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EDITORIAL

Happy 2009! It hardly seems a year since I sat down to write the editorial for the 2008 *Digest*. I hope that you will find the current issue both informative and entertaining. I am particularly pleased that we continue to attract high-quality submissions on subjects that are of interest and relevance to the membership of SAAD.

Professor Milgrom and his team have offered an article on adolescent patients' reaction to intravenous cannulation. It is particularly appropriate that we continue to publish articles on paediatric sedation. NICE has recently announced that it is to be looking at this subject. The title of the project is 'The use of sedation during diagnostic and therapeutic procedures in infants, children and young people (age 0 to 19)'.

The scoping document is available to be looked at on their website via this address:
http://www.nice.org.uk/guidance/index.jsp?action=byID&o=11967

The age range is interesting, as it extends to 19 years of age. When one looks at the various documents that cover paediatric sedation, it would appear that there is no consensus on when a child is not a child! Certainly the definition here seems to have no logic, as it is different from all other documents. There is an interesting contrast with the document produced by the Standing Committee on Sedation for Dentistry[1], where the recommendation is that those of 12 years of age and over be treated as adults as far as sedation techniques are concerned. I am delighted to be able to report that SAAD is represented on the NICE committee, as Dr Paul Averley is a member. Paul has a wide experience in paediatric conscious sedation for dentistry and thus I am sure that his presence will lead to recognition and use of the good work that the dental profession in general and members of SAAD and our sister organisations ADA and DSTG have carried out over the years.

A number of the members of SAAD Council, myself included, attended the stakeholders' meeting in London at the start of the summer where the scope of the NICE guidance was discussed. There were two major areas of concern. The first was that there was no mention of the area of training for sedation. Fortunately there was wholesale agreement amongst those present that training was of fundamental importance and thus should be included. The second was that there was repeated mention of 'deep sedation' as a therapeutic entity. Those of us from a dental background were very concerned at the thought that 'deep sedation' could be recommended in this country! While it may be appropriate in some fields of medicine, we must as dental sedationists campaign to ensure that this is not the case in dentistry. The excellent safety record we have maintained in dentistry is related to the use of conscious sedation. The introduction of 'deep sedation' would be a retrograde step. Fortunately, having a SAAD Trustee on the NICE committee, as well as the fact that ADA, DSTG and SAAD have registered as stakeholders, will ensure wide consultation with the dental profession prior to publication of any guidance.

I am sure that many of us will have the same reaction to hearing that there is yet another document being published, but I feel that as with the report from the Academy of Medical Royal Colleges[2] the main reason for the report is not a concern with the dental profession and their conduct, but rather with the conduct of sedation (not always conscious sedation) in medical practice.

Once again all those who have the best interests of conscious sedation in dentistry at heart must pull together to present a united front. Sadly, all too often there has been inter- and intra-professional bickering. This never presents a good image, and also allows a free rein to those who wish to do sedation down. I hope that we can unite whatever our background to advance the efficacy and safety of pain and anxiety control in dentistry.

We also have an article from Stanley Malamed in this issue of the Digest. He is addressing the issue of what is new in local anaesthesia. I feel that it is important for us to remember the importance of good pain control in the sedation we provide. As the profession that uses the largest amount of local anaesthetics, and that injects them more frequently than any of the other professions involved in healthcare, we should be the experts in this field. The appropriate and effective use of local anaesthesia is one of the reasons why conscious sedation for dentistry is different from sedation for many other medical treatments and interventions, where the local control of pain is not possible and thus there is the need for systemic analgesia and perhaps the requirement to stray into the area of deep sedation. We are fortunate to have Stanley write for us. Many of you will have heard him speak at international meetings as well as being aware of his long list of publications in the fields of local anaesthesia, sedation and the management of medical emergencies.

I hope that you will also enjoy reading the reports of the various initiatives that the Board of Trustees has taken on your behalf. These include the launching of the inhalation sedation machine loan scheme, which has proved to be a great success. One of the great dilemmas of education in conscious sedation has been the difficulty of translating attendance at courses into the practice of sedation, particularly in general dental practice. Allowing some of those who have been on our Courses to borrow the IS machines will hopefully remove the barrier of the cost of equipment. I am all too aware of the number of bits of equipment that are stored in various cupboards in dental practices around the country. We are also very grateful to McKesson for their assistance with this scheme.

