Efficacy of Nitrous Oxide in Inhalational Sedation

Conscious Sedation for Children

SAAD Dental Student’s Prize Winning Essay
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EDITORIAL

It is with great pleasure and some trepidation that I am writing to you as SAAD members in my new role as President. It is a great honour to be asked to hold this office and I will be working closely with David Craig, Immediate Past President, and our past Presidents to continue their excellent work for SAAD and its membership.

SAAD is in a healthy condition, both financially and with a large and thriving membership, and our Sedation courses continue to be fully subscribed both for the Dentistry course and the Dental Nurse courses. I would like to take this opportunity to thank all of the team who organise and deliver the courses, which are the bedrock of SAAD’s activities as a charity.

In 2005, the Resuscitation Council (UK), in association with the General Dental Council, put together a clarifying document to give dental practitioners and their teams an expert overview as to what the standards for the management of medical emergencies should be. I do recommend that you look carefully at this document as it addresses the concern expressed by many dentists about what is expected of them: Medical Emergencies and Resuscitation – Standards for Clinical Practice and Training for Dental Practitioners and Dental Care Professionals in General Dental Practice, July 2006, available at www.resus.org.uk.

I was asked to contribute to and review the draft document, in my roles both as a member of the Resuscitation Council and as President-elect of SAAD, and also as a member of Council of the Association of Dental Anaesthetists. It was a cause of some upset, however, that the GDC declined to endorse the document as it addresses the concern expressed by many dentists about what is expected of them: Medical Emergencies and Resuscitation – Standards for Clinical Practice and Training for Dental Practitioners and Dental Care Professionals in General Dental Practice, July 2006, available at www.resus.org.uk.

This leaves dental care professionals in some confusion as to the strength of the document in the context of clinical governance and risk management within clinical practice. SAAD Council has discussed whether to develop a further course to cover the curriculum described in the document and has decided to assess the impact of the document before proceeding. At present many members undertake Resuscitation Council accredited courses in Intermediate or Advanced Life Support to supplement their Basic Life Support training, but we are conscious that it may be useful for members to have a course that guides them through the specific needs of the dental team.

As with the Powsillo report of old, there is that issue of the funding of both the dental team training and the provision of an automated external defibrillator (AED). With the dental contracts for the NHS recently under review, we are ready to respond to the needs of the membership to promote the high standards of professional education for which SAAD is rightly renowned. Courses are expensive to run and must be fit for purpose. It is unlikely that the Resuscitation Council will endorse courses by other providers such as SAAD by issuing a nationally recognised certificate, but at the Resuscitation Council Annual General Meeting there was support for the suggestion that providers other than the Resuscitation Council can provide the necessary training for dental teams.

For five years I have been running a course for dental practitioners at the Bristol Medical Simulation Centre on the management of medical emergencies, and I am delighted that other SAAD Council members are coming to Bristol to see how we can take these ideas forward for SAAD. SAAD has a faculty of skilled teachers delivering our courses, and we are always keen to recruit dynamic communicators for the profession both to contribute to our current programmes but also to look at the development of other educational activity. I myself become involved with SAAD by teaching on the very successful ‘Lifesaver’ courses pioneered by the late Peter Hunter. The benefits of teaching for SAAD are great both in professional terms in being confident in best sedation practice, but also as an opportunity to meet members who show a commitment to delivering good-quality, safe care for our patients. If you have a desire to develop your skills as part of the SAAD team, and have a portfolio of teaching experience, we would like to hear from you, via our office at saad@aahti.org. I have enjoyed meeting my dental colleagues away from the clinical area, where we have been able to discuss concerns of mutual interest and foster understanding of good discipline. One of the great strengths of SAAD is the opportunity it presents to medical and dental practitioners to work together to evaluate and develop all aspects of anxiety and pain control for dental patients.

Another issue that has been raised is that of the name of the Society. The Society for the Advancement of Anaesthesia in Dentistry is a well established name, and when Council engaged on the incorporation of the Society it was decided to retain the original name so that we could register our title with the word ‘Dentistry’ retained. Council feels that ‘SAAD’ is an essential part of our identity, and that we should retain the initials, but should we change the name to reflect our involvement with pain and anxiety control in dentistry rather than anaesthesia? We would like to ascertain the views of the members.

The 2006 Annual Conference was a great success, and our thanks go to Carole Boyle and Barry Devonald for organising another interesting and useful meeting. The next Conference and Annual General Meeting of SAAD will be at the Royal Society of Medicine on 22 September 2007, so book it out in your diary now and come and meet your fellow members.

Despite claiming not to have an interest in politics, David Craig has steered SAAD skilfully during his presidency, and hands on a thriving Society to the team. I look forward to building on the strengths of SAAD’s core business, and working with the membership to promote and deliver anxiety and pain control for our dental patients.
Summary

Objective: To determine baseline data in relation to the extraction of first permanent molar teeth during nitrous oxide/oxygen inhalation sedation sessions within the hospital dental service.

Design: A prospective study.

Setting: The Department of Paediatric Dentistry, Dundee Dental Hospital, NHS Tayside, UK.

Method: Data were collected over a 12-month period for patients attending for the extraction of first permanent molar teeth using nitrous oxide/oxygen inhalation sedation.

Results: Data were available for 133 patients (M: 68; F: 65) with a median age of 11.3 (inter-quartile range 10.0, 12.6) years. Over 80% of cases were treated using a mixture of 30% nitrous oxide and 70% oxygen, with a median sedation time of 30.0 (inter-quartile range 25.0, 40.0) minutes. Overall, 94.0% of cases successfully completed treatment and only 0.75% of cases failed to commence or complete treatment. Regarding each visit, 85.6% and 14.4% of patients underwent single- and multiple-tooth extractions respectively. There were no statistically significant differences between male and female patients, comparing both behaviour (Mann-Whitney U, \( W = 4,619.9, P = 0.750 \)) and outcome scores (Mann-Whitney U, \( W = 4,392.5, P = 0.392 \)).

Conclusion: Extraction of first permanent molar teeth can be successfully achieved using nitrous oxide/oxygen inhalation sedation.

Introduction

Dental caries in children’s teeth is a major health problem in the UK; overall, 44% of 12-year-old children have some experience of dental caries with 75% of caries being concentrated on the first permanent molar teeth. Furthermore, hypoplastic and hypomineralised first permanent molar teeth are a frequent finding in children, being seen in up to 20% of cases. While there are a range of restorative techniques available, such as the use of glass ionomer cements, direct and indirect restorations of composite resin, indirect precious and non-precious alloys and pre-formed crowns, consideration should be given to the extraction of these teeth during the mixed dentition stage.

Traditionally, general anaesthetic has been the method of choice for undertaking first permanent molar tooth extractions, particularly in the younger child patient. The use of conscious sedation as a safe alternative to general anaesthesia for dental care in anxious patients has been encouraged by the Department of Health, the General Dental Council, the Royal College of Anaesthetists and the Society for the Advancement of Anaesthesia in Dentistry. Nitrous oxide inhalation sedation is a standard technique for managing paediatric patients with dental anxiety; the majority of studies that have been undertaken within the UK, however, have focused on mainly orthodontic extractions, i.e. premolar teeth, in the slightly older child patient. As such, this prospective study was designed to investigate the efficacy of nitrous oxide sedation for the extraction of first permanent molar teeth over a 12-month period in the hospital dental service.

Materials and methods

Study design: The study was designed as a prospective, observational survey, and was undertaken within the Department of Paediatric Dentistry, Dundee Dental Hospital, NHS Tayside over 12 months from December 2003 to November 2004, inclusive.
Clinical technique: An operator-sedationist (n = 10) accompanied by a second appropriately trained person (n = 8) administered nitrous oxide/oxygen sedation via a nasal mask using a Quantiflex MDM relative analgesia machine. The nitrous oxide was titrated in 5–10% increments to the maximum desired level for each individual patient (according to the operator-sedationist’s objective perception of the optimal level of sedation) while the clinician provided reassurance and positive reinforcement. Upon completion of dental treatment, the nitrous oxide flow was reduced in 10% increments and, finally, 100% oxygen was administered for two minutes before the nasal mask was removed. Dental treatment in all cases involved the extraction of between one and four first permanent molar teeth.

Questionnaire design: Following treatment, the dentist completed a questionnaire which sought the following details:

- Patient details
  - Sex of the patient;
  - Age of the patient.

- Details of personnel
  - The identity and the sedation experience of the operator-sedationist;
  - The identity of the second appropriately trained person, i.e. the dental nurse.

- Details of sedation/treatment
  - The duration of the appointment;
  - The maximum level of the nitrous oxide/oxygen mixture;
  - The dental treatment undertaken.

Retrospectively, the number of visits for each course of treatment for each of the operators was calculated. In addition, the Frankl Behaviour Rating Scale\(^{13}\) was used to grade the child’s behaviour during treatment (i.e. 1: refusal/distress; 2: uncooperative/reluctant; 3: cooperative/reserved; 4: interested/enjoyed). The Houpt Behaviour Rating Scale\(^{14}\) was used to record the overall behaviour and outcome of treatment (i.e. 1: aborted/no treatment rendered; 2: poor/treatment interrupted and partially completed; 3: fair/treatment interrupted but completed; 4: good/difficult but all treatment performed; 5: very good/limited crying or movement; 6: excellent/no crying or movement).

Data analysis: Patient ages, sedation times, behaviour and outcome scores were rejected as being normally distributed (Kolmogorov–Smirnov test) and hence median values were calculated and compared with Mann–Whitney U tests. All data were analysed using Minitab™ statistical software, Release 13.31.

Results

Data were collected for 133 patients (M: 68; F: 65) with a median age of 11.3 (inter-quartile range 10.0, 12.6) years. The median age range and sedation times according to operator-sedationist status are given in Table 1. In total, 262 first permanent molar teeth were extracted. Over the 12-month period, 10 dentists acted as operator-sedationist, including the following: one Consultant, three Staff Grade dentists and six Senior House Officers/General Professional Trainees (SHO/GPT); in addition, 31 undergraduate dental students took the role of operator-sedationist under the supervision of staff dentists. Eight different dental nurses acted as the second appropriately trained person. Regarding sedation experience at the start of the study, this ranged from less than six months to 18 years for the staff sedationists and from two months to nine years for the dental nurses.

Overall, 125 patients (M: 65; F: 60) with a median age of 11.2 (inter-quartile range 10.0, 12.7) years successfully completed treatment with sedation. Comparing the median sedation times (MST) for the different operators, this ranged from 28 minutes for the Staff Grade dentists to 40 minutes for the undergraduate students, with statistically significant differences between both the Consultant and Staff Grade dentists and the undergraduate students (Mann-Whitney U, \(W = 292.0, P = 0.007\) and \(W = 2,021.5, P = 0.001\) respectively) (Table 1). Regarding the median behaviour scores, there were statistically significant differences between the Staff Grade dentists and both the SHO/GPT grade and the undergraduate students (Mann-Whitney U, \(W = 2,559.5, P = 0.038\) and \(W = 2,729.0, P = 0.001\) respectively). Comparing median outcome scores, there were significant differences between both the Consultant and Staff Grade dentists and the undergraduate students (Mann-Whitney U, \(W = 546.5, P = 0.002\) and \(W = 2,702.0, P = 0.002\) respectively).

Overall, the MST for male patients was 34.0 (inter-quartile range 25.0, 40.0) minutes compared with 30.0 (inter-quartile range 25.0 to 40.0) minutes for female patients, although the difference was not statistically significant. Further analysis revealed that, regarding the sex of the patients, for both inter-group (e.g. female patients < 10 years of age vs. female patients > 10 years of age) and intra-group (e.g. female patients < 10 years of age vs. male patients < 10 years of age) comparisons, there were no statistically significant differences in MST,
although the value for younger male patients was 35 minutes compared with all other groups, where the MST was 30 minutes. The same trend in the younger male patients was also observed for both the median behaviour and outcome scores, although the differences were not statistically significant (Table 2).

Reviewing the breakdown of cases according to the maximum sedation levels, the MST ranged from 25 minutes to 37.5 minutes for a mixture of 20% \( \text{N}_2\text{O}:80% \text{O}_2 \) and 35% \( \text{N}_2\text{O}:65% \text{O}_2 \) respectively. Over 80% of cases were successfully treated using a mixture of 30% \( \text{N}_2\text{O}:70% \text{O}_2 \) with an MST of 30 minutes and median behaviour and outcome scores of 4 and 6 respectively (Table 3).

As regards dental treatment undertaken, a breakdown of treatment is given in Table 4. Overall, in 85.6% and 14.4% of cases, one and two teeth were extracted per visit respectively. Although there were no statistically significant differences comparing the MST for single- and multiple-tooth extractions individually (Table 4a and 4b respectively), when all single-extraction cases were compared with all multiple-extraction cases, the MST for the former was 30.00 (25.00, 40.00) minutes compared with 40.00 (32.00, 53.50) minutes for the latter, and this difference was statistically significant (Mann-Whitney U, \( W = 7,110.5 \), \( P = 0.002 \)). Overall, the median behaviour and outcome scores for both single- and multiple-tooth extractions were 4.0 (inter-quartile range 3.0, 4.0) and 6.0 (inter-quartile range 5.0, 6.0) and the differences were not statistically significant (Mann-Whitney U, \( W = 7,353.5 \), \( P = 0.24 \) and \( W = 7,629.0 \), \( P = 0.39 \) respectively) (Table 4). Regarding the number of visits for a course of treatment, this varied from one to four in all cases for all operators, with the exception of the SHO/GPT grade, where the number of visits ranged from one to three (Figure 1).

In only one case was treatment aborted (M: 1, age 10.3 years) and in seven cases (M: 2; F: 5, median age 11.4 years (inter-quartile range 10.0, 11.9) years), treatment was interrupted and completed with difficulty. The median sedation time for these cases was 45.50 (36.25, 57.00) minutes, significantly longer than for those cases that were treated successfully (Mann-Whitney U, \( W = 866.0 \), \( P = 0.002 \)). The median behaviour and outcome scores were 2.0 (inter-quartile range 2.0, 2.0) and 3.0 (inter-quartile range 3.0, 3.0) respectively. Regarding operator status, two of these cases were treated by the Staff Grade dentists while five cases were seen by the SHO/GPT grade dentists.

Discussion

Recent guidelines have stressed the use of competently provided conscious sedation as an alternative form of pain and anxiety control to general anaesthesia for patients requiring dental treatment\(^6\~^9\). The present prospective study was designed, therefore, to determine the current activity and efficacy of an inhalation sedation outpatient service for the extraction of first permanent molar teeth within a UK-based hospital dental service over a 12-month period. In total, data were collected for 133 patients, representing 37.7% of the overall outpatient attendance for sedation during the study period. Overall, 94% of patients successfully underwent first permanent molar tooth extraction using a mixture of nitrous oxide and oxygen inhalation sedation; this would appear to be in agreement with other workers who retrospectively reviewed sedation activity over a three-month period in the Community Dental Service and found a similar success rate\(^15\). In the present study, in only one case was treatment aborted and in 5.3% of cases was treatment interrupted or completed with difficulty. This finding, although surprising, is encouraging, given that other workers routinely treatment plan patients for first permanent molar extractions for general anaesthesia (unpubl. data). As such, the finding that nitrous oxide sedation can successfully facilitate the extraction of permanent molar teeth should ensure the continued downward trend in the use of dental general anaesthesia for permanent tooth extraction in older child patients.

Comparing all operators, the MST for the SHO/GPT grades and the undergraduate students was significantly greater than for the Staff Grade and Consultant dentists; this could be explained by the relative inexperience of the former. In addition, both the median behaviour and outcome scores were lower for the less experienced operators. All the SHO/GPT dentists had qualified less than two years previously and had less than 12 months’ experience of dental treatment using sedation. Regarding the undergraduate students, each had, at the most, been involved in six sedation sessions under the supervision of staff dentists; previous studies have also demonstrated longer sedation times for dental treatment with less experienced operators\(^16\). Furthermore, other workers have demonstrated that dental students have a poorer opinion of the use of sedation compared with the use of rewards or patient relaxation in the management of the dentally anxious child patient and this could perhaps have influenced the duration of the sedation visit\(^17\). Other authors have observed that undergraduate
sedation teaching must improve if conscious sedation is to become a useful tool in dental practice. The benefit of ascertaining the MST for different personnel has assisted in the planning of service provision and, as such, maximised the number of patients treated at each sedation session.

Nearly three-quarters of patients, of both sexes, were over ten years of age; this was to be expected given the dental procedure that was being undertaken, and perhaps, in part, this could explain the success rate for the present study. In relation to sex and age, the MST for younger male patients was greater and the median behaviour and outcome scores were lower compared with both older male patients and female patients of all ages, although this did not reach statistical significance. One prospective, questionnaire-based survey that investigated the acceptability and efficacy of nitrous oxide inhalation sedation in a group of fifty children determined that, in general, younger male patients coped less well with sedation than both older male patients and female patients of all ages. Furthermore, a recent review paper, using systematic methodology, concluded that inhalation sedation was particularly suitable for the older child patient. One previous retrospective study, however, investigated the effectiveness of various sedative agents in a group of 336 uncooperative paediatric dental patients and determined that the younger male patients had more effective sedation sessions than the female patients.

The majority of cases where treatment was completed were achieved with a mixture of 30% \( \text{N}_2\text{O}:70\% \text{O}_2 \) with an MST for all operators of 30 minutes. At this level of sedation, both the median behaviour and outcome scores appeared to be 'optimal' compared with both lower and higher levels of sedation, where the median behaviour and the median outcome scores respectively were lower. Regarding sedation times, published work to date relating to sedation in the clinical trial setting has demonstrated shorter sedation times compared with the present study. For example, one such study, a randomised, controlled, crossover trial comparing oral midazolam and nitrous oxide for paediatric dental sedation, demonstrated a median sedation time for the nitrous oxide group of 10 (range 5 to 25) minutes. Presumably the fact that orthodontic extractions, i.e. canine and premolar extractions, were being undertaken in this study, as opposed to the present one, accounted for the shorter sedation times.

Concerning the treatment undertaken, in the majority of cases one permanent molar tooth was extracted at each visit with no statistically significant differences between sedation times, behaviour or outcome scores comparing both arches and sides. Overall, during the study period, 67% of cases had either one or two teeth extracted and in only 12% of cases were all four first permanent molar teeth removed. One review paper confirmed that inhalation sedation is particularly suitable for the older patient who requires no more than four extractions and again, this may explain the high success rate for this procedure in this particular unit.

Conclusion

Extraction of first permanent molar teeth can be successfully undertaken using nitrous oxide/oxygen inhalation sedation. In general, however, only one tooth is extracted per visit, and where four molars are required to be removed, this necessitates approximately two hours of chairside time.

Table 1
Breakdown of cases according to operator-sedationist experience for completed cases: median values with 25% and 75% quartiles in parentheses. Within each parameter measured, values followed by the same letter are not significantly different from each other (Mann-Whitney U test).

<table>
<thead>
<tr>
<th>Operator-sedationist</th>
<th>Number of operators</th>
<th>Median age of patients treated (yrs)</th>
<th>Median sedation time (minutes)</th>
<th>Median behaviour scores</th>
<th>Median outcome scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant</td>
<td>1</td>
<td>12.1 (10.0, 14.2)</td>
<td>30:00 (25:00, 35:00)</td>
<td>4.0 (3.0, 4.0)b</td>
<td>6.0 (6.0, 6.0)b</td>
</tr>
<tr>
<td>Staff Grade</td>
<td>3</td>
<td>11.0 (10.0, 13.0)</td>
<td>28:00 (24:00, 35:00)</td>
<td>4.0 (3.0, 4.0)b</td>
<td>6.0 (5.0, 6.0)b</td>
</tr>
<tr>
<td>SHO/GPT</td>
<td>6</td>
<td>11.2 (10.5, 12.3)</td>
<td>30:00 (23:75, 45:75)b</td>
<td>3.0 (3.0, 4.0)b</td>
<td>6.0 (5.0, 6.0)b</td>
</tr>
<tr>
<td>Undergraduate student</td>
<td>31</td>
<td>11.9 (9.7, 12.5)</td>
<td>40:00 (28:00, 45:00)b</td>
<td>3.0 (3.0, 4.0)b</td>
<td>5.0 (4.0, 6.0)b</td>
</tr>
</tbody>
</table>
### Table 2
Breakdown of cases by sex for completed cases: median values with 25% and 75% quartiles in parentheses.

