a copy sent to fiona@saad.org.uk. The submission of electronic images on disc or by email is preferred. If submitting hard copy, please do not submit the original until the manuscript has been accepted for publication. Once the manuscript has been accepted, the submission of photographs or slides for professional scanning is required.

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References must be in the Vancouver style. They should be numbered in the order in which they appear in the text. The numbers should be inserted in superscript each time the author is cited (‘Jones reported...’ or ‘Smith et al’ found...’ or ‘Other reports have...’). A full list of references must be provided at the end of each manuscript. The reference list should give the names and initials of all the authors unless there are more than six, in which case only the first three should be given in full, followed by et al. The authors are followed by the title of the article; the journal title abbreviated as per Index Medicus and Index to Dental Literature; year of publication; volume number; and first and last page numbers in full. Titles of books should be followed by the place of publication; publisher; and year.

Examples of reference style:

Reference to an article

Reference to a book

Reference to a book chapter

Reference to a report

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CPD Questions: once a paper has been accepted, the author(s) will be approached to provide two to three multiple choice questions and answers on the content of their paper. These may be included in the CPD section of the journal, which gives an opportunity for readers to test their knowledge on the content of the article (see example below)

Example
Basic Sedation techniques include:
A. A titrated dose of intravenous midazolam
B. Alfentanil and propofol infusion
C. A titrated dose of sevoflurane in oxygen
D. A titrated dose of nitrous oxide in oxygen
Answers: A, D

The Editorial Board reserve the right to edit the manuscripts for clarity and to conform to acceptable style and the space available for publication. Proofs will be supplied for correction of misprints – material changes can only be made in exceptional circumstances.
The MC1 RA flow-meter from McKesson is an independent mixture control machine manufactured in the UK. The company provides a complete range of specialist equipment for inhalation sedation and relative analgesia.

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<td>ESRA</td>
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