I would also like to take this opportunity to thank all of our advertisers for supporting the publication of the Digest. The adverts help to subsidise the cost of production, allowing us to produce the type of publication that I hope we, as a Society, can be proud of.

It is important that SAAD develops and changes to meet the demands and needs of the profession in the 21st century. Our core business remains the provision of high-quality education in conscious sedation for dentistry, but our influence and the respect with which the Society is held continue to grow. Certainly when we are represented at the annual meeting of Specialist Anaesthetic Societies at the Association of Anaesthetists each November, it is apparent that we are one of the most successful of the specialist societies.

No society can flourish without the active support of its members, so I would like to also take this opportunity to encourage you to be actively involved in the Society. We run the Annual Conference, which counts as verifiable CPD in the area of pain and anxiety control. It is also an opportunity for members to meet and discuss issues informally over lunch and tea/coffee as well as the chance to bend the ear of the Trustees. We also welcome correspondence. Indeed, the items that appear in the Forum are taken from the many questions that are received by Trustees over the year – just as at lectures, if you would like to ask the question, probably many others also wish they knew the answer but are too shy to ask! We will try to publish your letters in the Digest whenever possible.

Finally I would like to thank all the members of the Editorial Board for their continued hard work in producing both the Digest and the Newsletter. Without the commitment and effort that go on behind the scenes we would not be able to produce these publications.

Nigel Robb

References

1. Standards for Conscious Sedation in Dentistry: Alternative Techniques. A Report from the Standing Committee on Sedation for Dentistry. FDSRCSEng; 2007.

2. Implementing and Ensuring Safe Sedation Practice for Healthcare Procedures in Adult Patients. Academy of Medical Royal Colleges; November 2001.

WHAT'S NEW IN LOCAL ANAESTHESIA?

Dr Stanley Malamed
Professor of Anaesthesia & Medicine University of Southern California School of Dentistry

Local anaesthesia forms the backbone of pain control techniques in dentistry. Its discovery in 1885 permitted the dental profession to expand greatly, to perform, on a routine basis, therapies such as surgical interventions that were previously faced with extreme dread by both patient and surgeon alike.[1]

Pharmacologically, local anaesthetics are the only drugs in medicine that actually prevent pain from occurring. Deposited in close proximity to a nerve a local anaesthetic prevents the nociceptive impulses provoked by dental treatment from reaching the patient's brain, where they would otherwise be interpreted as painful, eliciting both an external response (e.g. the patient moving, screaming) as well as an autonomic response (e.g. increased blood pressure and heart rate).

The delivery of local anaesthesia is an everyday occurrence in the contemporary dental office. Maxillary infiltrations, inferior dental nerve blocks are commonplace. In the United States, where approximately 180,000 dentists practice, in excess of 300 million dental cartridges of local anaesthetic are sold annually. Given that a cartridge is frequently used for more than one injection, it may be conservatively estimated that more than 500 million injections are administered to American dental patients each year.

By the mid-1960s lidocaine HCl, mepivacaine HCl and prilocaine HCl had supplanted procaine HCl and today remain the most used local anaesthetics in both dentistry and medicine. Given the sheer number of injections and volume of local anaesthetics administered, it is fair to say that 'local anaesthetics represent the safest and the most effective drugs in medicine for the prevention and management of pain'.

Local anaesthetics are drugs, and as such are capable of provoking or producing reactions that are both desirable and undesirable.

We use local anaesthetics because they prevent pain by transiently blocking nerve conduction. The anaesthetic effect dissipates over several hours with complete restoration of nerve function.

However, there are other actions of these drugs, or actions associated with the very act of administering these drugs – the injection – that are undesirable. Fortunately these are relatively uncommon and, in most cases, easily managed.

The most common adverse events associated with local anaesthetic administration are listed in Table 1.