<table>
<thead>
<tr>
<th>Sex and age range</th>
<th>Proportion of cases</th>
<th>Median age of patients treated (yrs)</th>
<th>Median sedation time (minutes)</th>
<th>Median behaviour scores</th>
<th>Median outcome scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>♂ &lt; 10 yrs</td>
<td>13.5</td>
<td>9.7 (8.6, 9.8)</td>
<td>30:00 (22:75, 42:50)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>♂ &gt; 10 yrs</td>
<td>35.3</td>
<td>12.1 (11.1, 13.2)</td>
<td>30:00 (25:00, 40:00)</td>
<td>3.0 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>♀ &lt; 10 yrs</td>
<td>12.8</td>
<td>9.3 (9.1, 9.8)</td>
<td>35:00 (26:00, 42:00)</td>
<td>3.0 (3.0, 4.0)</td>
<td>5.0 (4.5, 6.0)</td>
</tr>
<tr>
<td>♀ &gt; 10 yrs</td>
<td>38.4</td>
<td>12.2 (11.1, 13.3)</td>
<td>30:00 (24:00, 40:00)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
</tbody>
</table>

Key: ♂: male; ♀: female

### Table 3
Breakdown of cases according to the maximum sedation levels for completed cases: median values with 25% and 75% quartiles in parentheses. Within each parameter measured, values followed by the same letter are not significantly different from each other (Mann-Whitney U test).

<table>
<thead>
<tr>
<th>Maximum level of sedation ($\text{N}_2\text{O} : \text{O}_2$)</th>
<th>Proportion of cases</th>
<th>Median age of patients treated (yrs)</th>
<th>Median sedation time (minutes)</th>
<th>Median behaviour scores</th>
<th>Median outcome scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>20:80</td>
<td>6.8</td>
<td>11.9 (10.2, 12.9)$^{ab}$</td>
<td>25:00 (17:50, 50:00)</td>
<td>3.0 (3.0, 4.0)</td>
<td>6.0 (5.5, 6.0)</td>
</tr>
<tr>
<td>25:75</td>
<td>3.8</td>
<td>10.9 (9.1, 13.4)$^{ab}$</td>
<td>35:00 (15:00, 45:50)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (5.5, 6.0)</td>
</tr>
<tr>
<td>30:70</td>
<td>80.4</td>
<td>11.2 (10.0, 12.6)$^{a}$</td>
<td>30:00 (25:00, 40:00)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>35:65</td>
<td>9.0</td>
<td>12.4 (11.9, 13.2)$^{a}$</td>
<td>37:50 (26:25, 49:00)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (3.5, 6.0)</td>
</tr>
</tbody>
</table>

### Table 4
Breakdown of cases by first permanent molar extracted for completed cases for (a) single and (b) multiple extractions at each visit: median values with 25% and 75% quartiles in parentheses.

#### (a)

<table>
<thead>
<tr>
<th>Tooth extracted</th>
<th>Proportion of all cases</th>
<th>Median age of patients treated (yrs)</th>
<th>Median sedation time (minutes)</th>
<th>Median behaviour scores</th>
<th>Median outcome scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>23.4</td>
<td>11.2 (10.2, 12.3)</td>
<td>30:00 (24:50, 35:00)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>26</td>
<td>19.4</td>
<td>11.3 (10.4, 12.7)</td>
<td>29:50 (25:00, 34:25)</td>
<td>3.5 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>36</td>
<td>22.6</td>
<td>19.2 (10.0, 13.0)</td>
<td>30:00 (25:00, 42:50)</td>
<td>3.5 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>46</td>
<td>17.7</td>
<td>11.7 (9.9, 13.2)</td>
<td>32:50 (23:00, 43:50)</td>
<td>3.5 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
</tbody>
</table>

#### (b)

<table>
<thead>
<tr>
<th>Teeth extracted</th>
<th>Proportion of all cases</th>
<th>Median age of patients treated (yrs)</th>
<th>Median sedation time (minutes)</th>
<th>Median behaviour scores</th>
<th>Median outcome scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 and 26</td>
<td>2.4</td>
<td>12.1 (9.0, 12.1)</td>
<td>35:00 (22:00, 60:00)</td>
<td>4.0 (4.0, 4.0)</td>
<td>5.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>16 and 46</td>
<td>7.3</td>
<td>10.8 (9.8, 12.0)</td>
<td>40:00 (31:00, 50:00)</td>
<td>4.0 (3.0, 4.0)</td>
<td>6.0 (5.0, 6.0)</td>
</tr>
<tr>
<td>26 and 36</td>
<td>4.8</td>
<td>12.4 (9.7, 13.5)</td>
<td>38:00 (28:75, 56:95)</td>
<td>3.5 (3.0, 4.0)</td>
<td>5.0 (4.5, 6.0)</td>
</tr>
<tr>
<td>36 and 46</td>
<td>2.4</td>
<td>12.5 (11.1, 13.7)</td>
<td>55:00 (36:00, 60:00)</td>
<td>4.0 (3.0, 4.0)</td>
<td>5.0 (3.0, 6.0)</td>
</tr>
</tbody>
</table>
Figure 1
Number of visits for treatment according to operator-sedationist status (undergraduate students have been merged with the overall supervisor for each sedation session).

References


There is a lot of controversy around the subject of sedation for children. There are many sedative agents capable of providing successful results but there are also issues regarding their safe use on a regular basis. Guidelines do exist but sometimes there is leeway for different, individual interpretations. This pilot study is an attempt to explore the different views held on the matter of sedation as an adjunct to dental treatment for anxious children. An e-questionnaire was used and results varied. The preferred sedation type was inhalational sedation and the guidelines most dentists agreed with came from the GDC. Further research is definitely required in this field.

**Introduction**

Anxiety about dental treatment is a recognised problem: one half of all dentate adults claimed that fear of dental treatment was the main barrier to regular dental care, according to the recent *UK Adult Dental Health Survey*. Children are also affected and fearful of dental treatment, with published figures of up to 19.5% among low-income Americans. Behavioural management and prevention, coupled with local anaesthesia when required, form the foundation of the delivery of pain-free dentistry to children. Indeed, no pharmacological agent can be a substitute for effective communication and the persuasive ability of the operator. There are times, though, when behavioural management may need to be augmented with conscious sedation for some children. Treatment under general anaesthesia, which used to be the most widespread treatment option for anxious children, can no longer be provided within the practice. The Poswillo report recommended that ‘sedation be used in preference to general anaesthesia wherever possible’.

**Literature review**

Conscious sedation has been defined as ‘a state of depression of the central nervous system which reduces anxiety thus enabling treatment to be carried out satisfactorily. During sedation the patient will be able to independently maintain his airway, independently maintain an open mouth, and respond sensibly to verbal commands. In addition, the patient will retain adequate function of protective reflexes such as the laryngeal reflex. The drugs used should carry a margin of safety sufficient to render unintended loss of consciousness extremely unlikely’. This definition was originally proposed in the Wylie report (1978) and has been adopted by the General Dental Council, the Department of Health, SAAD, the Dental Sedation Teachers Group, the Scottish Office National Dental Advisory Committee and the British Society of Gastroenterology. The Department of Health states that nitrous oxide/oxygen should be the first choice for paediatric dental patients who are unable to tolerate treatment with local anaesthesia alone and who have a sufficient level of understanding to accept the procedure. This statement is embraced by the General Dental Council, the Scottish Intercollegiate Guidelines Network (SIGN), SAAD and the Dental Sedation Teachers Group, and follows a systematic review of validated clinical evidence and wide consultation. However, Wilson et al. state that IV midazolam sedation appears to be as effective as nitrous oxide sedation in healthy paediatric dental patients aged 12 to 16 years.

With regard to the use of IV sedation in children, the Department of Health states that intravenous sedation for children is only appropriate in a minority of cases and should only be provided by those who are trained and experienced in sedation for children and in the administration of intravenous drugs. It goes on to state
that the use of IV may be indicated in older children for whom inhalational sedation has been unsuccessful15. This is also stated in the document Safe Sedation of Children undergoing diagnostic and therapeutic procedures of SIGN11 and is embraced by Hosey38. The UK guidelines from the GDC and SIGN do not recommend the routine use of IV sedation below the age of 16. Hosey38 states that intravenous sedation for children below the age of 14 years should be carried out in a hospital facility10. In Ireland, according to the January 2005 Draft Guidelines relating to the Administration of GA & Sedation in the Practice of Dentistry and on Resuscitation, IV sedation is not recommended for children, particularly under the age of 10 years.

Wilson et al. go on to say that the evidence relating to the use of IV sedation techniques in paediatric dentistry is very limited and has been obtained mainly from studies outside the UK, where multiple techniques or the use of propofol has been advocated16. They state that although IV sedation with midazolam is widely used in endoscopy, biopsy etc17, little research is available regarding its use for paediatric dental sedation. Karl et al. state that midazolam has been described as having a safety and tolerability profile in children comparable with or superior to that observed in adults19. According to Roelofse et al., though, midazolam can cause hallucinations in children19. The use of midazolam as an intravenous agent for sedation in children is also embraced by Arya et al., who compared the efficacy and safety of both propofol and midazolam as intravenous sedative agents in the management of uncooperative children aged 2–5 years old. Results of this study showed both agents to be effective sedative agents for short dental procedures20. Robb et al., in their study of IV conscious sedation in patients under 16 years of age, concluded that further research into the use of IV sedation for the under-16s is required and that the evidence currently available about its routine use is insufficient. Equally, though, there is sufficient doubt to make an absolute prohibition of the use of these techniques in this age group unjustifiable21.

The use of propofol as an IV conscious sedative infusion agent in anxious children, but this time in a hospital environment, was also studied by Hosey et al., who concluded that sub-anaesthetic doses of propofol used for IV conscious sedation infusion facilitated operative dental treatment in anxious children22. However, propofol (Diprivan), which is used as an IV anaesthetic agent for induction and maintenance of general anaesthesia, is not recommended for sedation in children by the manufacturer AstraZeneca UK Limited, as safety and efficacy have not been demonstrated. Hosey, in an earlier article about managing anxious children, states that the use of propofol in paediatric dentistry is still experimental and requires the assistance of a qualified anaesthetist in a hospital environment10.

A recent study by Averley et al. showed that intravenous midazolam, especially in combination with inhaled nitrous oxide or sevoflurane and nitrous oxide, is an effective technique in the management of dentally anxious children, with the combination of midazolam and sevoflurane the one most likely to result in successful treatment23. However, Fee et al. report that there may be a risk of nephrotoxicity24 and Hosey states that sevoflurane is still experimental and should not be used in primary care dental practice until further research emerges. Additionally, with regard to the use of multiple sedative agents, all the UK guidelines recommend use of a single agent. Hosey states that the use of multiple drugs increases the risk of complication and is not recommended. Additionally, for young children, the use of fixed doses or bolus techniques is unacceptable in both inhalational and intravenous conscious sedation as success is directly related to titration of the dose according to the individual patient’s needs25.

Wilson et al. find that oral midazolam seems to be a safe and acceptable form of sedation for paediatric dental patients aged 10 to 16 years26. However, the Standards in Conscious Sedation for Dentistry27, as well as Hosey28, state that this form of treatment should be restricted to the experienced sedationist in an appropriate environment. Studies have produced conflicting results and are confounded by the use of restraints and co-sedatives, according to Gallardo et al.28, Haas et al.31 and Hartgraves and Primosch32. Silver et al. show the effective use of oral midazolam in 31 special-needs patients aged 3–18 years26. Manley et al. say that oral midazolam, administered in a preferred drink, can be a suitable sedative agent for many patients, including young ones with challenging behaviour or severe learning disabilities whose behaviour does not allow safe placement of a cannula. They also say that intranasal midazolam can provide sufficient sedation to allow cannulation and appropriate monitoring before proceeding to IV sedation. Manley et al. also state that midazolam administered by either of the above routes in the UK means it is used without a licence. This is permissible provided the supplier is made aware of the proposed unlicensed use of any drug and the patient’s consent/agreement to treatment should reflect this29.
All UK guidelines agree on the requirements for appropriate training and supervised hands-on education of the whole dental team for conscious sedation, especially for children. The Department of Health states that supervised hands-on education, training and experience must be acquired by practitioners administering sedation and by their assistants for each conscious sedation technique used.

Shearer et al. in their study exploring the attitudes and opinions of consultant anaesthetists in Scotland, with regard to conscious sedation carried out by dental practitioners, find that a significant number of anaesthetists do not feel it is appropriate for dentists to be administering even the most simple methods of sedation. They also say that, at present, there are no clear, recognised guidelines as to the level of formal training required for the practice of conscious sedation by dentists. Foley reveals that the majority of participants who are NHS dental practitioners feel there is a need for postgraduate training in sedation techniques.

In the UK, high-risk sedative techniques such as deep sedation have no place in paediatric dentistry. Indeed, even in parts of the world where deep sedation techniques are more common, their use is often limited to the hospital. Where there is evidence or a substantive body of opinion relating to a specific drug or route indicating that deep sedation might occur, referral to a hospital-based paediatric dental service and, where appropriate, the assistance of a qualified anaesthetist has been recommended. Hosey states that the diversity of published literature might lead some dental practitioners to consider using such drugs in an effort to find an alternative to general anaesthesia.

The project presented here is an exploration of the various attitudes and beliefs dentists have on the subject of conscious sedation for children, as there is so much contradictory evidence. The exploratory survey was performed electronically. There are very few medical trials that have been completed in this way. Seguin et al. found that email provides faster but fewer results compared with regular mail surveys. Kypri et al. showed that Internet-based surveys can yield a high response with carefully managed recruitment. In their study, comparison of the web versus pen-and-paper completions revealed no modality effects.

In the present study, the aims are:
- to examine the knowledge, attitudes, beliefs and behaviour of dentists working in the CDS, GDS and HDS regarding conscious sedation methods for anxious children and to explore how these vary for dentists with differing attributes; and
- to measure the effectiveness of an electronic survey in terms of participation and speed of submission, among dentists who are Internet users.

**Objectives**

To devise an electronic questionnaire and ask participant dentists about their:
- personal attributes;
- personal experience regarding conscious sedation for children and which type of sedation they use, if any;
- opinion on which type of sedation is more appropriate for children;
- opinion on the suitability of IV sedation for children;
- awareness of current GDC guidelines regarding conscious sedation for children; and
- opinion on those guidelines.

**Method**

**THE SAMPLE**

The study sample consisted of 141 participants aged 24–50+ years. Of the dentists, 43 were SAAD members based in CDS, GDP or a hospital setting. The rest of the participants (n = 98) were mainly from the CDS. The dentists came from various parts of the UK, including England and Wales, Scotland and Northern Ireland.

**Recruitment**

**FOR PILOT:**
A small pilot survey was initially undertaken in order to check the applicability of the questionnaire. An email message was sent to all the dentists in the CDS of the Barking and Dagenham PCT, containing explanatory notes and a link to the questionnaire. In order to access the questionnaire and submit it, the recipients were asked to simply click on the link provided. Reminders were sent via email and also by phone after approximately 15 days.

**FOR SAAD MEMBERS:**
Following attendance at the Annual SAAD Conference 2004, the President of SAAD was approached to obtain permission to distribute the questionnaire electronically. It was concluded that the best way of distribution would be as an insert in the SAAD Digest. The SAAD Digest was distributed to SAAD members at the beginning of March 2005 along with the insert. The insert was an invitation to the dentist to participate in this electronic...
survey. It included explanatory notes about the VT project and contained instructions on how to access the survey by typing in a URL in a web browser. No reminders were to be sent as there was no way of tracing back the non-respondents.

FOR NADHAT RECIPIENTS:
The National Association for Dentistry in Health Authorities and Trusts (NADHAT) list 2002 was obtained from the Barking and Dagenham PCT’s clinical director. A personally addressed letter was mailed to clinical directors listed (n = 247), inviting them to participate in the survey. The letter contained instructions on how to access the survey by typing in a URL link in a web browser. The letter had explanatory notes about the study and encouraged the potential participants to forward the link to other local dentists. The letters were sent at the end of February 2005. A unique ID number was allocated to each recipient for mailing purposes only, held by a trusted third party. Upon submitting the questionnaire the results were automatically emailed to the researcher(s). Dentists from the same Trust had the same ID number, allowing the monitoring of the number of links to the questionnaire forwarded to other dentists in the same Trust.

Measures
Participants were asked to use a point-and-click procedure to select their responses to a range of questions concerning: personal demographic details, practice of conscious sedation for children and thoughts/opinions on various aspects of conscious sedation for children.

Questionnaire
The survey instrument consisted of a web page linked to the researcher’s email account. There was no way of relating respondents to their results. The only way of ticking a respondent’s name off the mailing list was via the ID number, which was performed by a trusted, independent third party.

The questionnaire had three parts:
• The first part, the practitioner’s details, included questions about sex, age band, the number of years practising dentistry, the sector of primary or secondary care the dentist belonged to, their profession, the sedation training undertaken and the time when the training took place.

• The second part, conscious sedation in your practice, asked questions about current practice concerning conscious sedation for children, starting off with whether or not the respondent personally undertook conscious sedation for anxious children. If the answer was ‘yes’ then the type(s) of conscious sedation could be selected and the various sedative agents used. This part concluded with questions on the average number of children treated under conscious sedation, per month, and the average number of referrals for treatment under conscious sedation, per month.

• The third and last part of the questionnaire enquired about the opinions of the respondents as to the most appropriate type of conscious sedation for children aged 0–8, 9–12 and 13–16. Respondents could tick more than one reply. The next question was whether IV sedation was suitable for children younger than 16. Respondents were also asked the minimum age above which they thought IV sedation could be offered as an adjunct to dental treatment. They were asked which set of current guidelines most closely reflected their views on the matter and also whether or not they agreed with two aspects of the current GDC guidelines on conscious sedation for children:
  – the use of a single benzodiazepine as IV sedative agent; and
  – the age limit above which IV sedation could be used.

Results
THE SAMPLE
139 dentists and 2 doctors took part in this electronic pilot survey about conscious sedation for children. 44 out of the 141 participants were SAAD members. The rest were mainly dentists from the CDS, contacted by the clinical dental directors via the NADHAT list. Out of 97 participants, 85 (88%) (excluding SAAD members as area of origin unknown) were from England. Eight participants were from Scotland (8%) and there was one reply from the Falkland Islands (1%).

PRACTITIONER DETAILS
77 of the respondents (55%) were female and 64 were male (45%). The majority of the participants were within the 41–50 years age band (44%). 82 participants (58%) had been practising dentistry for more than 20 years.

Most of the respondents were from the CDS (105 out of 141: 74%). 26 of them (18%) were from the GDS and 10 respondents (7%) were from a hospital setting.

The majority of the participants had undertaken day
conducted course(s) as sedation training (64.5%). 30 out of the 141 participants had undertaken day course(s) (21%) and 16 out of the 97 participants who personally undertook conscious sedation for children had attended day course(s) (16.5%).

For half of the respondents the training had taken place within the last five years.

CONSCIOUS SEDATION IN RESPONDENT’S PRACTICE

The majority of the respondents personally undertook conscious sedation for anxious children as an adjunct to dental treatment (97 out of 141: 69%). Of those 97 participants, 88 used inhalational sedation (91%).

89 of the respondents (92% of those who undertook conscious sedation) used nitrous oxide as a sedative agent. The second most used sedative agent was midazolam. Only 7% of the respondents used a combination of two or more sedative agents and only 3% used a combination of three or more.

70% of the respondents who undertook conscious sedation generally treated fewer than five children per month.

The majority of the respondents referred, on average per month, 0–5 children aged between 0–16 for treatment under conscious sedation.

RESPONDENT’S THOUGHTS ON CONSCIOUS SEDATION

When asked about their opinion on the most appropriate type(s) of conscious sedation for children aged 0–8 years, 88% of the respondents thought inhalational sedation was the most appropriate (124 respondents). For children aged 9–12 years, 94% thought that inhalational sedation was the most appropriate (133 respondents). For children aged 13–16 years, 91% thought, again, that inhalational sedation was the most appropriate type of sedation (129 respondents).

It is interesting that the second most popular type of sedation was oral sedation: 25% of the respondents thought it was appropriate for the 0–8 age group, 23% for the 9–13 age group and 33% for the older 13–16 age group.

As far as IV sedation is concerned, 4% thought it was appropriate for the 0–8 age group, rising to 11% for the 9–13 age group and finally to 30% for the 13–16 age group.

Transmucosal sedation, i.e. intranasal, was quite stable at 6% for the young 0–8 age group, rising a little to 8% for the 9–13 age group and remaining stable for the older group. Rectal sedation did not seem to be a popular choice among the respondents.

It is interesting that types of sedation combined together were quite popular:

- inhalational sedation combined with IV sedation started off at just 3.5% for the youngest group (0–8 years), rose to 6% for the intermediate group (9–13 years) and rose even more to 11% for the oldest group (13–16 years).
- oral sedation combined with inhalational sedation seemed even more popular. It started at 8.5% for the 0–8 age group, rose to 13% for the 9–12 group and rose again to 16% for the 13–16 age group.