Table 1. Adverse events associated with local anaesthetic administration

Common adverse events	Most likely aetiology
Psychogenic: Syncope Hyperventilation 'Epinephrine (adrenaline) reaction'	Fear: act of injection
Allegation of allergy to local anaesthetic or epinephrine	Fear: act of injection
Allergy – true, documented and reproducible, either localised or anaphylaxis	Extremely unlikely to ever be observed
Overdose – mild (tremor, mild shaking)	Over-administration of LA
Overdose – severe (loss of consciousness, seizure)	Over-administration of LA

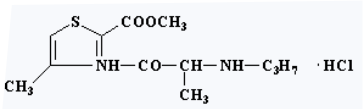
In this paper we will review some of the more recent additions to the local anaesthetic armamentarium, including articaine HCl; computer-controlled local anaesthetic delivery (C-CLAD) systems; and phentolamine mesylate, a drug that may be used to significantly diminish the duration of residual soft-tissue anaesthesia. In addition, the use of local anaesthetics in younger, lighter-weight children, either sedated or unsedated, will be discussed, as these patients represent a group that is at higher risk of developing adverse events related to the volume of local anaesthetic delivered.

Articaine HCl

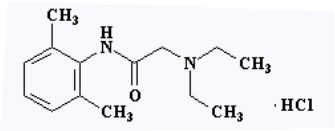
Articaine HCl was developed and first marketed in Germany in the early 1970s. Though commonly classified as an amide local anaesthetic (like lidocaine, mepivacaine and prilocaine), articaine HCl is actually a hybrid molecule, containing both amide and ester components. (Figure 1) Articaine HCl was introduced into the US dental market in 2000 and the UK in 2001. Though initially there was no scientific evidence of articaine's superiority to other local anaesthetics it quickly became a favoured drug in the hands of many dentists worldwide.[2] Recently, however, several well designed clinical trials have demonstrated statistically significant differences in the ability of articaine HCl to provide profound pulpal anaesthesia when administered by infiltration in the buccal fold adjacent to mandibular molars.[3,4] This finding has been of benefit primarily to endodontists, who are faced with the vexing problem of achieving anaesthesia for pulpal extirpation in infected mandibular molars, the most difficult situation in which to provide pain-free dental treatment.[5] Articaine's sulphur-containing thiophene ring (all other local anaesthetics contain a benzene ring) makes the drug more lipid-soluble, thereby enhancing its ability to diffuse through both soft and hard tissues. (Figure 1)

Figure 1. **Chemical formulas of articaine HC and lidocaine HD1**

Articaine Hydrochloride
$C_{13}H_{20}N_2O_3S$ HC1



Lidocaine Hydrochloride
$C_{14}H_{22}N_2O$ HC1



Articaine HCl is marketed as a 4% solution with epinephrine 1:100,000 or 1:200,000. Both formulations provide a rapid onset of anaesthesia (2–3 minutes); a duration of pulpal anaesthesia of approximately 1 hour; and soft-tissue anaesthesia lasting for about 3–5 hours.[2]

Concurrent with articaine's popularity amongst dentists has been a 'feeling' that its administration by inferior alveolar nerve block (IANB) is associated with a greater risk of prolonged anaesthesia (paresthesia). The first paper to state this was published in 1995 by Haas and Lennon, in which they extrapolated the reported incidence of paresthesia amongst dentists practicing in the Canadian province of Ontario.[6] Haas stated that the risk of developing paresthesia following local anaesthetic administration was 1:1,200,000 for 2% and 3% solutions, while it was 1:480,000 for 4% drugs (articaine HCl, prilocaine HCl). The overall incidence of paresthesia following LA administration was reported as 1:785,000 injections.

Hillerup and Jensen, in reviewing cases of paresthesia in Denmark, concluded that: 'Thus, there is an urgent need for further studies focused on the problem of neurotoxicity of local analgesics with specific focus on articaine 4%. Until factual information is available, a preference of other formulations to articaine 4% may be justified, especially for mandibular block analgesia.'[7]

In response, the Pharmacovigilance Working Party of the European Union studied articaine in depth and concluded in 2006: 'Regarding articaine, the conclusion is the safety profile of the drug has not significantly evolved since its initial launch (1998). Thus, no medical evidence exists to prohibit the use of articaine according to the current guidelines listed in the summary of product characteristics.'[8] They further state that all local anaesthetics may cause nerve damage (they are neurotoxic) and that nerve injuries may occur from several incidents including (1) mechanical injury due to needle insertion; (2) direct toxicity from the drug; and (3) neural ischemia.

In what this author considers to be the most scientific look at this question, Pogrel reported on his clinical evaluation of 53 patients referred to him between 1 January 2003 and 31 December 2005.[9] All patients still had neurological symptoms nine months after injection and were considered permanent. Lidocaine was associated with 35%, while articaine and prilocaine were each associated with approximately 30% of the cases.

Pogrel concluded his paper with a statement that based 'on the figures we have generated from our clinic we do not see a disproportionate nerve involvement from articaine'.[9,10] The Danish Medicines Agency more recently (2008) reaffirmed these findings.[11]

Computer-controlled local anaesthetic delivery (C-CLAD) systems

In 1997 the first computer-controlled local anaesthetic delivery (C-CLAD) system was introduced into dentistry. The Wand™ (Milestone Scientific, Inc. Livingston, NJ, USA) was designed to improve on the ergonomics and the precision of the traditional dental syringe as well as to help make the delivery of local anaesthesia as comfortable as possible regardless of the site of injection. (Figure 2) The system enables a dentist to accurately manipulate needle placement with fingertip accuracy and deliver the LA with a foot-activated control. C-CLAD represents a significant change in the manner in which a LA injection is administered. The operator need only focus their attention on needle

Figure 2. **Original C-CLAD device, The WAND**

Figure 3. **STA**

insertion and positioning, allowing the motor in the device to administer the drug at a pre-programmed rate of flow. It is likely the greater ergonomic control coupled with the fixed flow rates that are responsible for a more comfortable injection experience as demonstrated in many clinical studies conducted with these devices in dentistry.[12–16] Several clinical trials in medicine have also demonstrated measurable benefits of C-CLAD technology, primarily in injection sites such as the heel of the foot and the skin in and around the eye, two areas that are frequently associated with exquisitely painful injections.[17,18]

C-CLAD technology led to the development of two newly described nerve block techniques. The anterior middle superior alveolar (AMSA) injection and palatal approach – anterior superior alveolar (P-ASA) injection have been described by Friedman and Hochman using a C-CLAD system.[19,20] Both injections can be performed with a traditional syringe; however, the infusion characteristics and improved tactile control of a C-CLAD system allow for a more effective and comfortable drug administration.

Perry and Loomer presented data from a single blind crossover study comparing C-CLADs to traditional syringe delivery of LA for quadrant scaling and root

planing. Twenty subjects received the AMSA injection. Scores for the AMSA computer-controlled injection revealed a highly significant difference in favour of the computer-controlled device ($p < 0.0001$).[15]

Fukayama et al. conducted a controlled clinical study evaluating pain perception of a C-CLAD device. Seventeen of the 20 subjects reported slight or no-pain rating on a visual analogue scale (VAS) for palatal injections administered with C-CLADs. They concluded: 'The new system provides comfortable anesthesia for patients and can be a good alternative for conventional manual syringe injection.'[16]

A number of C-CLAD systems have entered onto the dental and medical markets in recent years. The latest iteration of the original Wand™ is STA™ (Single Tooth Anesthesia). (Figure 3), while the Anaeject™ is a hand-held, miniaturised C-CLAD system. (Figure 4) Others include Comfort Control™ Syringe, QuickSleeper™ and Cartri-Ace™.

The clinical summary from the First International C-CLAD Symposium (2008) found that (1) C-CLAD is the preferred method of administering palatal injections and the periodontal ligament (PDL) injection (also known as intraligamentary injection or ILI), and (2) that C-CLAD is the delivery instrument of choice to minimise disruptive behaviour in paediatric patients.[21]

Figure 4. **Anaeject**

Reversing local anaesthesia

The contemporary dentist is equipped with a local anaesthetic armamentarium consisting of multiple drug combinations that provide durations of pulpal and soft-tissue anaesthesia capable of managing the pain control requirements of all dental patients. Currently available local anaesthetic combinations are listed in Table 2.