---

Table 2.1

<table>
<thead>
<tr>
<th>Type of sedation</th>
<th>Number of respondents</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>88</td>
<td>91%</td>
</tr>
<tr>
<td>Sublingual</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Intranasal</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>Buccal</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Rectal</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Intravenous</td>
<td>26</td>
<td>26%</td>
</tr>
<tr>
<td>Intramuscular</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Inhalational+IV</td>
<td>12</td>
<td>12%</td>
</tr>
<tr>
<td>Oral+inhalational</td>
<td>15</td>
<td>15.5%</td>
</tr>
<tr>
<td>Other mixture</td>
<td>2</td>
<td>2%</td>
</tr>
</tbody>
</table>

Table 2.2

<table>
<thead>
<tr>
<th>Sedative agents</th>
<th>Number of respondents</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diazepam</td>
<td>17</td>
<td>17.5%</td>
</tr>
<tr>
<td>Temazepam</td>
<td>19</td>
<td>20%</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Midazolam</td>
<td>37</td>
<td>31%</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>89</td>
<td>92%</td>
</tr>
<tr>
<td>Isoflurane</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Sevoflurane</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>Propofol</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Ketamine</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Chloral hydrate</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Hydroxyzine</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Hydrochloride</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Promethazine</td>
<td>6</td>
<td>0%</td>
</tr>
<tr>
<td>Pethidine</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Combination of 2 or more of the above</td>
<td>7</td>
<td>7%</td>
</tr>
<tr>
<td>Combination of 3 or more of the above</td>
<td>3</td>
<td>3%</td>
</tr>
</tbody>
</table>
When asked if intravenous sedation was suitable for children under the age of 16, most respondents replied ‘maybe’: 67 out of 140, or 48%. One person did not reply. 19% replied ‘yes’ (27 out 140), and 33% replied ‘no’ (46 out of 140).

The most frequently occurring minimum age (mode) above which IV sedation was thought to be suitable to be offered as an adjunct to dental treatment was 16. The median age was 14.

The guidelines that most closely reflected the majority of the respondents’ views/beliefs were the GDC guidelines.

<table>
<thead>
<tr>
<th>Guidelines</th>
<th>Number of respondents</th>
<th>Percentages (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDC</td>
<td>73</td>
<td>53%</td>
</tr>
<tr>
<td>SIGN</td>
<td>9</td>
<td>7%</td>
</tr>
<tr>
<td>SDAC</td>
<td>14</td>
<td>10%</td>
</tr>
<tr>
<td>BSDP</td>
<td>24</td>
<td>17%</td>
</tr>
<tr>
<td>AAPD</td>
<td>3</td>
<td>2%</td>
</tr>
<tr>
<td>None</td>
<td>11</td>
<td>8%</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
<td>3%</td>
</tr>
</tbody>
</table>

The majority of the respondents said that they agreed with the GDC guidelines on conscious sedation for children regarding the use of a single benzodiazepine as IV sedative agent (94 respondents out of 138: 68%; 3 did not reply). Most of them also agreed on the age limit above which IV sedation could be used for children (80 respondents out of 133: 60%).

Discussion

The response rate of this pilot study was encouraging but the sample size, especially for the GDS and hospital services, was small. The results appeared to give a reasonable representation of current views on the use of conscious sedation for children within the CDS particularly but they by no means formed a valid indication on the use of conscious sedation for children. It is interesting that results came from Scotland and Northern Ireland as well as England and Wales but that no apparent differences were noted within those results. Even the three Northern Ireland participants seemed to be on the ‘cautious side’ of age 18, 16 and 16 when expressing their views on the age limit for IV sedation use in children, although the Irish guidelines relating to the use of IV sedation suggest the age of 10 as a ‘cut-off point’.

In terms of participation rate for this pilot study, it shows that dentists are generally interested in this subject. One has to consider the fact that the method of distribution of the e-questionnaires was not ideal as there was no way of obtaining an updated list of email addresses, according to the original plan. Participants had to log on to their computers, enter the link provided to their web browsers, complete the questionnaire and submit it, which is far more complicated a procedure than simply clicking on a link emailed to your business email account. It is interesting that the majority of respondents liked this electronic method of survey and a few dentists with no access to computers felt disappointed they could not participate. This just shows how important Internet access is within the healthcare professions.

The design of the questionnaire was far from perfect and many suggestions were made from participants as feedback to the study. The link was indeed not the simplest one and there was advertising involved but this was the only way to obtain free web space for the questionnaire.

From the results of this study, it is worth noting the following:

In terms of training, it is interesting that 16 out of the 97 participants (16.5% of the respondents) who personally undertook conscious sedation for children had only attended day course(s). Although these participants may feel confident and experienced enough to do so, this is not the training level recommended by the experts in this field. Day courses may be a great starting point to raise awareness as far as conscious sedation is concerned but they do not provide the hands-on component that is of crucial importance to the practice of conscious sedation, especially for children. Undergraduate training seems to be a key issue in this case and many participants included it in their replies.
It was encouraging to see from the results that inhalational sedation was very popular among dentists for paediatric sedation. The majority also thought that this was the most appropriate method of sedation for the different children’s age groups: 0–8 years, 9–12 years and 13–16 years.

The reason why those particular age groups were selected has to do with Jean Piaget’s theory of cognitive development. This theory proposes that children’s understanding of the world proceeds through four stages (the first 0–2 sensorimotor stage was not included here as not many children that age are sedated for dental treatment, so 0–8 was selected instead), with each stage demonstrating an increasingly sophisticated understanding of concepts and how they can be used. This has implications for understanding health. Size and even age is only a rough guide to cognitive development. Children may be big for their age or small for their age. According to Piaget’s theory, and also Newton and Harrison, it is probably best to examine the child’s age as a guide to the child’s understanding and to have a discussion with the parents and the child[3]. Many participants in their feedback pointed out that the division of age was not ideal and the maturity of the child is also of great importance but that is why this rough age guide was selected.

When asked if IV sedation was suitable for children under the age of 16, most respondents replied ‘maybe’. This makes sense for the 13–16 age group, and even for the 9–13 group, depending on the child’s understanding of course, use of IV sedation can be very useful. It is for the youngest age group, 0–8, that awareness needs to be raised, and perhaps a hospital setting would be more appropriate for that age group. It is also interesting that there are decreases in the number of responses between the ages of 14 and 16 years. This is strange as one would expect the number of responses to rise after the age of 14. It could be that participants took into account the fact that teenagers can be easily disinhibited when sedated, as they are less emotionally stable.

**Conclusion**

From the results gathered, it is evident that dentists’ attitudes, thoughts and beliefs towards the subject of conscious sedation for children vary. This subject remains slightly controversial and further research is required in order to obtain a valid representation of dentists’ thoughts on the matter. Whether this should be performed electronically is still debatable as it depends on the availability of updated email lists and of course access to the Internet.

**Acknowledgements**

Special thanks go to my VT trainer Dr. Jean Cooper for her support and guidance throughout this year. She is a true mentor to me. I would also like to thank Dr. Mary Henderson and Dr. Jason Leitch for their very useful advice and support for my project. A very warm thank you goes to SAAD, especially to Fiona Wrath, Dr Douglas Pike and the President Dr. David Craig for their help and support with my e-questionnaire. I would like to thank Mr Berthold Allgeier from the University of Surrey for the technical support of my project. Finally, I would like to thank my dental team at the Five Elms Community Clinic in Dagenham for their support and motivation, my fellow VT colleagues at the London Deanery and my VT advisor Dr. Nick Torlot for his support throughout the year.

Thank you all very much.

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AN EVIDENCE-BASED APPROACH TO VALID CONSENT AS APPLIED TO THE PHARMACOLOGICAL MANAGEMENT OF PATIENTS IN THE DENTAL SETTING

J. Christou and M. Sachdev

Introduction

Dentistry has long been associated with the infamous triad of fear, pain and anxiety. Even though historically the profession has customarily been highly respected, it has also been highly feared (coming second only to public speaking)²⁰. However, in this era of advances in both behavioural and pharmacological patient management, this association seems at best unfair. With the ongoing advancements in analgesia and sedation, the profession’s essential ethical and legal responsibility to provide valid consent will continue to increase²⁵.

Valid consent for any examination, investigation or treatment is fundamental to the provision of dental care. The most important element of the consent procedure is ensuring that the patient (or carer) understands the nature and purpose of the proposed treatment, together with any alternatives available and the potential benefits and risks²⁸.

Consent by definition is clear. Webster’s dictionary indicates that consent is a ‘legal condition whereby a person can be said to have given consent based upon a full appreciation and understanding of the facts and implications of any actions, with the individual being in possession of all of their faculties (not mentally retarded or mentally ill), and their judgment not being impaired at the time of consenting (by sleepiness, intoxication by alcohol or drug, other health problems, etc.’ (Webster’s Online Dictionary 2005, www.webster-dictionary.org/definition/law). Although conceived by many clinicians as a medico-legal formality, consent has a moral foundation expressed in the ethical principle of respect for autonomy, which is enshrined by article five (the right to liberty) and article eight (the right to privacy) of the Human Rights Act 1998. Whilst Thomas Percival acknowledged the right to information in the early nineteenth century, it was also seen as potentially harmful and he recommended ‘benevolent deception’¹⁴. Hence the concept of informed consent in relation to patient autonomy really developed from legal cases concerning battery and negligence brought against doctors in the mid-twentieth century (WMA Policy, http://www.wma.net/e/policy/b3.htm). The focus on patient autonomy has continued to increase since the establishment of the Nuremberg Code (1947), where 26 Nazi physicians were tried for research atrocities performed on prisoners of war, to the Declaration of Helsinki (1964), where the 18th World Medical Assembly met to issue recommendations to guide physicians in research involving human subjects (WMA Policy, http://www.wma.net/e/policy/b3.htm).

Modalities of consent

Types of consent may be classified as implied or expressed, with the latter being further subdivided into verbal or written consent. Implied consent is ‘assumed by reasonable inference’ from the patient’s actions even though there was no explicit consent given⁹,²⁵. For example, the patient lies in the dental chair and opens his or her mouth to allow an examination to be carried out. The ‘vast majority’ of all dental treatment between a patient and a dentist involves implied consent²⁶. However, implied consent may not provide sufficient protection for the dentist against legal action⁹.
It is thought that expressed consent should be obtained from a patient for a specific procedure that is either not routine or that carries a material risk. Verbal consent is the first form of expressed consent and it is normally adequate for basic treatment. For instance, a dentist may say, ‘I am going to give you local anaesthesia for this extraction’. The patient then agreeing verbally or indicating agreement through action, like nodding the head, has given valid verbal consent. Written consent is the other form of expressed consent and is usually obtained for more extensive treatment.

Implied or verbal consent is frequently sufficient for treatment under local anaesthesia as the patient can request treatment to be stopped at any time he or she wishes to ‘withdraw consent’. However, with regard to treatment under conscious sedation or general anaesthesia, expressed written consent must be obtained, as the patient is ‘not fully aware’ of the treatment being carried out and is therefore in no position to withdraw consent. Written consent must be obtained for each individual episode of general anaesthesia administration, whereas for conscious sedation, written consent can be obtained once for an agreed treatment plan, which may include multiple sedation appointments. Each aspect of the pharmacological management of dental patients may be assessed in turn with regard to the risks associated with each and with valid consent.

Local anaesthesia

In the case of local anaesthesia, implied consent is generally used where the clinician informs the patient of the procedures to be carried out and the need to numb up the area in order to prevent painful experiences. Major side effects to the injection of local anaesthesia are rare. Nevertheless, minor complications do arise occasionally. Such complications include failure to anaesthetise, syncope, pain during the injection, prolonged altered sensation, unilateral facial nerve paralysis, visual disturbances, aural disturbances, intra-vascular injection, haematoma formation, self-inflicted trauma, trismus, toxicity, psychogenic effects, allergic reactions, nausea, vomiting, respiratory depression and equipment failure. As the patient is fully awake and aware during the procedure, the treatment being carried out can be talked through with the patient while treatment is being undergone. The patient need not be made aware of every possible complication listed above but informed promptly if any occur at the time.

Conscious sedation

An ideal sedation regimen should produce a rapid and, more importantly, a predictable response, with an appropriate degree and duration of sedation for the procedure undertaken. It is difficult to assess the sedative dose requirement for any particular patient who may remain under-sedated, and thus perhaps over-excitble on the one hand, or over-sedated on the other. Therefore, there is a significant failure rate attached to this technique, especially when the patient is very anxious. Patients who are scheduled to receive conscious sedation must receive careful verbal and written instructions as to the effects of the sedation. The principal side effect in conscious sedation is respiratory depression, seen with acute administration of sedative doses of benzodiazepines. Patients with medical conditions that adversely affect the respiratory system, for example obstructive sleep apnoea, should understand the additional risks that sedation poses. Other less common risks of conscious sedation include myocardial infarction, drug interactions, tolerance, haematoma, sexual fantasy and paradoxical reactions. Again, the level of information provided to the patient is case-dependent. It is the clinician’s duty to enlighten the patient as to which of the potential risks are of particular concern, thus enabling the patient to make an informed decision.

General anaesthesia

The introduction of general anaesthesia in 1844 by Dr. Horace Wells revolutionised dental surgery by being the first reliable method of pain control. The subsequent advances in pharmacology and medicine have made the administration of general anaesthesia much safer. However, the use of general anaesthesia is still associated with greater morbidity and mortality when compared with local anaesthesia or conscious sedation.

To provide informed consent the patient must be aware of the risks of general anaesthesia, including sore throat, nausea and vomiting, and damage to teeth. The possibility of death when administering general anaesthesia remains less than 1:100,000 in the UK. Even though the risk of death is small, the consent is not informed if the patient is not aware of this serious complication. However, the list of possible complications in general anaesthesia is endless and the patient cannot realistically be informed of each, not least because he or she would not understand.
Some of the complications surrounding general anaesthesia include airway obstruction, myocardial infarction, hypotension, hypertensive crisis, anaphylaxis, hypoglycaemia, syncope and respiratory depression. If any one of these poses a particular risk to the patient, for example severe bleeding if the patient is receiving anticoagulation therapy, then he or she should be warned of this potential risk. Hence, the information provided to the patient should be tailored to him or her.

Written informed consent must be obtained in order for dental treatment to be performed under general anaesthesia. The hospital must have the original signed consent form and this cannot be photocopied or faxed.

How much should patients be told?

Since it is practically impossible to inform patients fully about all possible side effects of a treatment[^12],[^32], there is the question of how much information should be given. This remains unclear in law but it is well accepted that patients should be informed of the potential consequences of treatment that may keep them from carrying out day-to-day activities. Conversely, there may be other known consequences that may not interfere with the patient’s daily living[^32]. The judgement concerns how much information is required in order for the patient to make a valid decision. The amount of information provided for each patient may vary[^4]. Therefore, it may not be necessary to warn every patient that there is an insignificant chance of dying from sedation, but it is negligent to fail to warn a patient of a possible numb lip after surgical removal of a deeply impacted second premolar. Clinicians may be unsure of how much information is required and the relative emphasis on different points when informing patients. The answer to this issue is case-dependent and hinges upon the comparative risk of an unfavourable outcome, so advice may be sought independently from a dental advisory body.

When should consent be obtained?

Only after patients have had sufficient time to understand all the information should they be asked if they are prepared to sign the consent form. It seems unfair to ask patients to sign an informed consent form at the first visit when they have not had time either to digest the information disclosed or read information sheets or obtain other information about the treatment[^30]. Consent should also be repeated before carrying out the actual treatment procedure, especially if some time has elapsed between the signing of the consent form and the actual time of treatment. In no circumstances should a patient be asked to signify consent just before the procedure is due to start. At this time the patient may be feeling particularly vulnerable, and hence there may be real doubt as to its validity[^11].

Key issues

1. **AGE OF PATIENT**

   By virtue of family law (Family Law Reform Act 1969) all persons of 16 years or over have the right to provide consent for their own dental treatment. However, using the principle of Gillick competence[^17], a person under the age of 16 years can give valid consent provided that the clinician considers him or her to be mature enough to fully understand the proposed intervention, the consequences of the treatment, the alternatives and the failure to treat[^10]. The application of Gillick competence is an important recognition that 16 years is an arbitrary age and that there is a need for some flexibility[^4].

2. **ADULTS WITHOUT CAPACITY TO CONSENT**

   Adults with capacity are able to understand and retain information about treatment, assess the relevant information and weigh it up in order to make a decision[^10]. The fact that a patient’s decision may seem irrational does not in itself mean that the patient lacks capacity[^37]. Guidance on assessing capacity is covered in the Mental Capacity Bill. Currently, in England and Wales, no one can authorise treatment on behalf of an adult, whether that adult has capacity or not[^10]. Treatment of patients lacking competence may only proceed if the treatment is considered to be in their best interest, which means the best interest of the patient rather than best dental interests[^20]. This includes factors such as the patient’s past and present wishes, his or her general well-being and spiritual and religious welfare, the views of other people whom it is appropriate to consult, and whether the proposed treatment can be carried out as effectively but in a manner which is less restrictive to the patient’s freedom[^28].

   Assessment of a patient’s level of competence initially relies on the attending dentist and involves discussion.
with those who are closely involved with the care of the patient. Occasions may arise when the dentist finds it difficult to assess competence, and under these circumstances additional assessment must be sought. The procedure for obtaining further assessment varies in different parts of the UK. Presently, this can include assessment from a specialist medical practitioner, psychologist, psychiatrist, specialist learning disability teams or speech and language therapists. The involvement of these specialists forms part of the overall assessment of the patient, unless the urgency of the patient's condition dictates otherwise.

Competent patients who anticipate future incompetence through illness may indicate their preferences for future treatment by completing an Advanced Decisions document. For example, many Jehovah's Witnesses carry this document, forbidding the administration of blood. Advanced Decisions are legally binding on healthcare workers if they are made voluntarily by a competent, adequately informed patient who expresses a wish under certain defined circumstances.

3. HEARING IMPAIRMENT
Not all hearing-impaired patients will wear a hearing aid or be able to hear clearly even when wearing one. Patients who do not respond to a question can appear to be less competent simply because they fail to hear the question. Care must be taken to avoid speaking from behind the patient or while still wearing a face mask. The provision of a qualified sign-language interpreter should be made for patients who are deaf or hearing-impaired and who use sign language as their primary means of communication.

4. VISUAL IMPAIRMENT
Care must be taken in providing information leaflets for patients to familiarise themselves with proposed treatment prior to obtaining consent. It is the responsibility of the clinician to ensure the patient has fully understood in order to ensure the consent is informed. Any advice or patient information literature should be read to the patient if it is not available in Braille.

5. PHYSICAL IMPAIRMENT OR MOBILITY DISABILITY
It is important to remember that just because a patient has required help from a carer to enter the surgery, it does not mean that the carer is required to make decisions on behalf of the patient. Well-meaning family members or carers may unconsciously take over the decision-making process, even though the patient is fully capable of making his or her own decisions. It is important to establish that carers or relatives are not attempting to direct dental treatment for their own convenience.

6. LANGUAGE BARRIERS
Difficulties in communication can occur when English is not the patient's first language. Information leaflets can be provided in several different languages; however, this is insufficient if the patient is unable to read or can only understand a specific dialect. It is inappropriate to judge the competence of a patient to give consent if English is not their first language. In these circumstances, the services of an interpreter are required. The ideal interpreter is another clinician who can explain the exact treatment procedure in the patient's language. A member of auxiliary staff may be equally useful. It is important for the clinician to be aware of the interpreter's ability to communicate the exact information disclosed to the patient or guardian. The use of a child interpreter is not acceptable.

7. PATIENTS WITH SPECIFIC ETHNIC OR RELIGIOUS BELIEFS
Practitioners should always be sympathetic towards patient requests such as the objection of women to receiving treatment from a male. Blood transfusion, for instance, may also be an issue.

Treatment without consent
There are limited circumstances when a dentist may proceed to provide treatment without the patient giving consent, such as when the patient is unconscious. Under these circumstances consent is unobtainable and it may be justifiable to treat without consent. Emergency treatment should not be delayed. As in all cases, in deciding whether to treat, the overriding consideration must always be what is in the 'best interests' of the patient.

Litigation
From the time of Schloendorff v The New York Hospital 1914 the 'right of self-determination' has been used to justify imposing an obligation for obtaining consent from
the patient\textsuperscript{22}. Later, the Salgo court in 1957 suggested that ‘the duty to disclose the risks and alternatives of treatment was not a new duty but a logical extension of the already established duty to disclose the treatment’s nature and consequences\textsuperscript{22, 36}. The court focused not merely on whether consent had been given, but whether patients were ‘adequately informed’. Following the events in Salgo the American concept of ‘informed consent’ truly began\textsuperscript{36}. From here, many landmark cases in different countries (including Australia, Canada, America, the UK and Singapore) have taken place and legal action generally has been dramatically increasing\textsuperscript{36}.

It is the fear of litigation that has led to the formalities of obtaining written consent before intervention\textsuperscript{22, 31}. Yet these signed forms are not legal proof that the clinician has sought informed consent\textsuperscript{6, 36, 39} and a patient may successfully argue that because of misinformation about treatment a signature cannot count as legal proof of consent\textsuperscript{22, 36}. Insufficient information on the risks and benefits of the proposed treatment and alternative treatment options are the commonest source of complaint and litigation\textsuperscript{10}.