Three categories, based upon the expected duration of pulpal anaesthesia, are listed: short-, intermediate-, and long-duration. A number of factors act to influence, usually in a negative way, these expected durations. The durations provided in Table 2 reflect the normo-responding patient, one in the middle of the normal distribution curve. Approximately 70% of persons will respond 'normally' when administered the 'average' dose of a drug. Fifteen per cent exhibit longer durations than those listed (hyperresponders), while the remaining 15% demonstrate shorter durations (hyporesponders).

For all local anaesthetic formulations, in all duration categories, the duration of soft-tissue anaesthesia greatly exceeds that of pulpal anaesthesia. For the long-duration category this represents an important reason for using bupivacaine. The primary indication for bupivacaine + epinephrine is the prevention of pain in the post-surgical period. Administered by nerve block at the conclusion of a surgical procedure, bupivacaine HCl, commonly used in conjunction with orally administered non-steroidal anti-inflammatory drugs (NSAIDs), can make the post-surgical period comfortable (e.g. pain-free) for the vast majority of patients.[22]

However, most dental treatment, being non-surgical,❤ does not require pain management in the post-treatment period. Pulpal anaesthesia provides pain-free dental care during treatment, but on discharge from the dental

❤ By definition, almost *all* dental treatment is surgical. Surgery can be defined 'as the act of cutting tissue' as well as 'a branch of medicine concerned with diseases and conditions requiring or amenable to operative or manual procedures.' (Merriam-Webster's Online Dictionary. www.merriam-webster.com/dictionary. Accessed August 2008)

Table 2. Available local anaesthetic formulations (USA)

Short duration	Infiltration	Nerve block	Soft-tissue anaesthesia	Mg/2.2mL cartridge	Maximum dose	Maximum suggested dose, in cartridges			
						Adult		Paediatric	
						≥70kg	50kg	30kg	10kg
Lidocaine HCl 2% plain	5 minutes indicated	Not	2 hrs	44	300mg 4.5mg/kg	7	5	3	1
Mepivacaine HCl 3% plain	20–30 min	34–45 min	2–3 hrs	66	400mg 6.6mg/kg	7	5	3	1
Prilocaine HCl 4% plain	10–15 min	45–65 min	3–4 hrs	72	600mg 8.0mg/kg	7_	5_	3.3	_
Intermediate duration – with vasoconstrictor									
Articaine HCl 4% + epinephrine 1:100,000	60 min	Up to 120 min	3–5	88	7.0mg/kg*	5.5	4	2.3	_
Articaine HCl 4% + epinephrine 1:200,000	60 min	Up to 120 min	3–5	88	7.0mg/kg*	5.5	4	2.3	_
Lidocaine HCl 2% + epinephrine 1:80,000 or 1:100,000	55–65 min	80–90 min	3–5 hrs	44	500mg 7.0mg/kg	11	8	4_	1_
Lidocaine HCl 2% + epinephrine 1:50,000	55–65 min	80–90 min	3–5 hrs	44	7 cartridges 0.1 cart./kg	7	5	3	1
Mepivacaine HCl 2% + epinephrine 1:100,000	40–60 min	60–90 min	3–5 hrs	44	400mg 6.6	10_	7_	3	1
Prilocaine HCl 3% + felypressin 1:20,000	35–45 min	50–70 min	3–6 hrs	66	600mg 8.0mg/kg	8.5	6	3_	1_
Long duration									
Bupivacaine HCl 0.5% + epinephrine 1:200,000	Up to 7 hrs	Up to 7 hrs	Up to 12 hrs	11	90mg**			Not recommended in children	

*Maximum single dose determined by manufacturer. **Smaller doses are recommended for small adults as well as adults in poor health.

surgery the patient is faced with a period of residual soft-tissue anaesthesia that may range from an additional 1–2 hours (3% mepivacaine) to as many as 5–6 hours (articaine, lidocaine, mepivacaine, and prilocaine with vasopressor).

Residual soft-tissue anaesthesia, though beneficial following many surgical interventions, can also prove to be detrimental. Without sensation in their lip(s) and/or tongue, the patient may accidentally chew or bite the soft tissues, inflicting potentially significant traumatic injury. (Figure 5) As always, the dentist must weigh the benefit to be gained from the administration of a drug such as bupivacaine post-surgically for pain prevention versus the potential risk of self-inflicted soft-tissue injury. The patient's desires should be a part of this decision.

Figure 5. **Traumatic injury to soft tissues**

Figure 17.7 A and B. Traumatized lip caused by inadvertent biting while it was still anesthetized. from Malamed SF. Handbook of Local Anesthesia 5th ed. 2004, St. Louis, C V Mosby, , page 293

Dental procedures such as routine restorative and non-surgical periodontics are typically completed in less than one hour and are rarely associated with a need for post-operative pain control. However, the need for effective intraoperative pain control normally mandates the use of a local anaesthetic containing a vasopressor, such as epinephrine, and has become a routine part of dentistry.[5,23] In fact, 95% of local anaesthetics administered in dentistry in the USA contain a vasoconstrictor. Patients are commonly discharged from the dental office with residual numbness to their lips and tongue typically persisting for 3–5 hours.[24]

Traumatic soft-tissue injury can occur in any patient. However, it is in paediatric and in mentally disabled adult and paediatric patients where self-inflicted injury is more apt to be seen.[25] A survey of paediatric patients by College et al. revealed that 13% of inferior alveolar nerve blocks were associated with inadvertent biting of the lips.[25] By age group, trauma frequency was 18% (< 4 yrs), 16% (4–7 yrs), 13% (8–11 yrs) and 7% (> 12 yrs). Though infrequent, such injury does occur in the adult population as well.

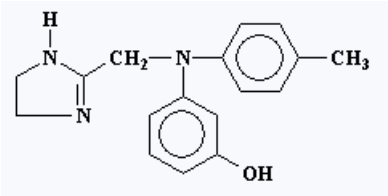
More commonly, residual soft-tissue anaesthesia represents an inconvenience and/or embarrassment to the patient who, on leaving the dental office, wishes only to return to their normal life. Patients feel that residual soft-tissue anaesthesia interferes with their normal daily activities in three areas: perceptual (perception of altered physical appearance), sensory (lack of sensation) and functional (diminished ability to speak, smile, drink and control drooling).[26]

Patients may complain to their dentists at subsequent appointments that they were unable to eat a meal or to talk normally for many hours after their last dental visit because their lip and/or tongue were still numb. The request of 'Can't you make the numbness go away faster?' has been uttered by patients to most dentists.

Local anaesthetic techniques, such as the periodontal ligament injection (PDL, ILI),[27] intraosseous (IO) anaesthesia,[28] the anterior middle superior alveolar nerve block (AMSA),[29] and C-CLAD systems have provided the means, in limited situations, of providing clinically adequate pain control with little or no extraoral soft-tissue anaesthesia. However, at present, no therapeutic modality exists to hasten the return of normal sensation and function after local anaesthetic injection. Phentolamine mesylate (Figure 6) is a non-selective alpha-adrenergic blocking agent that is indicated via IM or IV administration for the treatment of dermal necrosis resulting from the extravasation of the vasopressors norepinephrine and epinephrine[30] and for the diagnosis and treatment of severe hypertension in patients with pheochromocytoma, a rare tumour of the adrenal medulla that secretes excessive epinephrine and norepinephrine.[31]

Figure 6. **Phentolamine mesylate**

Phentolamine
$C_{17}H_{19}N_3O$



Clinical effects of phentolamine include peripheral vasodilation and tachycardia. Vasodilation is a result of both direct relaxation of vascular smooth muscle and alpha blockade.[32] Following the administration of a local anaesthetic with a vasoconstrictor, a subsequent

phentolamine injection into the same location should theoretically enhance redistribution of the local anaesthetic away from the injection site, providing a more rapid return of normal intraoral and perioral sensation.[33]

An injectable form of phentolamine mesylate (PM) has been developed to terminate the numbing action of local anaesthesia when it is no longer desirable. The product contains 0.4mg PM (0.235mg/mL) packaged in a 1.7mL dental cartridge.[34] On 12 May 2008, the United States Food & Drug Administration (FDA) granted approval of phentolamine mesylate, which will be marketed under the proprietary name OraVerse™.[34]