In English law, if a patient makes an allegation that they did not have sufficient information then the Bolam test is applied. The Bolam principle\textsuperscript{1} is when ‘a doctor is not guilty of negligence if he has acted in accordance with practice accepted as proper by a reasonable body of medical men skilled in that particular art’. The test as applied to the issue of consent is whether the practitioner has exercised a reasonable duty of care in informing the patient. However, English law has changed since the House of Lords ruled in favour of the patient in Chester v Afshar, October 2004\textsuperscript{36}. Miss Chester was not informed about the 1-2\% risk of cauda equina syndrome, and with a lack of documented evidence on the doctor’s part she sued successfully\textsuperscript{36}. This new case makes it even more essential to warn patients ‘about significant adverse outcomes, risks and complications’ for procedures\textsuperscript{12, 32}. It is also important therefore to document treatment that is refused after the patient has been adequately informed.

Conclusions

Good communication (both verbal and written) between dentist and patient has always been key to a successful relationship, as has obtaining valid consent during treatment. Consent should be not only read but understood. This builds on the all-important trust between the two parties and allows the patient to give consent or refusal accurately based on the dentist’s disclosure of information. It is the perceived breach of this trust that makes patients take action against the practitioner.

References

1. Bolam v Friern Hospital Management Committee. 1957. 1 WLR: 582.
17. Gillick v West Norfolk and Wisbech Area Health Authority 1986.
Reasons for failed local anaesthesia in dentistry and their management

Local anaesthesia (LA) is a common yet important procedure in dentistry. LA can be defined as:

‘The loss of sensation in a circumscribed area of the body by a depression of excitation in peripheral nerve endings or by inhibition of the conduction process in peripheral nerves’

Local anaesthesia causes loss of all sensory modalities, of which the blocking of pain is desired during dental surgery. It acts peripherally and involves no loss of consciousness.

Local anaesthesia is produced by drugs called local anaesthetics, e.g. lignocaine and bupivacaine. The target for these drugs is the fast sodium (Na+) channel in nerve axons. When charged, the local anaesthetic molecule binds to a phenylalanine residue on helix 6 of the Na+ channel, blocking the pore and preventing the passage of Na+ ions through the channel. The interaction also causes a conformational change in the channel to its inactivated state, also preventing flux of Na+.

This action reduces depolarisation and upstroke of an action potential; the nerve is blocked at a site and does not propagate action potentials to the central nervous system (CNS). Sensory modalities are not consciously interpreted. All significant, clinically used local anaesthetics work by a hydrophilic pathway.

The two main techniques used in dental LA are infiltrations and regional nerve blocks. Infiltrations are where LA is deposited at the apex of the tooth to be operated on, with the needle penetrating the oral mucosa and advancing towards the apex. The deposited LA is left to diffuse through the alveolar bone to achieve pulpal anaesthesia.

Regional nerve block anaesthesia is when local anaesthetic is applied to a named anatomical nerve (distal to the operative site) by injection. The nerve is blocked and therefore its receptive field is anaesthetised. Receptive fields can involve the oral mucosa, the periodontium and several teeth, e.g. inferior alveolar/dental (ID) nerve block. Clinical uses include restorations of multiple teeth and oral surgery procedures.

Local anaesthesia does not usually fail, but the incidence of failure is significant. ‘U.S dental practitioners administer 4,000,000 local anaesthetic injections annually; failure rate of analgesia is estimated at 5-15%.’

The above statistic represents a large number of people. Failure of local anaesthesia may seem strange, as we are dealing with a molecular interaction that we assume would work every time. Some causes of failure concern the molecular interaction, but most causes are totally independent of a successful drug interaction.

Good pain control is essential in dental surgery; failure to achieve complete anaesthesia of the site will lead to pain and stress with anxiety caused to both dentist and patient, with loss of the patient’s confidence in addition. The purpose of this essay is to describe the main causes of local anaesthetic failure and to suggest some ways for the clinician to manage the various situations of failure that may occur.

Causes of failure of local anaesthesia will now be assessed under a number of headings.

1. OPERATOR-DEPENDENT FAILURE

Factors in this category have no physiological/pharmacological basis but are the most common cause of failure, almost always with inexperienced operators. Incorrect positioning of the needle, e.g. during an ID block, could involve depositing LA solution too near in the medial pterygoid muscle or too far into the parotid gland, thus missing the target. Failure to touch bone at the right location and depth will not ensure that the ID nerve has been targeted successfully. Local anaesthetic can be injected intravascularly with the entire drug being carried
away from the target site. If injection speed is too fast then local anaesthetic will spray, not accumulating at the target.

With infiltrations, poor localisation of the tooth apex is a major problem; for example, failure to inject at the true depth of the sulcus and depositing the LA solution into the cheek will result in poor pulpal anaesthesia.

2. PHARMACOLOGICAL FAILURE

This situation occurs rarely and could be due to the LA drug being out of date or not strong enough to achieve effective anaesthesia. But pharmacological failure usually concerns vasoconstrictors.

A vasoconstrictor (usually adrenaline) is used alongside local anaesthetics. It acts to constrict local blood vessels, reducing bleeding and prolonging the time of action of the LA drug. If a vasoconstrictor was contra-indicated (e.g. in cases involving severe arrhythmias or osteoradionecrosis of the jaw) then the efficacy of the local anaesthetic may be reduced as it may be washed away rapidly and its elimination through diffusion into blood vessels may be increased. The duration of anaesthesia will therefore be significantly reduced when using plain solutions, and such solutions may therefore fail to provide complete anaesthesia for the whole procedure.

Finally, there are two types of LA drugs available: ester-linked and amide-linked. Esters are metabolised locally by plasma and tissue esterases, while amides are metabolised in the liver. Esters therefore have a shorter half-life and duration of action. For this reason, ester LA drugs such as Procaine may again fail to provide complete anaesthesia for the whole procedure.

3. PSYCHOLOGICAL FAILURE

Fear, phobia or anxiety will increase the patient’s pain threshold. This will often present clinically as the patient interpreting pressure or cold air from instruments as pain, even with a successful nerve block or infiltration anaesthesia.

4. ANATOMICAL VARIATION

This refers to the variable positioning of foraminae (and therefore nerve trunks) between patients. For example, the mandibular foramen is commonly more superior in position than usual, resulting in local anaesthetic being deposited below the nerve trunk with no regional block obtained. The mental foramen is also variable in position, which could account for some mental-incisive nerve block failures. Wong and Jacobsen reported problems in achieving a correctly positioned block in patients with wide, flaring mandibles, bulky musculature and excessive adipose tissue.

For maxillary buccal infiltrations the zygomatic buttress may act as a diffusion barrier when LA is deposited at the apices of first molars. For posterior mandibular infiltrations the thick and dense cortical bone of the mandible also acts as a diffusion barrier for LA.

Failure of topical LA on the palatal soft tissues occurs because the tissues are orthokeratinised and again act as a diffusion barrier, unlike the non-keratinised buccal tissues.

5. ACCESSORY NERVE SUPPLY

Normally, specific areas of the mouth are innervated by designated nerves. ‘Accessory nerve supply’ refers to the situation where these areas in the mouth are innervated by additional branches of nerve trunks that are primarily involved with the innervation of other structures. Here we are mainly concerned with tooth pulpal fibres that originate from accessory nerve trunks. Accessory nerve supply is a major cause of LA failure, as accessory nerve trunks are not anaesthetised in a specific nerve block. Many people have researched accessory nerve supply, and some accepted theories are outlined below. First are the ipsilateral connections.

5.1 Palatal nerves

It has been accepted that the pulpal supply of the upper molars may originate from the greater palatine nerve, and of upper incisors from the nasopalatine nerve, causing failure of the posterior, anterior and superior alveolar nerve blocks respectively.

5.2 Lingual nerve

P. P. Robinson found that in 10 out of 12 anaesthetised cats, anterior mandibular teeth were supplied by ipsilateral and one by contralateral lingual nerve fibres. He suggested that the lingual nerve accessed tooth pulp through accessory foraminae in the lingual cortex of the mandible. In another study by R. N. Sutton it was found that 265/300 human cadaver mandibles contained many small accessory foraminae, commonly lingually. Rood believed that the lingual nerve was responsible for two failures out of 334 ID blocks. It is suggested, then, that the lingual nerve is responsible for accessory supply to anterior mandible teeth in humans with access through accessory foraminae.
5.3 Mylohyoid nerve
The mylohyoid nerve is considered to be a common source of accessory nerve supply. Wilson et al. discovered that in 16 out of 37 (43%) of human cadavers the mylohyoid nerve continued beyond the mylohyoid muscle and entered the lingual aspect of the mandible through accessory foraminae. It was also found that the mylohyoid nerve branched from interior alveolar at a mean distance of 14.7 mm superior to the mandibular foramen. This was higher than previously thought. Local anaesthetics work at the nodes of Ranvier and it was discovered that three nodes of Ranvier had to be blocked in order to prevent action potential propagation and block the nerve. It was proposed by Wilson et al. that the mylohyoid nerve may exist only as a very small segment in the pterygomandibular space, with too few nodes of Ranvier to be sufficiently anaesthetised during an ID block, and that the nerve’s higher branching point would also prevent it being blocked as local anaesthetic may not diffuse this far up the pterygomandibular space. The mylohyoid nerve is likely to account for some failures of total anaesthesia of anterior mandibular teeth with an ID block. Wilson suggested that this evidence could explain the increased success rate of the Gow-Gates block (where local anaesthetic is deposited higher, at the neck of the condyle, and is likely to block inferior alveolar, mylohyoid, long buccal and lingual nerves (and many possible accessory nerves). The Gow-Gates block has been demonstrated to have a 96% success rate, compared with 65% for the inferior alveolar block.

All theories are backed up by Frommer et al. who demonstrated (histologically) that the mylohyoid nerve contained sensory fibres, i.e. it was not a pure motor nerve.

5.4 Long buccal nerve
This nerve is believed to supply posterior, mandibular teeth in some cases. This theory is supported by Rood, who demonstrated that the dental infiltrations resolved 72 out of 79 failed ID blocks, and Sutton, who proposed that the long buccal nerve could enter the mandible through external surface accessory foramina and that buccal infiltrations resolved failed local anaesthesia here in many of his patients.

5.5 Facial nerve
The mandibular branch of the facial nerve was shown in dissections by Sutton to lie close to the mental foramen. This led Sutton to suggest, based on the previous work by Farache and Alonso, that the facial nerve can enter the mandible here and supply the pulps of the teeth.

5.6 Upper cervical nerves
These nerves are thought by many to supply pulpal afferents to some of the mandibular teeth. Sutton found in dissections that cervical nerves ran close to the mandible and proposed that they could enter buccally through accessory foraminae. Supply from these nerves could explain a failed Gow-Gates block.

5.7 Auriculotemporal nerve
The role of accessory supply to mandibular teeth by this nerve was reviewed by Heasman and Beynon. They explained that auriculotemporal nerve branches may enter accessory foraminae high on the coronoid process and condyle of the mandible.

5.8 Bilateral supply
This is common for mandibular central incisors: innervation of these teeth commonly arrives from its ipsilateral as well as its contralateral inferior alveolar nerve, crossing the midline symphysis.

In a study by Yonchak et al., 38 patients were given (randomly) unilateral or bilateral ID blocks over two visits. The pulps of teeth 1 to 3 were tested afterwards. In conclusion, the bilateral ID block had a success rate of 66% compared with 39% for a unilateral nerve block for a lower central incisor. Greater success was also reported for teeth 2 and 3. Bilateral supply is a likely cause of failure of an ipsilateral ID block to anaesthetise anterior mandibular teeth.

6. PRESENCE OF ACUTE INFLAMMATION
It is well recognised that local anaesthesia readily fails in the presence of acute inflammation. This is commonly due to a pH decrease (to 5 or 6) in inflamed tissue, associated with mediators of inflammation (Figure 2).

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**THE TISSUE pH IS A MAJOR FACTOR IN THE RATIO OF CHARGED TO UNCHARGED LOCAL ANAESTHETIC MOLECULES CALCULATED BY THE HENDERSON-HASSELBALCH EQUATION, I.E.:**

\[ \text{PKA} - \text{PH} = \log \left( \frac{[\text{LAH}^+]}{[\text{LA}]} \right) \]

A DECREASE IN pH RESULTS IN AN INCREASE IN THE AMOUNT OF CHARGED MOLECULES PRESENT, WHICH REDUCES THE AMOUNT OF LOCAL ANAESTHETIC MOLECULES PENETRATING THE NERVE MEMBRANE AND INTERACTING WITH THE TARGET. THE NERVE WILL NOT BE SUFFICIENTLY BLOCKED.

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*Figure 2*
This theory may explain failure of infiltration anaesthesia but it does not explain failure of nerve blocks where local anaesthetic is deposited away from the site of infection.

Hyperaemia during acute inflammation will cause washing of local anaesthetic from the system and increased elimination via diffusion into local blood vessels. The theory can only explain failure of infiltration anaesthesia.

Hyperalgesia is when the threshold of nociceptive neurones to noxious stimuli is decreased, both in and around the site of insult. Excessive discharge from these nerves results from the weakest of noxious stimuli. This was demonstrated by Rood and Pateromichelakis, who applied artificial inflammation to sciatic nerves in rats. There was an increased rate of firing and action potential amplitude for the inflamed nerves opposed to the control nerves, suggesting hyperalgesia. Rood concluded that a solution to hyperalgesia is to use a stronger concentration of drug, which will sufficiently block hyperalgesic nerves.

Brown applied artificial inflammation to saphenous nerves in rats. He discovered, after a time period of several hours, the action potential amplitude of the inflamed nerves increased on average by 11.1%, as opposed to the control nerves. This would reduce local anaesthetic efficacy in decreasing the upstroke of an action potential. He proposed that a time delay was required for certain inflammatory mediators to be synthesised and that these worked to increase their nerve axons' permeability to sodium ions, thus increasing the action potential amplitude.

### Management of Failed Local Anaesthesia

#### 1. Management of Operator-Dependent Failure

This usually involves the clinician reviewing his or her knowledge of anatomy and/or clinical injection technique. In the event of difficulties in locating the mandibular foramen an OPG radiograph may be useful for location. Correct syringe aspiration prior to injection will usually prevent an intravascular injection. A slow injection technique and a massage of the injected area will help to maximise the localisation of the LA drug to the site of interest during infiltration anaesthesia.

#### 2. Management of Psychological Failure

A calm and reassuring manner on the part of the clinician is appropriate in most situations. However, in cases of more severe anxiety, IV sedation, e.g. with midazolam, can be used to good effect. Dental phobias require treatment under GA or referral to a specialist phobia clinic.

#### 3. Management of Pharmacological Failure

Firstly, the clinician should always check the expiry date of the LA drug.

If a stronger drug is needed, then 5% lidocaine with adrenaline is usually effective, or articaine can be used for its excellent diffusion properties. When adrenaline is contra-indicated then Citanest (3% Prilocaine + 0.03 IU/ml Felypressin) is very effective. When forced to use a plain LA solution then Scandonest (3% Mepivacaine) is the most effective. Ester LA drugs should be avoided at all costs.

#### 4. Management of Anatomical Variation

An OPG can be used to locate the mental and mandibular foraminae. Infiltrations mesial and distal to the zygomatic buttress will overcome its effect as a barrier. Posterior mandibular infiltrations should be conducted with articaine because of its excellent diffusion properties.

#### 5. Management of Accessory Nerve Supply

In the maxilla, greater palatine/nasopalatine nerve blocks can be used to stop possible accessory supply. In the mandible, additional buccal and lingual infiltrations following an ID block can be used to combat accessory supply.

During an ID block the lingual nerve should be deliberately anaesthetised in order to eliminate any possible accessory supply, especially in oral surgery procedures. Alternatively a Gow-Gates block, which deposits LA higher at the neck of the condyle, can be used to block long buccal, infralveolar, mylohyoid and lingual nerves and thus significantly reduce the risk of their accessory supply. In difficult cases, intraligamentary anaesthesia with articaine is very effective, or intrapulpal LA if permitted.
To overcome bilateral supply, buccal and lingual infiltrations can be used in the midline to block the crossover supply.

6. MANAGEMENT OF ACUTE INFLAMMATION

In the event of persistent failure to obtain local anaesthesia with conventional techniques, intraligamentary local anaesthetic can be given using articaine, or a stronger solution of 5% lidocaine and adrenaline can be used in infiltrations to combat hyperalgesia. Articaine is also effective in infiltrations here because of its excellent diffusion properties.

In the event of absolute failure, treatment should stop and the patient should be discharged with a course of antibiotics and ibuprofen to take to reduce or stop the inflammation/infection. The treatment can then be undergone at a later date.

In conclusion, total local analgesia is essential for dental treatment. Failure of this has effects on the patient, increasing pain, fear, anxiety and loss of confidence, and on the dentist, increasing stress in performing the procedure. The failure of dental LA has many causes, with much firm experimental evidence behind each one. I believe that failure could arise from any of the factors described above, possibly from combinations of factors. To avoid failure of total local analgesia the operator should increase knowledge and practice of the relevant surgical techniques, apply correct dosages, use radiographs to check for anatomical variations, consider the use of anxiolytic drugs for anxious patients, use infiltration techniques around the tooth concerned or consider a Gow-Gates block if accessory nerve supply is suspected, and use antibiotics or a stronger solution of local anaesthetic in the case of acute inflammation.

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Recent research has suggested that fear of dental treatment drives many individuals to seek out dental care with the help of some type of pharmacological adjunct. Sedative treatment allows many patients to obtain dental care they would not otherwise tolerate due to fear. In addition, behavioural anxiety-management techniques have also been shown to be effective in helping individuals cope with dental treatment. This paper presents a standardised behavioural approach for dental providers to use with patients prior to sedation procedures. This approach gives providers a step-by-step guide for instructing patients in simple coping skills, such as deep breathing techniques. In addition, this paper reviews how dental providers can gradually introduce patients to potentially fear-producing procedures in a way that allows patients to use coping skills to manage their fears of these procedures. The techniques introduced here are intended to increase patients’ comfort and enhance the efficacy of sedative medications, facilitating treatment for both patients and practitioners.

Patients seek out sedation, and clinicians provide it, in order both to reduce the barriers to approaching a feared procedure and to reduce the stress of the actual experience. We know very little about patient preferences except to say that multiple population based surveys have suggested in general that demand outstrips supply for these scarce sedation resources1,3,7. More importantly, we know little about how these patient preferences develop. However, we do know that clinician preference plays a substantial role10.

The focus of most sedative treatment, whether the route of administration is inhalational, intravenous or oral or whether the approach is relatively simple nitrous oxide administration or more complex multiple-drug intravenous sedation, is on completing a dental treatment plan (see, for example, Wallace14). Many studies demonstrate that various sedative treatments lower intra-operative anxiety and stress and facilitate treatment15.
Nevertheless, getting through a single episode of treatment should not be the only goal\textsuperscript{15}. Few patients want to remain anxious and so have to avoid dental care. Most appreciate the improvements in oral health that are derived from having a regular source of preventive and rehabilitative care. It appears that many sedation patients are caught up in a cycle of repeated sedations that may not have the desired outcome of long-term fear reduction. We need to recognise that their past behaviour is not simply a matter of dental negligence but rather a product of repeated interactions with the dental care system. That is, these attitudes and behaviours are learned.

Working with people with a phobia of needles at the Dental Fears Research Clinic at the University of Washington (Coldwell et al., in press), as with similar parallel studies with panic disorder patients in the US\textsuperscript{3} and the UK\textsuperscript{9}, has provided an opportunity to examine whether the widely prescribed anxiety-reducing oral medications alprazolam (Xanax) and imipramine have made learning not to be fearful more efficient or effective. In these studies, graduated exposure therapies were provided in the presence or absence of the drugs. The rationale was to lower the anxiety of the patient so that he or she could have a positive experience and be less afraid at that time and in the future. This is not unlike the argument presented in one dental sedation study testing the effectiveness of oral premedication before venepuncture\textsuperscript{13}. Pre-treatment also has the added value of lowering the overall drug doses required to carry out treatment and thus increases safety.

Exposure-oriented behavioural treatment regimens are the gold standard in fear treatment, and a recent meta-analytic paper by Kvale and colleagues\textsuperscript{8} clearly illustrated that such relatively short-term treatments are very effective with phobic dental patients over the long run.