Prior to approval, phentolamine mesylate went through a number of clinical trials to demonstrate its safety and efficacy for this new therapeutic indication. Two Phase 3, double-blinded, randomised, multi-centre, controlled studies were undertaken.[35,36] One trial involved the effectiveness of PM in reversing mandibular soft-tissue anaesthesia; a second the effectiveness of PM in reversing maxillary soft-tissue anaesthesia;[35] while a paediatric Phase 2, double-blinded, randomised, multi-centre, controlled study was conducted in dental patients, aged 4–11 years, who had received 2% lidocaine with 1:100,000 epinephrine.[36]

In the maxillary trial the median time to recovery of normal sensation in the upper lip was 50 minutes for PM patients and 132.5 minutes for sham injection patients, a reduction in upper lip anaesthesia of 82.5 minutes. This result was statistically significant ($p < 0.0001$).[35] In the mandibular trial the median time to recovery of normal sensation in the lower lip was 70 minutes for PM patients and 155 minutes for sham patients, a reduction in lower lip anaesthesia of 85 minutes. The difference between these times was statistically significant ($p < 0.0001$).[35]

Interestingly, within 30 minutes of PM administration, 26.7% of patients reported normal lip sensation as compared with 1.7% in the control group in the upper lip. At 1 hour 59.2% had normal upper lip sensation versus 11.7% for sham. At 2 hours these figures were 88.4% and 45.8% respectively. Upper lip anaesthesia persisting beyond 2 hours occurred in 54.2% of sham patients versus 11.6% in PM patients. These results are presented in Table 3.

In the mandible, within 30 minutes of PM administration, 17.2% of patients reported normal lip sensation as compared with 0.8% in the control group in the lower lip. At 1 hour 41% had normal lower lip sensation versus 7.4% for sham. At 2 hours these figures were 81.1% and 29.5% respectively. Lower lip anaesthesia persisting beyond 2 hours occurred in 70.5% of sham patients versus 18.9% in PM patients.

The median time to return of normal sensation to the tongue was 60 minutes for PM patients and 125 minutes for sham-treated patients, a statistically significant ($p < 0.0001$) difference of 65 minutes.[35]

OraVerse™ is marketed in 1.7mL cartridges containing 0.4mg phentolamine mesylate. (Figure 6) It is indicated for reversal of soft-tissue anaesthesia, i.e. anaesthesia of the lip and tongue, and the associated functional deficits resulting from an intraoral submucosal injection of a local anaesthetic containing a vasoconstrictor. OraVerse™ is not recommended for use in children less than 6 years of age or weighing less than 15kg (33 lbs).

The recommended dose of OraVerse™ is based on the number of cartridges of LA + vasoconstrictor administered. (Table 3) OraVerse™ should be administered following the traumatic part of the dental procedure using the same location(s) and technique(s) (infiltration or nerve block injection) employed for the LA administration.

Table 3. Dosing information

Amount of Local Anesthetic Administered	Dose of OraVerse (mg)	Dose of OraVerse (Cartridge(s))
1/2 Cartridge	**0.2**	**1/2**
1 Cartridge	**0.4**	**1**
2 Cartridges	**0.8**	**2**

The majority of dental treatments today are not so traumatic in nature as to require a patient to leave the dental surgery with residual soft-tissue anaesthesia that commonly persists for many hours while gradually resolving. These include conservative dental restorations, crowns and periodontal maintenance procedures, such as scaling and root planing. In addition, paediatric patients, whether in the general dentistry or paediatric dentistry office, will benefit from the diminished soft-tissue duration associated with phentolamine mesylate administration. Patients with medical conditions requiring strict adherence to eating regimens, such as diabetics, will also benefit from the reversal of anaesthesia.

Maximum doses of local anaesthetics in children

Though local anaesthetics represent the safest drugs available for the prevention and management of pain, they are drugs, and as such have the potential to produce unwanted and potential serious adverse reactions. Foremost amongst these is overdose (also known as toxic reaction).