Interestingly, the results of the two medical studies suggested that the drug treatment decreased the effectiveness of the graduated exposure treatment and that patients who received drugs relapsed more frequently than those who received behavioural treatment alone. The dental study showed that alprazolam did not increase the efficiency of the graduated exposure treatment and may have actually increased the upset of patients, who would then face oral injections in the absence of the drug. The authors argue that such results may come about because patients attribute their success to the drugs rather than to their own volition or because the drugs interfere with the emotional processing required to extinguish their fear. This is not an argument that sedative treatments in dental care are counter-productive. Nor is it an argument that patient demand should be ignored. Rather, the data suggest that limited behavioural treatment, focused on exposure to the feared stimulus, may render a sedative treatment ‘package’ more effective in the long run than sedation alone. This approach does not per se turn dentist sedationists into psychologists, nor does it imply bringing the psychologist into the dental practice. It does mean, however, that patients seeking sedation treatment should receive some specialised preparation before the sedation treatment. A dentist might provide this preparation, but it may be equally effective provided by a dental therapist or even a well-trained dental nurse. In the University of Washington study a dental hygienist provided the exposure therapy.

This approach also implies that studies are required to examine the long-term rates of dental attendance for patients receiving this type of treatment compared with the high rates demonstrated for behavioural treatments alone. Studies that examine the oral health of such clients would also be valuable.

**Behavioural pre-treatment for sedation patients**

Effective sedationists develop a way of talking to patients that reduces the stress of cannula or mask placement and induction. However, this patter is highly idiosyncratic. In the pre-treatment demonstrated here, the approach is standardised.

Initially, the dental provider should provide the patient with a brief rationale of the behavioural skills to be taught. Patients seeking sedation may approach the sedation appointment with the belief that ‘they’ll just knock me out and I won't remember anything’, and are probably not expecting to discuss fear-management techniques in preparation for sedation. A brief explanation of why these techniques are useful provides a good basis for increasing patients’ abilities to cope with dental treatment. The following narrative provides an example of such an introduction.

*Dentist: My long-term goal is to help you get rid of the fears and upset that have brought you to sedation.*

*Patient: What do you mean? I just want to get this over with.*
Dentist: Of course you do, that is natural. I have that feeling myself sometimes when I go to the dentist. I wonder whether I could share with you a strategy that has worked for some of my other patients.

Patient: Yes, OK.

Dentist: The basic approach is to introduce you to some of the things that we’re going to do when you’re sedated. We do it beforehand so you’ll remember. The things we do during the sedation you probably will not remember at all.

Patient: Yes, that is what I want. I don’t want to remember anything!

Dentist: I understand – but this will not be difficult for you. We’re going to begin with a simple breathing exercise. Like this… Take a big breath and fill your lungs with air [dentist demonstrates while coaching the patient]. Come on, really full, like a big balloon. Now hold your breath for the count of five [dentist counts slowly].

Dentist: OK, now let it out slowly as if the balloon has a tiny hole in it. Let all the air out until you feel as if the balloon is empty. Don’t take another breath until you’re completely empty. Do this again, five or six times.

Dentist: That’s great. Now, when you’re all full of air, you are all tensed up. When the air is all out you’re very relaxed. When we do the next step, you’ll need to breathe like that and get yourself very relaxed. The essential thing is to breathe very slowly.

Patient: It’s funny, but my heart doesn’t beat so fast when I slow down my breathing. I don’t feel so tense…

Dentist: Great, that’s exactly what is supposed to happen. You’re learning how to manage some of that tension that you feel in the dental chair, just by using some simple skills. OK, now I am going to go through all the steps leading up to a dental injection. We will go slowly and you can stop any time if you get upset.

Before going on it is important to note a couple of key points. First, experts in fear treatment have long argued that patients need a competitive response to the anxiety response. That is, if they are prepared to do structured breathing, as described above, they have a way to control their anxiety. In the earliest days of this work, progressive muscle relaxation was used extensively. Research today suggests that this serves the purpose of allowing the patient to face exposure to the feared stimulus. It focuses the mind and body on the task. It probably is not, as was suggested several decades ago, the key ingredient in successful treatment. The conversation suggested above is one variation of a successful dialogue and can be adapted.

Second, the key step in all this is the actual exposure. For this we create a hierarchy of exposure to the feared object. Hierarchies go from distal (least feared) to medial (most feared). A hierarchy for needle fear looks like this:

1. The dentist retracts the cheek with a mirror.
2. The dentist places a small amount of topical anaesthetic on the gum. The anaesthetic is allowed to remain in place for at least one minute.
3. The dentist or patient gently probes the area to demonstrate that the topical anaesthetic is working.
4. The patient is shown the LA syringe with the plastic cap in place.
5. The syringe and capped needle are placed in the mouth at the site of the injection. The syringe is allowed to remain in the mouth for at least one minute.
6. The patient is shown the syringe with the cap removed.
7. The syringe and uncapped needle are placed in the mouth at the site of the injection. The syringe is allowed to remain in the mouth for at least one minute. Some clinicians find it helpful to place the tip of the needle on their thumbnail in order to stabilise it.

Before beginning each step, the patient repeats the simple breathing exercise practised beforehand. The rate of progress is determined by the patient’s self-reported level of anxiety. If patient anxiety is too high, the clinician repeats the last step that could be tolerated without too much anxiety until the patient can move forward. A little bit of upset is all right, but getting very upset is not useful.

Depending on how much information patients desire about the injection, the dental practitioner may give a brief description of the syringe itself prior to the steps listed above. For example, in the University of Washington study, the dental hygienist spent a few minutes addressing some of the more common concerns about dental injections (e.g. the size of the syringe, the length of the needle, how the local anaesthetic works) prior to rehearsing the actual steps of the hierarchy. Patients are encouraged to use the breathing exercise during this step, as in the steps of the hierarchy. Many patients appreciate having some information about the feared object or procedure. It is important, however, to
ask patients how much information they require before moving ahead. While many patients want information, others find details about the procedure to be extremely anxiety-inducing.

Third, patients should always be told that they can stop at any step if they become too upset. It may be paradoxical, but having an ‘escape route’ reduces their anxiety and they rarely ever use it.

While rehearsing the steps of the hierarchy, it is important to monitor the patient’s anxiety levels. This is easily done by asking the patient to rate his or her anxiety on a scale of 1 to 10 and adjusting the pace of the rehearsal accordingly. Generally, if a patient rates his or her anxiety as 5 or lower, the rehearsal moves to the next step. If the patient’s anxiety is rated a 6 or higher, the patient is encouraged to use the breathing skills until he or she feels calmer, and then that step of the hierarchy is repeated.

Dentist: OK, we’ll begin by using the mirror to hold back your cheek so I can see your teeth and gums. Take a deep breath now, yes… just like we practised…

Dentist: I know that is hard for you. On a scale of 1 to 10, where 10 is very upset, how upset were you during that step we just did? Five? That’s great. We’ll go on to the next step…

Dentist: OK, now I am going to place the syringe and the capped needle in your mouth. Remember to breathe now… I am about half done now, three-quarters done… there, now we’re finished. How was that?

Patient: Whew. That felt like the real thing.

Dentist: Yes, it is amazing how much we can imagine. Give me a rating again on my 1 to 10 scale. How upset were you?

Patient: Seven… no, maybe eight.

Dentist: Thanks for telling me that. Let’s have a sip of water and we’ll practise that step again. We want to be sure that you’re feeling comfortable before we move on to the next step. Remember to breathe…

Most patients pass through this hierarchy fairly rapidly, although some will require longer. Ideally, this is done at an appointment separate from the one where sedation and treatment will be provided. If you get through at least part of the protocol, it will increase your chances of success with the patient. The patient should be encouraged to use the same breathing technique when the cannula is placed or when relative analgesia is administered. Practising beforehand will make even the most upset patient easier to treat and require lower doses of medication.

In situations where the patient is slow to move through the hierarchy, the dentist should assign homework.

Dentist: During the next week, before we see you again, I need you to do some homework.

Patient: Well, I am pretty busy…

Dentist: It will only take a few minutes each day and it will greatly improve the outcome of your sedation appointment.

Patient: OK, I’ll try it…

Dentist: You’ll need a comfortable chair in a place where it is quiet. Sit in the chair and do the breathing exercise we’ve practised. Do you remember how to do this? Some people like to kick off their shoes when they do it.

Dentist: OK, now focus all your thoughts on the dental syringe with the needle. Make sure you can see it in your imagination. Think of it in your mouth.

Patient: That seems awful. Why do I want to think about getting a shot when I’m at home?

Dentist: Each time you imagine the syringe, take another series of breaths. Each time you do this it will get easier. If you can imagine this really vividly at home, and still be able to relax and do your breathing exercises, it will be easier for you to get an injection here. OK, take another long breath and relax.

Dentist: Will you do it? When during the day do you think you can manage it? Would it be easier before you go to work, or at night, before you go to bed? Do you think you can do this practice every day?

Try to get a commitment from the patient to practise. Patients who don’t practise, in our experience, will be especially difficult in the surgery. Most patients, on the other hand, will work hard to reduce their fears. It is also sometimes helpful to give the patient a simple diary in which he or she can note down the times when he or she practises.

All such treatments should be accompanied by suggestions of ‘self-efficacy’. All success in treatment
should be attributed to the patient’s response to these behavioural rehearsals rather than to the drug treatment alone. Recognising that the sedated patient will not remember such praise, it is good to offer it at the rehearsal-prep stage so it can be remembered. It is also useful to give the same message to the patient’s escort and/or family. Similar messages can be given in follow-up telephone calls. Such an approach is designed specifically to increase the probability that the patient will seek further preventive care.

It is important to set realistic goals. Some patients may believe that unless they are completely relaxed (i.e. 1 out of 10) they have failed at managing their anxiety. It is important for the dentist and staff to provide praise and encouragement to patients, no matter how minimal the change might seem to the patient. For example, a patient who previously rated his or her anxiety at 8 out of 10 during rehearsals is now able to receive an injection with anxiety at 5 out of 10. While the patient is still anxious, he or she has made great strides in being able to receive an injection while taking active steps to manage his or her anxiety.

In the future, patients will often graduate to having regular simple care done without sedation or with only low levels of nitrous oxide, reserving sedation for procedures that are longer or potentially more painful.

Conclusions

The purpose of this paper is to suggest ways in which dental practitioners may provide their patients with behavioural anxiety-management skills prior to the sedation appointment. Delfino⁶, reporting on the results of a Gallup poll, found that while over half (56%) of respondents expressed a desire for amnesia-producing anaesthesia for oral surgery, nearly all respondents (98%) stated that they preferred having information about the procedure prior to receiving care. This suggests that while patients may present for sedation claiming that they ‘just want to be knocked out’, the majority of patients desire and benefit from some kind of pre-surgical preparation for treatment. Brief instruction on anxiety-management skills can easily be included when giving patients information on the planned procedures.

As previously mentioned, the purpose of providing these skills is not to circumvent the need for sedation, nor to provide psychological therapy to fearful patients. Rather, the goals of providing patients with anxiety-management skills are to reduce patients’ physiological arousal prior to administration of sedative agents and to increase their perceived ability to cope with dental procedures. Ideally, patients will come to trust their own abilities to cope with dental treatment and see pharmacological adjuncts as simply helping ‘take the edge off’, rather than as the only way they are able to tolerate treatment. A bit of extra time taken by dental providers prior to treatment can reap long-lasting benefits for patients and the overall practice.

SAAD has recently agreed to help support the production of a computer-based fear-reduction program that allows patients to overcome their dental anxiety on their own or with minimal professional help. The program was developed at the Dental Fears Research Clinic at the University of Washington and is being adapted for the UK by colleagues at the King’s College Dental Institute. Hopefully, SAAD members will be among the first dentists to make such an approach available to their patients.

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CHRIS DICKINSON

I currently work in the Department of Sedation and Special Care Dentistry at the KCL Dental Institute at Guy’s Hospital. After qualification in 1983 I initially worked in general practice but returned to the hospital service with posts in oral surgery, prosthetics and periodontology, and completed an MSc in Prosthetic Dentistry at the Eastman in 1991. I am on the specialist list in prosthodontics.

During the 10 years spent working in the Department, I gained a teaching qualification, became an examiner for the NEBDN Certificate in Sedation Nursing and worked my way up to Dental Nurse Manager in the Department until being promoted to Head of Nursing for Dental Services in October 2003. My current role involves clinical and management responsibility for all dental nurse services within the Dental Institute at Guy’s and St Thomas’ NHS Foundation Trust.

I became a member of the SAAD teaching faculty in 1999 and continue to teach on both the Dentist and Dental Nurse courses.

I am a very sociable person outside work and enjoy cooking and entertaining. I have recently developed an interest in motorcycle touring and plan to travel abroad in the near future. I like to keep fit in the gym but equally enjoy relaxing times with my partner.

EMMA CRADDOCK

Afer qualifying as a dental nurse in 1991 at Guy’s and St Thomas’ Hospital, I worked in the Oral Surgery department, during which time I gained the NEBDN Certificate in Dental Sedation Nursing, enabling me to join the Department of Sedation and Special Care Dentistry in 1993 as a Specialist Dental Nurse.

During the 10 years spent working in the Department, I gained a teaching qualification, became an examiner for the NEBDN Certificate in Sedation Nursing and worked my way up to Dental Nurse Manager in the Department until being promoted to Head of Nursing for Dental Services in October 2003. My current role involves clinical and management responsibility for all dental nurse services within the Dental Institute at Guy’s and St Thomas’ NHS Foundation Trust.

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I am a very sociable person outside work and enjoy cooking and entertaining. I have recently developed an interest in motorcycle touring and plan to travel abroad in the near future. I like to keep fit in the gym but equally enjoy relaxing times with my partner.
JOANNE RUSHFORD

I qualified as a dental nurse at Guy’s and St Thomas’ Hospital in 1998. Following this I gained the NEBDN Certificate in Dental Sedation Nursing, and the NEBDN Certificate in Special Care Dental Nursing which enabled me to work in the Department of Sedation and Special Care Dentistry as a Specialist Dental Nurse. In 2003 I was promoted to Senior Dental Nurse, managing a team of nine Specialists. This role enables me to utilise my teaching skills to support the education of postgraduate and undergraduate dentists and dental nurses.

I recently took part in the making of a DVD for ‘Smile On’ and feature as the dental nurse dealing with medically compromised patients and those with special needs.

I became a member of the SAAD teaching faculty in 2002 and regularly teach on the Dentist and Dental Nurses courses.

Outside work I enjoy spending time with my partner of two years, who I met on holiday and who has since moved to London from Newcastle. We have a common interest in music, which takes us around the country to live concerts. I enjoy travelling and planning holidays and have a busy social life with my family and friends.

JOHN TIERNAN

After graduating from Trinity College Dublin in 1980 I worked as an associate within a general dental practice in Kent before purchasing my first practice in Waterlooville, Hampshire in 1981. In 1994, following the conversion of the practice to private dentistry in 1989, I decided to further develop my association with Dental Protection (having worked with them on a part-time basis in 1993) and transferred to the newly opened Leeds office as a full-time Dento-legal Adviser.

Currently Assistant Dental Director of Dental Protection and still based in Leeds, I have lectured extensively (both within the UK and internationally) on the subject of risk management. A regular contributing author to The Dentist magazine (since 1987) and member of the Editorial Board, I continue to try to raise awareness among the profession on general developments and trends within dentistry. More recently I have been appointed Professional Adviser to the Independent Review of Medical Card Scheme in the Republic of Ireland and Honorary Editorial Adviser to the Hong Kong Dental Journal.

During my time at the General Dental Council (elected member 1991–2001) I chaired the working party that introduced specialist lists into UK dentistry, which involved me in extensive liaison with the various specialist groups.
My association with SAAD has seen me lecture for the faculty since 1995, and I played a role in the expert working group ‘Standards in Conscious Sedation for Dentistry’ in 2000. I enjoy the opportunity to highlight for colleagues some of the risk management opportunities afforded by improved communication techniques and am delighted that these techniques can be employed by the whole team. Case studies and the chance to discuss various scenario outcomes guarantee to keep me on my toes during SAAD training events.

Maire and I live in North Yorkshire, our two sons having finally departed the family home, where we enjoy entertaining friends, walking and playing golf – at which I’m not really competitive! Sadly, however, my enjoyment of sailing has been restricted by our location.

CHRIS WRIGHT

Hello! I am an Associate Specialist in primary care at Birmingham Dental Hospital. My principal duties are within the Oral Surgery department providing care to apprehensive patients undergoing invasive dental procedures. I also lecture and demonstrate to undergraduates and postgraduates in the fields of conscious dental sedation, oral surgery, management of medical emergencies and resuscitation.

I qualified from Birmingham Dental School in 1966. Following house surgeon jobs at the Birmingham Dental Hospital and General Hospital, I joined my father in his group practice as an associate. This was in the days when general anaesthesia was provided as a norm in general practice. During this time, I administered hundreds of general anaesthetics to ambulatory patients. At the same time I held a clinical assistant post at Birmingham Children’s Hospital providing care to special-needs patients, whom I treated either under GA in theatre or relative analgesia in the outpatient clinic.

Later I became a part-time lecturer at Birmingham Dental School as well as maintaining my interest as a principal in general practice. It was from the mid-1970s that I started to offer treatment to my patients under IV sedation following a course with SAAD. I helped to start and develop the sedation teaching course at Birmingham Dental School. At this time I was actively involved with Birmingham Local Dental Committee, eventually to become chairman. I joined the DSTG just after its inception, as the Birmingham University representative, and subsequently became a member of the SAAD teaching faculty, together with being a member of ADA.

I retired from general practice in 2004 to take up my current post, which is for three days a week. The rest of the week I provide consultation services to local practices in oral surgery and sedation and demonstrate on various courses throughout the country.

I am a keen fixed-wing pilot, having gained my licence late on in life, and have visited most of the UK together with the near-Continent. I enjoy the odd round of golf but lose far too many golf balls. I am a keen walker and have recently taken up the sport of cycling to fight the flab.

Other members of the faculty not profiled here: Carole Boyle, Mike Clarke, David Craig, Derek Debuse, Christopher Holden, Avril Macpherson, Toni Philpot, Nigel Robb and Michael Wood.
The Annual Conference took place on Saturday 23 September 2006 at the Royal Society of Medicine, London, and was entitled ‘Pain and Anxiety Control in Medicine and Dentistry’.

The President, David Craig, welcomed delegates and stated that the theme of the meeting was ‘learning from other specialities’. David highlighted the fact that dental guidelines in conscious sedation led the field and that SAAD was a potent force that kept dentistry in the forefront. He also thanked Carole Boyle and Barry Devonald (two of SAAD’s Trustees), Fiona Wraith, SAAD Executive Secretary, and Busola Adesanya-Yusuf, Specialist Society Coordinator, for organising the event.

David had great pleasure in welcoming Professor Peter Milgrom, SAAD Visiting Professor in Pain and Anxiety Control for Dentistry at King’s College London Dental Institute, to the Conference. Professor Milgrom was to deliver two lectures during the day. Last year’s Conference had investigated sedation practice in Europe, so it was a logical development to learn about pain and anxiety control in the United States.

In his first paper Professor Milgrom took us on a short tour of his home city and his work base at the University of Washington, both of which are in Seattle, before outlining trends in current anaesthesia practice in the United States. Some salient points mentioned were the dominance of oral surgeons in this field, the development of the Dental Organization for Conscious Sedation, the lack of a coherent structure for paediatric conscious sedation and the difficulty in applying standard sedation protocols across the country.

His second paper, which focused on new sedation techniques, was a discussion of the use of Triazolam. Professor Milgrom also has an interest in psychological techniques for the control of anxiety, a subject that conveniently dovetailed with the presentation given by Professor Isaac Marks, who is Professor Emeritus at the Institute of Psychiatry.

In his paper, ‘Self-help for anxiety in dentistry’, Professor Marks described how behavioural techniques could be applied to reduce fear in dental patients. A computer program, FearFighter, was used by patients with specific phobias; a graded self-exposure process was used as a means of self-help. This might be carried out in a remote location using the software on a home computer or on the Internet; these methods reduced therapist time by 80%. Dentists suffering from burnout could also be treated by this technique. Two interesting one-liners given by Professor Marks were ‘What a patient learns when drunk they don’t retain when sober’ and ‘Tell, show, do – don’t rush’.

Mike Clarke from Dental Protection gave a comprehensive presentation, ‘Medico-legal aspects of managing the anxious patient’; his delivery style was exceptionally engaging! Mike highlighted the crucial issues of the characteristics of excessively anxious patients and how the dental team might manage these individuals in order to reduce the risk of generating complaints or worse.
Unmistakable trends in US anaesthesia practice have emerged in 2006. These trends are 1) a movement of surgery away from the hospital to outpatient facilities including dental offices and consequent concerns about the safety of surgery and anaesthesia in outpatient facilities; 2) renewed attention to the safety of the single operator in oral surgery sedation practice; 3) a shortage of trained dental anaesthetists and development of the Dental Organization for Conscious Sedation with expanded use of stacked-dose oral benzodiazepine conscious sedation and increased scrutiny and governmental regulation; 4) a paucity of definitive clinical research on dental sedation for children, and its poor quality; 5) patient dissatisfaction with both dental conscious sedation and general anaesthesia in adults; and 6) emergence of effective behavioural treatments for dental fear leading to improved attendance. The paper reviews pharmacological agents used in current US dental anaesthesia practice and trends.
NEW SEDATION TECHNIQUES IN THE USA

Peter Milgrom

The shortage of trained anaesthesia providers in dentistry and limited training opportunities for dentists in general practice has led to the development of multiple-dose oral sedation techniques that mimic intravenous sedation. These clinical regimens are largely taught outside the dental schools and are generally little regulated by the government. The clinical application of these techniques has preceded any systematic scientific investigation. The paper presents pharmacokinetic and clinical data on stacked-dose administration of triazolam (Halcion®) as well as intra-oral flumazenil. It suggests that the technique has clinical application but has the potential for deeper than intended sedation.

SELF-HELP FOR ANXIETY IN DENTISTRY

Isaac Marks

Patients’ fear of dentistry is very common and often leads to chronic and serious dental neglect. It is eminently treatable by the behavioural method of self-exposure therapy aided by the dentist’s carefully graded dental procedures negotiated with the patient. The dentist’s extra time required is rewarded by several payoffs. Computer-aided self-help for phobias saves much therapist time, is effective, and is recommended by National Institute for Clinical Excellence (NICE). Dentists’ fear of dentistry with burnout can also be treated successfully by graded self-exposure therapy.

THE USE OF SEDATION IN MEDICINE

Andrew Morley

The careful use of sedative agents allows clinicians in many medical specialties to perform procedures on patients who would otherwise find them intolerable. Successful sedation in these situations removes the necessity for general anaesthesia with its potential clinical, logistical and economic consequences.

The fact that sedation is used in such diverse environments by clinicians of different backgrounds has meant that the techniques and agents used vary enormously. The extent and nature of training undergone by those medical and nursing staff who administer sedation and care for sedated patients is also specialty-dependent.

There is some justification for this as each clinical discipline presents its own particular challenges in terms of patient sedation. Sedation for magnetic resonance imaging, for example, is often conducted in remote parts of the hospital. In the accident and emergency department, sedation may have to be conducted out of hours with a degree of urgency in patients who have recently ingested large quantities of alcohol, drugs or chips. Endoscopy and bronchoscopy have a procedure-related mortality of up to 1:2000 and sedation for these investigations inevitably involves airway issues. The intensive-care unit raises a number of particular problems and will not be discussed further in this article.

Until relatively recently, there were no general standards for sedative administration. The first all-embracing cross-specialty guidelines for adult patients were published in 2001 by the UK Academy of Medical Royal Colleges and their Faculties (UKAOMRC): ‘Implementing and ensuring safe sedation practice for healthcare procedures in adults’. Among other things, this report was commissioned in response to concerns about compliance with the various specialty-specific guidelines that predated it.

The UKAOMRC report starts by posing, and attempting to answer, a number of questions about sedation practices in medicine. Existing guidelines are summarised and the lack of adherence to them is noted. As to whether harm results from this, the paucity of epidemiological data is acknowledged. The report, however, includes some of the supporting anecdotal evidence to this effect and describes some of the known adverse physiological effects that occur during procedures under sedation. Different
sedation methods are discussed. The report refers to the fact that most sedation users never attend formal courses of instruction – among the specialities, dentistry is cited as an 'honourable exception'.

The UKAOMRC report finishes with some recommendations of its own, including formal assessment of patients before sedation, the availability of a referral service where problems are anticipated and the use of predetermined discharge criteria. As far as drugs and techniques are concerned, the report is not overly prescriptive but states that, whatever method is used, the clinicians involved should be familiar with it and receive appropriate training. Secure intravenous access should be established and any relevant specific antagonists should be to hand.

In a reference to different sedation techniques in the US, where deeper levels are deemed acceptable, the recommended target state of 'conscious sedation' is carefully defined. Monitoring and equipment issues are covered, including oxygen administration and pulse oximetry. The use of head-down trolleys and the immediate availability of suction apparatus and resuscitation equipment are advised.

The UKAOMRC’s clinical recommendations are necessarily general, given that they are meant to be applied in all situations where procedural sedation is given. Matters of national and local administration are also covered in the report. These include the role of the Royal Colleges and others in dictating safe sedation techniques and defining the nature of formal postgraduate sedation training. Hospitals are expected to audit the process and outcome of procedures performed under sedation, and to appoint consultants to lead the implementation of UKAOMRC recommendations.

The response at national level has been impressive. In 2001, the year of the UKAOMRC report, guidance on the use of sedation during diagnostic or therapeutic procedures was also issued by the British Thoracic Society and the Royal College of Ophthalmologists. Similar guidance (updated or altogether new) has since been published by the British Society of Gastroenterology, the Standing Dental Advisory Committee, the Royal College of Radiologists and, for paediatric sedation, by the Scottish Intercollegiate Guidelines Network.

At local level, things are rather different. Three years after the UKAOMRC report, it was clear that only a small minority of hospitals were making efforts to implement the recommendations. Whether there has been any substantial progress since then is doubtful.

The first adult sedation policy in Guy's and St Thomas' NHS Foundation Trust (GSTT), which incorporates 1,250 beds in two teaching hospitals, was devised over two years and finally activated in 2004. It is based closely on the UKAOMRC report and was designed to incorporate any pre-existing examples of good sedation practice in the Trust. In accordance with the UKAOMRC recommendations, a consultant anaesthetist – the author – has responsibility for sedation matters in the Trust, together with individual departmental directors.

The policy was written so as to encompass the widest variety of safe approaches to sedation but, despite the close involvement of the many relevant departments throughout the drafting process, compliance has been patchy at best. The main barrier appears to be the additional administrative and logistical burden for senior clinicians, especially in respect of training.

Training requirements for those administering sedation are alluded to in only the most general terms by the UKAOMRC report, and in the various relevant College guidelines. At GSTT, training was discussed at length in a multidisciplinary meeting during development of Trust sedation policy. At the suggestion of the nursing management, the training requirements for staff monitoring sedated patients ('sedation assistants') were
made less onerous than those for staff administering sedative agents (‘sedationists’).

Sedation assistants are required to have current Basic Life Support certification and to have completed a competency framework – a series of points which need to be discussed with, and signed off by, a member of departmental staff experienced in sedation. Sedationists are required to have Intermediate or Advanced Life Support certification. They have their own competency framework to complete and are also required to provide a logbook of 25 cases for which they have administered sedation under the supervision of an experienced colleague. Finally, both sedationists and sedation assistants complete a short intranet-based multiple choice questionnaire. In recognition of the comprehensive training system already in place for dentists in the Trust, and the particular issues involved in dental sedation, MCQ questions and competencies for dental staff differ slightly from those for non-dental staff.

From the very start of the drafting process, it was clear that the work of the hospital had to go on while those already involved in sedation fulfilled the new training requirements. To this end, departmental directors were asked to nominate at the outset members of their staff whom they deemed suitably qualified, by virtue of experience, to act as sedationists and sedation assistants. The intention was that these staff members would be responsible for continuing the clinical workload and assisting junior staff in completing their competency frameworks and logbooks.

The policy is due for review this month and the revised version will run for a further two years. It is to be hoped that compliance will start to improve, though the imposition of a single set of rules on independent clinicians from a wide range of specialties is never going to be an easy political task without support from the highest levels of management.

As to the future nationally, the issue that is likely to dominate discussion about sedation in the UK for some years to come is: ‘What drugs may be given, and by whom?’ With the recent advent of anaesthesia practitioners in the UK, might we eventually adopt US-style practices? The long-standing existence of nurse-anaesthetists there has probably facilitated the dissemination outside the operating theatre of ‘anaesthetic secrets’ such as propofol – widely used in the US by non-anaesthetists during procedures such as colonoscopy. Ketamine, too, is increasingly being discovered and used for sedation by clinicians at UK hospitals.

It is futile for anaesthetists to become resentful or obstructive about these changes when economic factors preclude the presence of an anaesthetist every time a sedative is administered in the hospital. A more constructive approach is to offer our expertise in the development of sedation services, to be available for advice in advance of difficult cases and, if all else fails, to pick up the pieces when things go wrong.

MEDICO-LEGAL ASPECTS OF MANAGING THE ANXIOUS PATIENT

Mike Clarke

Most of us pride ourselves on our ability to deal with anxious and nervous patients. It is a very definite skill that not all dentists have and requires not only a high degree of clinical expertise, but also a great deal of empathy. The latter is perhaps a little odd as most of us would surely agree that we have never been in the position ourselves. Dental treatment, in theory at least, should hold no fears for the average dentist. As such, then, we have little or no idea of what it must feel like to be so anxious that attending the dentist is difficult, to say nothing of these patients for whom sitting in the dental chair is a monumental task.

The really anxious patient is a rare phenomenon and perhaps represents far less than 1% of the population. Most of these patients would be unlikely to accept dental treatment whilst awake and will continue to place a
demand on hospital services for GA. By contrast, the average anxious patient is relatively common and is seen in most practices on a daily basis. It follows, then, that in order to understand the medico-legal problems that come with the anxious patient, the clinician must not only understand the nature of anxiety, but also appreciate the difficulties that it causes.

Research shows that the anxious patient brings with him or her a lot of acquired baggage drawn mainly from such aspects as apparent poor experiences in childhood, a lack of understanding of dental procedures and most importantly a feeling of not being in control and embarrassment at their own actions. Treating this patient, then, requires a new set of skills that unfortunately are not taught at dental school to any great degree and are generally learned much later in the clinician’s career, mainly by experience or, even worse, trial and error.

**Surroundings**

Before even entering the surgery the anxious patient is already ‘on guard’. All too often he or she will question even the most innocent of requests, assuming that there is some ulterior motive. Considering the surroundings of the dental practice through the eyes of the anxious dental patient is therefore quite significant and may indeed prevent an argument or disagreement before it starts. Such seemingly mundane items as pamphlets, pictures and posters displayed in the reception area can have a very negative effect on the anxious patient, particularly if decayed or even perfect teeth are shown. Within the surgery itself the arrangement of the equipment, dental drills and instruments can be intimidating to patients even if they are non-threatening. Curing lights in particular are said to be seen as some form of laser whilst even the sight of a simple radiograph can elicit an unreasonable response in the susceptible patient.

Sound, and in particular the high-pitched whine of the dental turbine, is also a significant factor in the fear of the anxious patient, as it presumably brings with it images in the patient’s mind of the assumed pain of having teeth drilled. It is also worth bearing in mind that the noise made by a suction motor and compressor are often mistaken as being a ‘drill’. Conversely, music and even the chatter of the radio will divert the patient’s attention and therefore produce a comforting effect.

Even such aspects as colours can create undesired feelings of fear arousal, with reds, dark or vivid blues, yellow and dark greens being most at fault, whilst the so-called calming colours (light blue, pink and grey) are said to help relaxation. Paying attention, then, to the ambience of a practice can be an important first step in treating the anxious patient.

Once in the surgery the anxious patient will often complain of feeling captured. The heart rate rises, the pupils dilate and the skin is cold and clammy. This is a classic reaction to the release of adrenaline and the ‘fight and flight’ response in the central nervous system. In this condition the patient presents the dentist with behavioural and communication problems. It is therefore worth looking at these in a little more detail and considering how best they can be addressed.

**Behavioural Problems**

The classic cartoon figure of an anxious dental patient shows him or her cowering behind the chair, shaking like a leaf. Although some of us probably do have patients who fit into this category, they are rare. The average anxious patient will have enough decorum to try to hide his or her fears, but if you scratch below the surface the signs and symptoms are there.

From the clinical point of view, treating an anxious patient is time-consuming. Many are poor attendees and will cancel at short notice or not turn up at all. Others demonstrate poor cooperation not only in the surgery but even when undertaking oral hygiene at home. It is as if their fear of the dentist is in reality a fear of all aspects of dentistry, however innocuous. For the clinician this leads to a degree of frustration that shows itself through body language and vocal tone. These signals are picked up by the patient quite subconsciously and can further increase his or her concerns.

Most anxious patients are irritable and restless. Typically they shake and shiver. This is relatively easy to deal with simply by having a little patience. But in some cases the movement is a quick or rapid response to even the mildest of stimuli, away from what is perceived to be the source of pain. It follows, therefore, that whilst using sharp instruments or high-speed drills there is a real possibility of damaging the patient’s tissues, if care is not taken.

This restlessness can also show itself as muscle tension. We have all seen patients gripping the arms of the chair, demonstrating the so-called ‘white-knuckle’ clench. Oddly, when this happens in the sedated patient, many dentists will react by suggesting that the patient is too lightly sedated. In reality the sedation is probably of little
importance and it may well be the pain control that is at fault.

For a minority of patients the anxiety is not apparent in the usual way, but manifests itself in aggressive behaviour. Physical aggression is extremely rare, although often joked about: ‘We’re not going to hurt each other, are we?’. More commonly the aggression shows itself in a purely verbal way, possibly in arguments with the clinician or members of staff over the most trivial of aspects. Complaints from an anxious patient can in some cases be a manifestation not of dissatisfaction but of latent embarrassment at his or her actions while in the surgery. Over the years Dental Protection has seen numerous examples of extraordinary letters of complaint threatening all manner of physical and mental injury on the hapless clinician. Thankfully none of these are ever carried out, but can again lead to a degree of frustration. After all you were only trying to help.

Communication Problems
As dental students we rarely if ever learn how to communicate with patients. Teaching in this area is thin, and the necessary skills are expected to be absorbed during the training process, the argument being that if you place students in a particular situation they will learn by their mistakes. Where the anxious patient is concerned, those mistakes can be extremely costly from the medico-legal point of view and can in the most extreme of situations bring to an end a very promising dental career.

Most anxious patients, due to the nature of their anxiety, are extremely poor listeners. They are easily distracted by other elements within the surgery and their gaze wanders from one point to another with remarkable rapidity. All too often their attention span is short, and in order to try to be helpful they will generally agree with everything the clinician says. This combination of factors is hardly conducive to acquiring valid, informed consent as is required by law. Just to make matters even more complicated, most sedative agents have a degree of post-amnesiac effect which may well be extremely useful from the clinical treatment point of view, but can be a nightmare where consent is concerned.

Thus, the prudent clinician will go to great lengths to ensure that the patient understands the treatment that is to be provided, the pros and cons of that treatment and its likely risks and effects. This is often best done at a separate appointment when no dental treatment is to take place. The patient in that situation will be far less anxious and therefore more receptive. Following this discussion, the provision of a written costed treatment plan often pays dividends in helping to protect the dentist from future allegations by ensuring that proof exists as to the valid consent process.

Other Considerations
Regarding the choice of sedative agent, this is very much up to the personal preference of the individual clinician. It is argued that multi-drug sedation, when used with extremely anxious patients, is far more effective, and certainly in my experience this is the case. There does appear, however, to be something of a temptation to perhaps over-sedate these patients, and that in itself can store up problems a later date. A large proportion of anxiety is completely irrational, and obliterating a patient’s senses to any degree can send out the signal to the patient that this is always required to reduce their anxiety. In this respect it is interesting to see how few general anaesthetics are provided for patients these days, when ten or fifteen years ago it was almost commonplace. What is required, therefore, for many of these patients is a little less clinical intervention and a little more clinical adaptation.

Aside from the purely clinical point of view it is of course important not to neglect the administrative side of dentistry. Clear and careful records are required in relation to all dental treatment. Where sedation is concerned additional records are also required to detail the procedures that have been carried out. It is no longer acceptable simply to indicate that a patient had IV sedation without recording details of the drugs used, the timings of administration, treatment and recovery, and what monitoring took place throughout the procedure. In addition, careful records reflecting the initial assessment and the consent process are of paramount importance. The latter, of course, is required as part of the GDC’s guidance. There is nothing more soul-destroying from Dental Protection’s point of view than to see a case that on the face of it is eminently defensible that has to be conceded due to poor record-keeping. Two or three minutes spent at the end of treatment can literally ensure a long and distinguished career.

Finally, then, it is important not to underestimate the medico-legal difficulties that the anxious patient can cause. Having said that, the treatment of these patients can be immensely satisfying. There is nothing more pleasing than a thank-you card from a grateful patient, and nothing more distressing than an invitation to provide your records to a litigation solicitor.

Mike Clarke is a Dento-legal Advisor with Dental Protection and a GDP
DCD: Diana, your name has been associated with SAAD for many years now. How did you first get involved?

DT: I first got involved with SAAD through my interest in the teaching of resuscitation skills. Having been newly appointed as a consultant, and with the setting up of the Resuscitation Council (UK), I was invited by Dr Peter Baskett to be one of the first National Instructors for the new Advanced Life Support courses, and to teach on the SAAD Lifesaver courses which were conceived and run by Peter Hunter. I enjoyed being part of the roadshow for SAAD around the country, and was asked by SAAD Council to take over the running of the sedation courses when Douglas Stewart returned to Australia. I took up this challenge and with the support of an excellent faculty and supportive Council we were able to expand the courses and update the content and delivery.

DCD: Do you come from a medical family?

DT: My parents both came from poor backgrounds in Nottingham and Wigan, and my father read medicine at King’s in London, working as a GP in south London in a practice not unlike that shown in Doctor Finlay’s Casebook on TV.

DCD: When did you decide to become a doctor? Where did you attend medical school?

DT: My mother was Head of Department for Biology at a local school and strove unceasingly to get more girls into medicine, which was then very difficult, with a quota for women undergraduates regardless of ability and discrimination against those with no professional background at that time. I therefore had two highly motivated parents and felt that medicine was a good way to build on their achievements. I studied at King’s in London and very soon identified anaesthesia as my ambition.

DCD: When and how did you decide that anaesthesia was the speciality for you? Do you ever wish that you had done something else?
DT: I chose anaesthesia as the anaesthetists seemed to be such a nice group of people and it was a career which was theoretically compatible with family life and a chance to make it to consultant status. I have never regretted this position and have enjoyed seeing the specialty grow in numbers and fight for recognition. The founding of the Royal College of Anaesthetists was an essential part of the development of my speciality.

DCD: Do you feel comfortable in the company of dentists?

DT: I have always enjoyed working with my dental colleagues, despite two memorably horrible experiences with Trilene in the dental gas room as a child patient having orthodontic extractions. As a junior anaesthetist, I spent many hours in the outpatient GA room at King’s and realised that in the areas of both patient safety and consent we had a lot to learn from each other.

The publication of the Poswillo report and my interest in resuscitation teaching led naturally to SAAD, where there was a great desire among the members to improve standards in dentistry.

DCD: You are also deeply involved with the Association of Dental Anaesthetists. Do you see any scope for further cooperation between SAAD and ADA. A merger even?

DT: As my consultant post involved special-needs dentistry, I joined ADA and soon became involved on the Committee and organised a Scientific Meeting. ADA and SAAD have many areas of mutual interest, and both have a strong culture of multi-disciplinary cooperation. With the many changes in the health services in the UK, all the specialist medical societies are having to look hard at their function and what their members require. Discussions have been ongoing as to how SAAD and ADA can work together to achieve their educational and advisory roles.

DCD: How do you view the future for pain and anxiety control in dentistry? Are you optimistic that dentists will retain control of these useful techniques for the benefit of their patients?

DT: The Autumn 2005 Conference in London was a stark reminder to SAAD members that sedation practice is well developed in the UK and that other European dentists are very restricted in their ability to offer a wide range of pain and anxiety control techniques, with threats over the use of nitrous oxide for sedation. SAAD has an important role in showing the public, the profession and the regulatory authorities that dentists can both regulate and develop sedation for those who need it. We must be quick to show commitment to clinical governance and audit to demonstrate good practice and outcomes; sadly, the Department of Health, which asked SAAD to develop this area, was not prepared to fund the project in the past.

DCD: The SAAD National Courses continue to be very successful. Do you anticipate any changes or expansion in this area?

DT: The SAAD National Courses have been expertly run and developed by Dr Chris Holden and Dr David Craig with an impressive faculty from all over the UK. I would aim to build on the strength of the current courses, and to respond to ideas to develop advanced training for those who have an interest in advanced techniques and paediatric practice.

We also have a role in providing education for our delegates in response to the Resuscitation Council (UK) document on the management of Medical Emergencies and Resuscitation 2006. The courses can only happen with the enthusiasm and skill of the organisers and faculty, and SAAD provides an excellent opportunity for those who have a desire to teach. We are always seeking talented professionals who can work with SAAD to achieve our charitable objects in the provision of education.

DCD: Anaesthetics can be a stressful profession… I know, as my daughter is a 4th year SpR anaesthetist. What do you do to relax when not working?

DT: When not working I love mountains and open spaces. Luckily I live an hour’s drive from the Black Mountains of Wales, and the South West Coast Path and the Cotswold Way are nearby. For longer trips I like to go to the more exotic destinations; this year we visited Bhutan – lots of mountains there! I enjoy attending classical music concerts and have a keen interest in ceramics and studio pottery, though as a follower not a practitioner at present.
A statement from the Resuscitation Council (UK), published July 2006

This statement is an important piece of work that provides the first unified UK guidance for general dental practitioners and their teams, whether they practise conscious sedation or not. This statement has been widely accepted by UK stakeholders and it has been welcomed by the General Dental Council. It is consistent with recent revisions from the Resuscitation Council (UK) on Basic, Intermediate and Advanced Life Support. The statement provides exact standards for training, equipment and drugs for medical emergencies and resuscitation in a general dental practice setting. Any dental practice involved in the delivery of conscious sedation will still be required to comply with the contemporary guidance on conscious sedation.

The statement is summarised below:

- Medical emergencies are rare in general dental practice.
- There is a public expectation that dental practitioners and dental care professionals should be competent in managing common medical emergencies.
- All dental practitioners should have a procedure for the medical risk assessment of their patients.
- All dental practitioners and dental care professionals should adopt the ‘ABCDE’ approach to assessing the acutely sick patient.
- Specific emergency drugs and items of emergency medical equipment should be immediately available in all dental surgery premises. These should be standardised throughout the UK.
- All clinical areas should have immediate access to an automated external defibrillator (AED).
- All dental practitioners and dental care professionals should undergo training in cardiopulmonary resuscitation (CPR), basic airway management and the use of an AED.
- There should be regular practice and scenario-based exercises using simulated emergencies.
- Dental practices should have a plan in place for summoning medical assistance in an emergency. For most practices this will mean calling 999.
- Staff should be given annual updates.
- An audit of all medical emergencies should take place.

It is vital for all dental practitioners and their teams to review their protocols to ensure compliance with this statement. It is likely that the implementation of this guidance will have cost and training implications for most practices.

Copies of the guidance should be obtained from:
Resuscitation Council (UK), 5th Floor, Tavistock House North, Tavistock Square, London WC1H 9HR.
Tel (020) 7388 4678
Email enquiries@resus.org.uk
Website www.resus.org.uk

Paul Averley
FORUM

SAAD FORUM QUESTIONS

1. DOES A GDP OFFERING DENTAL SEDATION NEED AN AUTOMATED EXTERNAL DEFIBRILLATOR (AED)?

*Alec Crighton writes:* No dentist is currently required by law to have an AED. The guidance recommended by the Resuscitation Council (UK) makes the provision of defibrillation on dental premises ‘best practice’, and all dental teams should be moving towards being able to offer defibrillation as part of their medical emergency care. Dentists offering sedation are expected to have a higher level of training in managing sedation-related complications and monitoring equipment than non-sedation practices. There is no evidence to suggest that the use of simple sedation techniques increases the need for an AED, but it is required for those using ‘advanced’ techniques, for whom early adoption of defibrillation provision may be considered a logical extension to their care package.

Many companies selling defibrillation equipment will also provide basic training in the use of their equipment. Although most AEDs work in a very similar manner, it is important that any training is given to the dental team on the AED they will use and that team rather than individual training is given. Training is usually organised at a local level by primary care trusts, either through in-house resuscitation training teams or by private providers, usually individuals trained to paramedic level. Often the local postgraduate dean can be helpful in locating a suitable training provider.

*Michael Wood writes:* Current sedation guidance does not require dentists practising sedation to have an AED. Recent guidance issued by the Resuscitation Council (UK) recommends that in all areas where dentistry is performed, an AED is available and that dental staff are trained appropriately in its use in an emergency scenario.

2. HOW CAN THE DENTAL SEDATION TEAM BE TRAINED?

*David Craig writes:* The short answer is go on a SAAD course or equivalent! The long answer runs to the whole chapter on training in the new handbook! It is imperative to follow current GDC and DoH guidance. This guidance emphasises the importance of supervised clinical practice. Suggested amounts of this practice are contained in the DSTG’s document *Training in Conscious Sedation for Dentistry*.

*Michael Wood writes:* Training in sedation can take various forms:

- Formal courses like the triannual SAAD course or Section 63 courses where staff members (dentists and nurses) receive documentation of attendance.
- Mentors can help provide training for specific practices. A list of mentors in your area will shortly become available on the SAAD website.
- In–practice training can take place in practices already providing sedation. The new team members can shadow and model more experienced members of staff and can learn skills in the surgery (hands-on training). This training should be carefully documented for each member of staff.

Resuscitation training would best be obtained from the resuscitation department of your local NHS Trust.

3. I AM IN GENERAL PRACTICE. WHERE CAN I GET MY PULSE OXIMETER CALIBRATED? HOW OFTEN SHOULD IT BE CALIBRATED?

*Michael Wood writes:* Pulse oximeters can be calibrated by the specific manufacturer. What I tend to do is attach two pulse oximeters to my fingers and check the readings.
If the readings are out by more than 1%, I swap the finger probes over and retake the readings. Over the 10 years that I have been involved in sedation, I have not found any problems with the calibration, but problems frequently arise from the finger probes or from the cables and their attachments to the pulse oximeter. I recommend that this is done at least once a year. If any further problems arise or you are struggling to get your oximeter calibrated, our SAAD sponsors, who frequently advertise in the SAAD Digest, will be helpful.

4. ORAL SEDATION PRIOR TO IV SEDATION? IF OK, WHAT IS THE BEST DRUG AND THE NORMAL RECOMMENDED DOSE?

Avril Macpherson writes: Oral sedation may be used in patients where the titratable techniques are not appropriate, e.g. in the case of anxiety about cannulation. The degree of sedation produced may be as deep as IV sedation and therefore the sedationist must be trained in IVS and must gain experience in the use of the oral drug used. The most commonly used drugs in the UK are temazepam (up to 30 mg) and midazolam (up to 20 mg). The drug should be given under the supervision of the sedationist and the patient monitored clinically and with pulse oximetry. If possible, once sedation is established, a cannula should be inserted. It is possible to give additional sedation via the IV route, but due consideration should be given to the pharmacokinetics and pharmacodynamics of the drugs used. Midazolam does not have a product licence for oral administration in the UK so patients and clinicians need to be aware that the drug is being used off licence.

Michael Wood writes: Oral sedation should only be used by practitioners who are experienced in IV sedation. The use of the term ‘oral sedation’ infers that the aim is to provide a level of sedation where the patient would be sedated with an oral dose of drug. On the other hand, I think that what you are enquiring about is premedication. A premedication is a prescription of a low dose of sedative to allay a patient’s fears prior to a dental appointment. This may be taken the night before the appointment or a few hours prior to the appointment. The usual dose is 2–10 mg of diazepam orally the night before, on waking and, if the patient has an afternoon appointment, another dose two hours prior to the appointment. This may take place outwith the surgery environment.

If the intention is to get the patient to a deeper level of sedation than just anxiolysis for the dental appointment, i.e. in uncooperative patients, whether for reasons of age, involuntary movements or possibly needle phobia, I would prescribe 20 mg of midazolam orally and then cannulate the patient. Consent, including specific consent for ‘out of licence’ use of midazolam, must be sought prior to its administration. Patients could then be cannulated at about 20–30 minutes.

Adults may alternatively be prescribed 20–40 mg of temazepam orally 45 minutes prior to the dental appointment – but the administration and the monitoring of this drug must take place within the dental practice under the supervision of the dentist or sedationist.

For both of these sedation techniques it is assumed that the sedationist is experienced in cannulation and has the reversal agent flumazenil (Anexate) at hand. Monitoring of the patient is as for IV sedation.

5. PLEASE COMMENT ON INHALATION SEDATION IN CONJUNCTION WITH IV FOR PATIENTS WHO ARE EXTREMELY NERVOUS. IV SEDATION ALONE IS NOT ALWAYS EFFECTIVE.

Avril Macpherson writes: Inhalation sedation and IV sedation may be used in combination. It is important to titrate the nitrous oxide/oxygen to the patient’s response initially and then titrate the IV drug carefully. This edition’s Journal Scan includes the abstract of a well designed trial looking at the safety and efficacy of inhaled nitrous oxide/oxygen and IV midazolam as a combined technique.

6. PLEASE COMMENT ON INHALATION SEDATION PRIOR TO IV SEDATION FOR PATIENTS WHO ARE EXTREMELY NERVOUS. IV SEDATION ALONE IS NOT ALWAYS EFFECTIVE.

Michael Wood writes: Inhalation sedation is useful prior to cannulation for various reasons:
- Anxious and needle-phobic patients may feel more relaxed and may more readily accept venepuncture.
• The analgesic effect of the nitrous oxide may mask the pain of injections – both during cannulation and during intra-oral injections. Analgesic benefits continue while the nitrous oxide is being administered.
• The nitrous oxide and the midazolam have separate modes of action and potentiate each other's sedative effects – some patients enjoy the added euphoria associated with the nitrous oxide.
• It is possible that during co-administration of these two drugs the patient would require a smaller IV midazolam dose, allowing faster recovery from sedation. From a safety point of view, the patient remains well oxygenated throughout the administration. A word of caution, however – during co-administration of nitrous oxide and IV midazolam the saturation may remain high and will mask any clinical respiratory depression – so keep monitoring the patient on the pulse oximeter well into recovery.

7. WHAT ARE THE CURRENT THOUGHTS REGARDING THE USE OF PROPOFOL IN IV SEDATION IN CLINICS?

Michael Wood writes: Intravenous propofol should only be used by people who have been trained in the appropriate use of the drug. Only those teams who have the necessary training and experience can use this drug in the clinic environment.

Nigel Robb writes: Propofol is undoubtedly a useful sedative drug with many advantages. It is very different to use from midazolam, and produces a completely different character of sedation. The technique is currently one where a separate sedationist is normally recommended, and this, coupled with the high cost of the equipment, has tended to limit the use of propofol in dentistry. As with any sedation technique, it must only be practised by those with the appropriate training (including supervised clinical practice).

8. ANY STUDIES ON COMPLICATIONS WITH THE USE OF IV SEDATION IN THE UK? MAJOR AND MINOR COMPLICATIONS, RATHER THAN THEORETICAL ONES.

Paul Averley writes: I have done a fairly extensive search for UK published studies on complications with IV sedation and come up with a blank. Apart from the theoretical ones in the textbooks there is no evidence base for UK-specific complications.

Nigel Robb writes: This is an area that has concerned many of us for some time. We keep saying that sedation in dentistry is safe, but we have no evidence. The assumption is made that because we don't see the sort of headlines that were all too common in the GA-in-practice days everything must be OK. When the Department of Health in England published the report *A Conscious Decision* in 2000 one of the recommendations was that the complications of sedation should be audited. It was suggested that SAAD should be the organisation responsible for monitoring morbidity associated with conscious sedation in dentistry. This never happened, mainly because there was no funding forthcoming to facilitate it.

Michael Wood writes: No, not in dentistry. One interesting study worth noting was in the field of gastroenterology (Quine, Bell and McCloy 1995) where 14,149 patients were treated in 36 hospitals where midazolam or diazepam was used for sedation for therapeutic and diagnostic gastroenterological procedures. The death rate for diagnostic procedures was 1:2000 with a morbidity rate of 1:200. Cardiorespiratory problems were most common in this group. There was a strong relation between lack of monitoring and high doses of benzodiazepines and the occurrence of these adverse events. It was also noted that junior doctors endoscopists were performing these procedures unsupervised and with minimal training. It is important to note that some of these patients were sick and not necessarily ASA I or II. Mortality in dental sedation remains rare in the UK – let us keep it that way! ■
Over the next six months SAAD will be involved with the development of a 'Sedation Research Toolkit'. It is hoped that this Toolkit will support conscious sedation research.

Good-quality UK research is needed that fits our UK definition of conscious sedation.

Those who have an interest in conscious sedation have a responsibility to improve the quality of research outputs. This is required to develop the evidence that supports best practice, to support the development of techniques and to allow evidence to shape future service delivery. To do this there are a number of areas that need to be addressed:

- To have an organised and coordinated approach to conscious sedation research. This will require the sharing of projects and ideas to form a UK research strategy. It may be necessary to formulate target areas where the biggest demand and the most evidence is required (e.g. paediatric conscious sedation).
- To agree on validated tools and common outcome measures. This will allow the comparison of studies and increase the significance of their findings.
- To ensure high-quality research outputs that will be picked up by systematic reviews. Dental academic expertise is essential to support this process. It may be possible to gather a willing academic team to lead and support a conscious sedation research strategy.

Reference


Paul Averley
The ADA Summer Meeting 2006 was held in the Hilton Hotel in Dundee on 23 and 24 June. The meeting was organised by the President Dr Nigel Robb.

The Hotel is situated on the shore of the Firth of Tay next to Discovery Point, where the Discovery, the ship that took Captain Scott and his team to the Antarctic, is permanently moored.

The meeting followed the traditional format of a day and a half’s scientific meeting on the Friday and Saturday morning with the Annual Dinner on the Saturday night. The programme covered a number of topical issues in the field of pain and anxiety control for dentistry.

The programme commenced with Dr Martin Foster presenting an interesting discussion entitled ‘The Borders of Incapacity: Who are you calling incapable?’ Martin explored the issues of obtaining valid consent for dental treatment under sedation. Also included was a discussion of how to approach the patient who is incapable of giving consent. The differences between north and south of the border were explored. Martin provided an entertaining and informative presentation drawing both on his dental experience and his legal background.

The rest of the morning session was devoted to resuscitation and the management of medical emergencies. When the programme was put together it could not be envisaged how topical it would turn out to be. Trevor McNulty, who is an RTO from Belfast, presented the ‘New’ Resuscitation Council Guidelines, which although published in November 2005 had only been introduced to clinical practice from 1 April 2006. Many of the delegates had obviously not had their update training between the beginning of April and the end of June, and so this paper was a timely updating. As would be expected from someone from the Province, Trevor’s presentation was extremely amusing as well as informative. He was an ideal choice for this role as, in addition to his employment as an RTO at the Royal Group of Hospitals, he teaches resuscitation in many dental practices.
The second presentation in this area was given by Alec Crighton, who co-chaired the group that produced the Resuscitation Council report ‘Medical Emergencies and Resuscitation - Standards for Clinical Practice and Training for Dental Practitioners and Dental Care Professionals in General Dental Practice’ which was published earlier this year. Dr Crighton was able to explain the background to and the implications of the recommendations.

Needless to say the discussion after the presentations was lively, allowing plenty of time for the presenters to answer the many points that were raised.

After lunch the first session of the afternoon was devoted to the field of sedation for special-needs patients. There were two excellent presentations. The first was led by Jenny Meek, a Consultant Anaesthetist from Fife. Jenny has been a long-standing supporter of ADA, and this was her last meeting prior to retirement. The presentation took the form of a look back at the development of the service and how the pattern of care has changed. There is now a much greater emphasis on the use of conscious sedation, with general anaesthesia services having been centralised. Jenny and her team were able to give us the benefit of their long and varied experience in this area. The second presentation was given by Rachel Pollard, who is a Consultant Anaesthetist from Oxford and a current member of ADA Council. The paper was an audit of current practice.

The third presentation was by Duncan Henderson, from Livingston, who concentrated more on the medical matters of interest when providing a service to special-needs patients. Duncan covered the difficult issue of how to assess these patients, as well as providing a good, common-sense approach to their management.

There were two free papers, and Rachel Pollard again presented – this time on the use of ethyl chloride as a topical anaesthetic prior to intravenous cannulation. The results showed that this was an effective alternative to the other topical agents, and suggested that it be more widely available for use when the alternatives were deemed inappropriate. David Baker then presented an audit that had been carried out within the General Anaesthetic facility of Liverpool Dental Hospital. Amongst his interesting results were the parents’ views that child patients should not be able to refuse treatment, and the fact that the parents would rather they restrained their children than the staff of the unit.

The Presidential Reception and Annual Dinner were held at Tannadice Park, which is the home of one of the two first, class football clubs in Dundee. Dundee United are the only one of the two currently in the Scottish Premier League. The evening started with a drinks reception in the Boardroom before a tour of the stadium led by Ronnie Dare (the head of corporate hospitality at the club). In addition to the tour Ronnie also gave an account of the history of the club, including its fortunes in the European tournaments. The highlights were appearances in the semi-final of the European Cup (now the Champions League) and the UEFA Cup final. Following the tour, the guests were piped into dinner by Graham McLean. Graham is the son of one of the President's cousins. The evening concluded with a bus run back to the hotel.

The AGM was the first item on the agenda on the Saturday morning. At the AGM Dr Ken Ruiz was elected as President-elect, and Ian Tring and Barry Corkey were elected to Council.

Ken is well known in dental sedation circles as an advocate of the use of propofol sedation in dentistry. Ken works at Rotherham District Hospital as a Consultant Anaesthetist. He has served on Council for a number of years, and we congratulate him on his election.

Ian Tring is a Consultant Anaesthetist from Scarborough who has a long-standing interest in anaesthesia for dentistry. Ian was most helpful some years ago when the Certificate in Dental Anaesthetic Nursing was developed as a qualification for dental nurses.

Barry Corkey is a Senior Dental Officer in the Community Dental Service in Fife. He is on the Paediatric Dentistry Specialist list, and has been providing sedation as part of the service that Jenny described at the meeting.

It bodes well that Council continues to attract such experienced members, and it is especially pleasing that the tradition of there being equal representation from both the dental and medical professions continues.

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The subject for the Saturday morning, after the AGM, was antibiotic cover. Once again, when the subject was suggested it was impossible to know just how topical this would be with the publication of the latest guidelines this spring.
The first of the presentations was from Christine Randall, Senior Medicines Information Pharmacist, North West Medicines Information Centre, Liverpool. Christine presented the results of a systematic review she had carried out on the question of antibiotic cover and hydrocephalus shunts. Christine also gave us an insight into the work of the Medicines Information Centres and useful advice on how to contact them for advice. The results of her work were to reassure us that antibiotic cover was not required for this group of patients.

The second presenter was Professor Graham Roberts from KCL in London. Graham's presentation was on 'Infective Endocarditis Prophylaxis and Guidelines'. This subject has been one of Graham's interests for many years. Graham gave us a detailed account of the new guidelines and the evidence behind them. Despite the fact that there have been objections to them, and that the BNF is still publishing the old guidelines, anyone who heard the presentation could not fail to be convinced of the argument that the new guidelines are a huge improvement on what was there before, and that generally the risks of giving the antibiotics outweigh the benefits to the patients!

The meeting closed with the open forum where members were able to air the subjects closest to their hearts. There was a lively and wide-ranging discussion. All who were present enjoyed the meeting and found the programme interesting and informative – the only regret is that more members did not make the journey to the City of Discovery for the meeting.

The next meeting will be the Winter Meeting, which will be held at the Association of Anaesthetists on Thursday, 8 February 2007. The ADA has decided to experiment to see if a midweek meeting will be more attractive to members. The subjects for the meeting will be medico-legal and ethical issues. One of the speakers will be Tom Hayes, the Senior Solicitor at Capsticks, who is responsible for the cases going to the GDC. Further details to follow!
The theme of this year’s Annual Symposium, held on the King’s College campus, London, was ‘Undergraduate sedation teaching. Where are we?’

Carole Boyle, Chairman of DSTG, welcomed delegates, describing how just over a decade ago half a dozen sedationists had met to discuss the establishment of a group with the aim of improving standards of teaching conscious sedation in dentistry. DSTG has now developed into the current thriving organisation.

In order to ascertain what was happening throughout dental schools with regard to undergraduate sedation teaching a questionnaire had been designed and circulated to 14 dental school representatives under the umbrella of DSTG. The purpose of the Symposium was to report on, and to interpret, the findings.

The questionnaire comprised five sections:
1. Who teaches sedation and where
2. Course description
3. Role of DCPs in teaching sedation
4. Protocols
5. Course materials

Chris Bell, of the University of Bristol Dental School, opened the innings with a presentation that discussed results of section 2: ‘Course description’. This set out to determine the extent of the exposure and ‘hands-on’ experience of undergraduates (UGs) of: inhalational sedation (IS) to adult and paediatric patients; intravenous sedation (IVS); observation of, and number of, adult and paediatric IS cases; and observation of, and number of, IVS cases.

Further questions looked at UG sedation experience at outreach centres, teaching of alternative methods of pain and anxiety control and teaching of the use of sedation for those who require special-care dentistry.

Analysis of the returned data showed that most UGs obtained experience in their 4th and 5th years for both IS and IVS, although some schools did not offer UGs access to IS in children and one school did not offer access to IS in adult patients.

However, while UGs obtained experience in IS, only six schools confirmed that all students undertook cases, with five schools stating that the number of cases treated was between five and ten.

Seven schools (50 per cent) confirmed that UGs obtained ‘hands-on’ experience with IS in adult patients.

The extent of exposure for UGs to IVS was greater than for IS with 13 schools (93 per cent) confirming this. The average number of IVS administrations was between one and four but the Dublin, KCL, Manchester and Newcastle schools reported a range of 15 to 20 completed cases.

Ten schools (71 per cent) reported that UGs observed approximately three to five cases of IVS, with one school stating that a video was used in the tuition process.

Regarding cannulation, 13 schools (93 per cent) reported that their UGs gained ‘hands-on’ experience, and in ten of these establishments (72 per cent) the UGs undertook cannulation training on fellow colleagues.

In only three schools (21 per cent) were UGs directly involved in the provision of restorative care to inpatients who were receiving either sedation or general anaesthesia.

Whilst 13 schools had arrangements for UGs to attend and undertake adult assessments in clinics, only seven...
schools (50 per cent) had similar arrangements for paediatric assessment.

Outreach training at community dental or personal dental service sites was available to six schools (42 per cent). Three schools reported UG experience in alternative pain and anxiety control techniques such as hypnosis and psychotherapy. Of the seven schools that reported teaching in special-care dentistry, four said it was done at outreach sites.

In conclusion, all schools were providing access for experience in IVS; however, the picture regarding access for IS was patchy.

Unruffled from the experience of London Transport signal failures, Lesley Longman, Consultant/Senior Lecturer in Restorative Dentistry, Liverpool University Dental Hospital delivered the findings to the questions posed in section 1: ‘Who teaches sedation and where’.

The departments involved across the 14 schools included departments of oral surgery, oral and maxillofacial surgery, restorative dentistry, adult dental health, paediatric dentistry and sedation suites/units. Of the paediatric sites, some stated that a variable amount of training occurred at outreach centres.

Five schools (Dublin, Glasgow, Liverpool, KCL and Newcastle) reported that training was undertaken, though necessarily exclusively, in sedation suites.

The good news was that all schools had at least one lead to coordinate sedation teaching and four stated that it was the leads’ primary role rather than a secondary one. Nine leads were from oral surgery, seven from restorative dentistry, nine from paediatric dentistry and five from sedation suites.

Six schools (43 per cent) had a named consultant anaesthetist who collaborated with the lead dental sedationist. The number of chairs available for dental sedation ranged from one to 23, but Lesley emphasised that the important factor was occupancy.

In summary, there was great variation in who taught sedation and where it was taught, but of critical importance was that every school in the survey had a sedation lead.

Chris Mercer, Senior Lecturer/Hon. Consultant in Restorative Dentistry, Barts and The London, Queen Mary’s School of Medicine and Dentistry gave a thought-provoking presentation on the ‘Role of DCPs in teaching sedation’. Although there were only four questions in the questionnaire, all related to dental nurses (DNs), Chris raised some important ‘teamwork’ issues.

The pivotal and extensive role of DNs in the sedation setting was outlined; it was evident that dentists expected much of their sedation-trained DN. Duties and responsibilities included setting up, chairside assistance, monitoring, patient comfort and support, recovery, removal of cannulae, acting as second appropriate person and teaching. Chris suggested that they were ‘super humans’!

All schools reported that sedation-trained DNs were involved in assisting UGs during the provision of IS and IVS (except for one school that did not teach IS). In twelve schools the DNs assisted with cannulation.

It was significant that in nine schools (64 per cent) DNs undertook cannulation on patients and in all schools DNs either held the NEBDN Certificate in Dental Sedation Nursing or were working towards it.

From the comments section it was obvious that DNs were an invaluable asset who enhanced the learning experience for UGs, who did not always appreciate the skills of the DNs. However, the salient point was that dentists did not give DNs training on how to teach.

Points arising from the ensuing panel discussion highlighted the variance in dental schools with respect to the numbers of UGs, how they were organised, facilities available for sedation training, emergence of outreach training and some of the constraints posed by discharging the GDC’s ‘First Five Years’ imperatives.

Nicole Dunning, Senior Dental Officer, Sedation and Special Care Dentistry, South East Sheffield PCT and Honorary Clinical Teacher, University of Sheffield, reported on section 4, which was devoted to ‘Protocols’. Three main areas were investigated: fasting, escorts and recovery.

There was unanimous agreement from the fourteen schools that patients were not asked to fast for IS, two thirds of schools did not fast those undergoing oral sedation, and there was an almost equal split for those undergoing IVS: six schools indicated ‘yes’ (43 per cent) with eight (57 per cent) stating ‘no’. The length of fasting varied from two to four hours. For patients who had fasted, nine schools (64 per cent) gave a pre-operative glucose drink.
Regarding escorts, only one of 14 schools would commence sedation if the escort was ‘parking the car’, justified because the local parking problems were particularly difficult. There were equal responses to the question, ‘Do you ever treat adult patients under IS if there is no escort?’ Only three schools (21 per cent) would permit escorts to leave premises while treatment was being carried out whilst 10 schools (71 per cent) insisted that patients travelled by private transport.

The age of a responsible escort was deemed to be 18 years by seven respondents (50 per cent), and 11 (75 per cent) would permit escorts to sit in the surgery to witness treatment, although this was stated to be a reluctant ‘yes’.

The results showed that UGs did not have a significant role in the discharge process, and in only two schools (14 per cent) did UGs observe the use of Flumazenil, although a teaching video was used in certain schools.

While nine schools (64 per cent) had a protocol for the administration of sedation, these all varied in their content.

In conclusion, discrepancies between the schools were found in fasting regimes, with the consistencies related to escorts.

Paul Coulthard, Head of Department and Senior Lecturer in Oral and Maxfac Surgery, University Dental Hospital of Manchester delivered section 5, the final part of the questionnaire, ‘Course materials’, which investigated how students monitored their sedation clinical activity, case load, teaching materials and assessment of students.

Most schools used logbooks in which details of skills mastered and number and types of cases were recorded. This was deemed useful not only for training and audit purposes (as it offered the student a mechanism for self-appraisal of performance and for reflection) but also for the lifelong learning process. Logbooks were a useful measure of performance and could be used for formative or summative assessment.

Most schools included questions on sedation in written and OSCE professional examinations and had a recommended textbook, but a wide range was used.

Two Venn diagrams were used by Paul to demonstrate that there was still much to do if the targets of five assessments and 10 IS and 20 IVS cases, as proposed in DSTG’s *The Competent Graduate*, were to be achieved. However, it was emphasised that it was not possible to guarantee that any level of training and experience would produce competence but that these figures represented a sound foundation.

This matter was discussed more fully in the ensuing panel discussion, where it was stated that in the GDC’s ‘First Five Years’ that students should have knowledge of conscious sedation, rather than be competent. It was deemed essential that there be longitudinal clinical pathways so that students could take a patient from the assessment stage to the final outcome and that sedation be demystified so that it was as common as giving local anaesthetic.

The AGM followed the conclusion of the morning’s proceedings. Carole summarised her term of office and described how daunting it had initially appeared but how, with such a supportive committee, it had been a pleasant experience enabling sedation matters to be moved forward at a national level.

The evidence of the questionnaire had disclosed that DSTG targets at UG level were not being achieved, so Carole was able to conclude that there was an important role for the Group. She then gave her thanks for the opportunity to hold this office.

Paul Coulthard, the Secretary, asked members to endorse the Resuscitation Council’s document on Medical Emergencies in the Dental Environment. He reported that DSTG and SAAD would run mentor lists together, which made much sense.

Shelagh Thompson, Hon. Treasurer, presented the accounts; these showed a decreasing deficit from previous years. Membership stood at 393; income from this source that was down as non-payers had been chased up and some members had resigned from the Group. Shelagh had been in the post for six years and this was her final report as she was stepping down.

Elections and appointments to executive posts on the Committee were:

Chairman: Paul Coulthard  
Hon. Secretary: Lesley Longman  
Hon. Treasurer: Chris Dickinson

Paul, in his capacity as Chairman, asked that various ‘tidying up’ constitutional amendments be accepted, and these were duly approved by members.
Next year’s Annual Symposium would be held in Birmingham on the provisional date of Tuesday 8 May 2007.

The afternoon session was dedicated to a series of short papers. Imran Nathoo, an UG at Cardiff Dental School, supported by Shelagh Thompson, delivered the findings of his final year project, ‘What our students think of us’. Staff and students from the UK and Ireland were surveyed; the outcome from the student perspective was that on the whole sedation teaching was adequate, students would like to do more sedation and they found sedation enjoyable. The applause at the conclusion was testimony to Imran’s confident delivery and the high standard of his project.

Francis Collier, Associate Clinical Director, Hertfordshire Community Dental Service, reviewed ‘Undergraduate feedback from the KCL course’. Of students, 90 per cent found staff and dental nurses very helpful, 83 per cent thought the number of patients booked for them was just right, almost all UGs found the introductory course to be satisfactory and 80 per cent enjoyed their time on the department.

Colette Balmer, Associate Specialist in Oral Surgery, Liverpool University Dental Hospital, described the aims of the Liverpool Medical Emergencies course. These were to ensure a sound theoretical knowledge and to increase competence in this area. The course was very intensive and required much hard work from both staff and students.

The integrated firepower of Claire Cole and Marguerite Reith, who serve in the Royal Air Force and Royal Navy (Dental Defence Services), was used to deliver an absolutely scintillating presentation, ‘Sedation in the Armed Forces’. They both had recently gained the Diploma in Conscious Sedation from GKT and described how they were developing this service within their respective military organisations. The illustrations of fighting personnel and machines that punctuated this display were spectacular and many of the audience could have taken the Queen’s shilling there and then!

Sedation to Armed Forces personnel needed different management considerations than civilians receiving such care. It was comforting to hear that protocols were in place to prohibit pilots from flying duties until 48 hours had elapsed since receiving sedation, and that restrictions related to weapons handling were also in place.

The final presentation was a triple act from Kathy Wilson, Senior Dental Officer (Special Care Dentistry)/Honorary Associate Specialist (Sedation), Newcastle, Derek Debuse, Senior Clinical Teacher, KCL Dental Institute and Nigel Robb, Senior Lecturer in Sedation in Relation to Dentistry, University of Glasgow Dental Hospital and School. They reviewed postgraduate qualifications in sedation covering outcomes, course topics, delivery, assessments, clinical practice and skills and examinations. Nigel also gave a taster of how Scotland was considering the development of conscious sedation education pathways.

This had been a full day with much to reflect on, another successful Symposium.

Stephen Jones
June 2006
Does Completing a Dental Anxiety Questionnaire Increase Anxiety? A Randomized Controlled Trial with Adults in General Practice.


**Objective:**
To test the null hypothesis that completing the Modified Dental Anxiety Scale had no immediate influence on patient state anxiety.

**Outcome Measure:**
Spielberger State Anxiety Inventory 6-item short form.

**Study Design:**
Randomised controlled trial.

**Participants:**
Patients (n = 1,028) attending 18 dental practices in Northern Ireland were invited to participate.

**Results:**
Twenty-four patients refused (response rate 98%) providing 1,004 patients (mean age = 41 years, range = 16 to 90 years; 65% female) for analysis. Patients who completed the Dental Anxiety Scale were found to have a virtually identical state anxiety score: mean (SD) = 11.36 (4.33), compared with those who completed the state anxiety assessment only: mean (SD) = 11.01 (4.35). The mean (CI95%) difference was 0.35 (0.89 to -0.18), t = 1.29, df1002, p = 0.2.

**Conclusion:**
The completion of a brief dental anxiety questionnaire before seeing the dentist had a non-significant effect on state anxiety.

Improved Sedation for Oral Surgery by Combining Nitrous Oxide and Intravenous Midazolam: A Randomized Controlled Trial.


**Objective:**
To investigate whether sedation techniques for oral surgery can be improved by combining the use of inhalation of nitrous oxide/oxygen with intravenous midazolam.

**Design:**
A prospective, randomised controlled clinical trial in which patients requiring extractions or surgery were randomly allocated to subgroups receiving either intravenous midazolam or nitrous oxide/oxygen or a combined technique using nitrous oxide/oxygen and intravenous midazolam. Safety parameters, amounts of sedative agents administered, recovery time and cooperation scores were recorded. Patients receiving the combined sedation technique were initially titrated with 10% nitrous oxide, increasing by increments of 10% up to a maximum of 40% nitrous oxide and 60% oxygen. Midazolam was then titrated (initially 2 mg wait 2 min with increments of 1 mg every minute until appropriately sedated) whilst still administering 40% nitrous oxide.
RESULTS:
When a combined technique of nitrous oxide/oxygen and midazolam was used there was a statistically significant reduction in the amount of midazolam required to achieve effective sedation ($P < 0.001$), an overall significant reduction in recovery time ($P < 0.001$) and a significant improvement in cooperation ($P < 0.01$) and arterial oxygen saturation ($P < 0.001$).

CONCLUSION:
This combined technique was found to be safe and reliable, requiring reduced doses of midazolam and demonstrating improvement in patient recovery and cooperation.

CORRELATION AND COMPARISON OF BODY MASS INDEX ON HEMODYNAMICS IN HYPERTENSIVE AND NORMOTENSIVE PATIENTS UNDERGOING INTRAVENOUS SEDATION.


OBJECTIVE:
The purpose of this project was to retrospectively compare and correlate body mass index (BMI) and haemodynamics in hypertensive and normotensive patients undergoing intravenous sedation for dento-alveolar surgery.

DESIGN:
A retrospective chart analysis of 263 consecutive male patients undergoing intravenous (IV) sedation for dento-alveolar surgery was divided into five BMI groups: underweight, normal weight, overweight, obese, extremely obese. Data recorded were non-invasive baseline and intra-operative haemodynamic measurements at five-minute intervals for systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), pulse pressure (PP) and pulse (P). Statistical analysis of mean values between groups was carried out using multivariate linear regression analysis, Pearson’s correlation coefficient, and Student’s t test and found significant for $P < 0.05$.

RESULTS:
Average haemodynamic values for normotensive patients were significantly lower for all groups except for pulse in the normal group, pulse in the obese group, and DBP in the extremely obese group. For normotensive patients, there was a statistically significant strong positive correlation for elevated BMI and increased baseline changes in SBP and PP. For the hypertensive group, there was a statistically significant moderate positive correlation for elevated BMI and increased baseline changes in PP and statistically significant strong positive correlation for baseline changes in MAP. Baseline changes were significant for greater increases in SBP and decreases in DBP and MAP in the underweight hypertensive group. Significant increases from baseline in the normotensive group were found in PP in the normal BMI group and in pulse in the obese group. All baseline changes, with the exception of normotensive underweight SBP (+26.7%) and hypertensive PP (+23.9%), were within +/-20% of baseline (range = -12.2% to +17.4%).

CONCLUSIONS:
In general, normotensive patients in this study had lower average haemodynamic values than hypertensive patients in all BMI groups. Great variability was seen in baseline changes for all BMI groups, but a substantial majority of changes were within +/-20% of baseline. There were statistically significant moderate and positive correlations in BMI for changes from baseline for several haemodynamic measurements. Intravenous sedation for oral and maxillofacial surgery procedures maintains a stable haemodynamic state in hypertensive and normotensive patients regardless of BMI.

THE PRACTICE OF CONSCIOUS SEDATION BY SENIOR DENTAL SURGEONS IN THE HEALTH BOARD DENTAL SERVICE IN THE REPUBLIC OF IRELAND.


OBJECTIVE:
To establish the nature and extent of the practice of conscious sedation by senior dental surgeons in the Health Board Dental Service (HBDS) in the Republic of Ireland and to determine the barriers to the use of conscious sedation.

DESIGN:
A postal questionnaire survey of 55 senior dental surgeons working in the Health Board Dental Service.

RESULTS:
Fifty questionnaires (90.9%) were returned. Less than a quarter of senior dental surgeons reported current sedation use in their area. Oral sedation was the most commonly used method, with few using relative analgesia and fewer using intravenous sedation. Of the senior dental surgeons surveyed, 40% reported receiving training in conscious sedation as an undergraduate. Nearly 60% of those surveyed reported using conscious sedation in a previous employment. All respondents said the main barrier to the use of conscious sedation in the HBDS was the lack of training opportunities on the subject in Ireland.

CONCLUSIONS:
Conscious sedation techniques other than oral sedation are used to a very limited extent in the HBDS in Ireland. There is great interest amongst senior dental surgeons in the increased use of conscious sedation techniques. A lack of training opportunities is the main barrier to the expansion of their use.
COMPARISON OF ARTICaine 4% AND LIDOCAINE 2% IN PAEDIATRIC DENTAL PATIENTS.


OBJECTIVE:
To evaluate and compare the reaction of children who received local anaesthesia with lidocaine 2% with 1:100,000 epinephrine and articaine 4% with 1:200,000 epinephrine and to assess the time of the onset, efficacy, duration of numbness of the soft tissues, and the children’s sensation after treatment to both anaesthetic solutions, as well as the occurrence of adverse events.

DESIGN:
Sixty-two children (34 girls and 28 boys) aged 5 to 13 years (mean age 8.4 +/- 2.3) from two established paediatric dental clinics who needed similar operative procedures preceded by local anaesthesia were randomly assigned to receive either lidocaine or articaine at their first or second visit. Modified Taddio’s behavioural pain scale was used to evaluate pain reaction during injection and treatment. The sensation after injection and treatment was evaluated using the Wong-Baker FACES pain rating scale. Parents recorded the time when the feeling of local anaesthesia in soft tissues disappeared.

RESULTS:
Duration of numbness of soft tissues was significantly longer for articaine (3.43 +/- 0.7 h) than for lidocaine (3.0 +/- 0.8 h) (P = 0.003). No difference regarding the efficacy of the anaesthesia was observed. Reaction to pain was similar for both local anaesthetic solutions and no significant difference was found between the sexes. The efficacy of the anaesthesia, the feeling after treatment and the rate of adverse effects were similar for the two solutions.

CONCLUSIONS:
Articaine 4% with 1:200,000 epinephrine was as effective as lidocaine 2% with 1:100,000 epinephrine. The effect of numbness of soft tissues was longer-lasting with articaine than with lidocaine.

EVALUATION OF A NEW EFFECT-SITE-CONTROLLED, PATIENT-MAINTAINED SEDATION SYSTEM IN PATIENTS


OBJECTIVES:
Propofol is a sedation agent superior to the commonly used midazolam. Its drawback is the ease with which over-sedation may occur, necessitating the presence of a second doctor during sedation. The study presented here is a look at the use of effect-site concentration in preference to plasma concentration with removal of the patient’s handset once a satisfactory level of sedation had been achieved, the effect-site concentration of propofol that had been titrated by the patient then being maintained throughout the surgery. Sedation levels and physiological values were recorded, and surgical and patient satisfaction assessed.

METHOD:
40 adult patients ASA I and II were recruited. An anaesthetist with full resuscitation facilities was present. The Marsh pharmacokinetic model for target-site concentration was used. This was initially set at 1.0 mcg/ml; the target algorithm allowed for initial plasma levels to exceed the target by up to 100% during induction. Once the plasma levels had fallen to within 10% of the target the patient was given the control handset. A successful double-press of this increased the target concentration by 0.2 mcg/ml. After each increment the patient was asked if he or she was ready to accept the local anaesthetic injection. Once a satisfactory level of sedation was achieved the handset was removed from the patient and the target concentration chosen maintained throughout the procedure. Supplemental oxygen was not given unless saturation fell below 90%. Heart rate, blood pressure, oxygen saturation, respiratory rate and level of sedation were recorded. Overall experience was marked by the patient on a scale of 1 to 4. The surgeon was asked to mark patient cooperation and surgical experience on a scale of 1 to 4.

RESULTS:
39 of the 40 patients completed their treatments. One extreme phobic went on to GA. The mean propofol target level was 1.5 (1 to 2.5) mcg/ml. All measured parameters remained within 20% of baseline. No patient required additional oxygen, the lowest recorded SaO₂ being 91%, mean lowest being 96%. No patient became over-sedated. All 39 were happy with the sedation received and would repeat the system. Surgical scoring was: procedure: easy 10, mild difficulty 22, difficult 8, very difficult 0; cooperation: very good 35, good 1, average 3, minimal 1.

DISCUSSION:
In this study, target-controlled infusion with the high initial serum concentration decreased the time taken to reach adequate sedation, mean 8.9 mins. No patient became too deeply sedated. No patient required supplementary oxygen. All were happy with the experience. This could possibly be the way forward for the operator-sedationist.
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Saturday 22 September 2007

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You are invited to express your views on any subject related to CONSCIOUS SEDATION, ANALGESIA OR DENTAL ANAESTHESIA

INTERESTED?

• Write an essay on one topic in ENGLISH on A4 paper, double-spaced, formatted on disc as a Microsoft Word document and not exceeding 3,000 words
• Entries must be received by 1 March 2007
• The decision of the panel of assessors appointed by SAAD will be final
• Entries, accompanied by name and address, should be sent to:

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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)/authors' name(s), qualifications and address(es).

SUBMISSION: in the case of paper submission, the author(s) should send two copies of the 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 SAADoffice@aol.com.

In both cases the submission should be accompanied by a covering letter signed by all of the authors.

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 AND 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 SAADoffice@aol.com. 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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Efficacy of Nitrous Oxide in Inhalational Sedation

Conscious Sedation for Children

SAAD Dental Student’s Prize Winning Essay