Drug overdose occurs when the blood level of a drug in its target organ (an area of the body in which the drug exerts a pharmacologic effect) becomes overly high. The target organs for LAs are (1) the CNS and (2) myocardium.[5] As LA blood levels increase they produce a

Table 4. Signs & symptoms of local anesthetic overdose (toxic reaction)

Overdose Levels

MINIMAL TO MODERATE OVERDOSE LEVELS

Signs	**Symptoms (progressive with increasing blood levels)**
Talkativeness	Lightheadedness and dizziness
Apprehexsion	Restlessness
Excitability	Nervousness
Slurred speech	Numbness
Generalized stutter, leading to muscular twitching and tremor in the face and distal extremities	Sensation of twitching before actual twitching is observed (see "Generalized stutter" under "Signs")
Euphoria	Metallic taste
Dysarthria	Visual disturbances (inability to focus)
Nystagmus	Auditory disturbances (tinnitus)
Sweating	Drowsiness and disorientation
Vomiting	Loss of consciousness
Failure to follow commands or be reasoned with	
Disorientation	
Loss of response to painful stimuli	
Elevated blood pressure	
Elevated heart rate	
Elevated respiratory rate	

MODERATE TO HIGH OVERDOSE LEVELS

Signs

Tonic-clonic seizure activity followed by:
- Generalized central nervous system depression
- Depressed blood pressure, hear rate, and respiratory rate

progressive depression of these two target organs. Table 4 lists the signs and symptoms associated with overdose, as the blood level progressively rises. Classic overdose of a local anaesthetic is a generalised tonic-clonic seizure (GTCS), the duration of which is based upon the length of time the blood level (in the target organ) remains above the seizure threshold for that local anaesthetic. In most instances a local-anaesthetic-induced GTCS lasts for a period of about 30 seconds. Once a seizure ceases it is imperative that the patient's airway be maintained (head tilt-chin lift) to permit CO2 to be expired and O2 inhaled. If this simple step is performed the patient will shortly regain consciousness and, after thorough evaluation in the hospital, will likely be discharged home. Absent effective airway management in the post-seizure phase, CO2 levels increase (hypercarbia) and O2 levels decrease (hypoxia), leading to both metabolic and respiratory acidosis, the end result of which is to lower the seizure threshold of the LA, increasing the likelihood of a second, more intense and longer-lasting seizure developing. Survival from this episode is less likely or, if survival does occur, it is frequently with some degree of permanent neurological damage to the patient.

The two most common etiologies of LA overdose are (1) administration of too much LA (which does not contain a vasoconstrictor), and (2) rapid intravascular injection. Over-administration is, by far, the most common cause of serious LA adverse reactions.[37]

Though LA overdose can occur in any patient the most likely candidate is a younger (3–6 years), lighter-weight patient (< 30kg), in need of extensive (3–4 quadrants) dental care, in the dental surgery of a non-paediatric dental specialist.

Classically, in this situation, the general dentist elects to treat all 4 quadrants at one visit under LA alone. As the child is young, the dentist selects a non-vasoconstrictor-containing LA, such as mepivacaine 3%, so as to minimise the risk of post-surgical soft-tissue injury secondary to residual soft-tissue anaesthesia. LA is administered to all 4 quadrants at one time, with the dentist injecting the same volume of LA (2.2mL per injection) as they would for an adult patient. As the LA is absorbed from the multiple injection sites into the cardiovascular system, its blood level rises and at approximately 10 minutes after the injections a seizure develops as the blood level of LA reaches its seizure threshold.

In situations in which a technique of sedation has been employed (LA + oral, inhalation (N2O/O2), intranasal or IV), the CNS-depressant actions of the sedative drug might prevent the CNS effects of the LA from being seen. This is especially so with IV sedation or general anaesthesia. However, the cardiovascular-depressant actions resulting from the now elevated LA blood levels will still be observed, commonly manifested by a sudden onset of either (1) acute hypotension, and/or (2) acute ventricular dysrhythmias, including asystole (sudden cardiac arrest).

Given the abysmal survival rates of young children from out-of-hospital sudden cardiac arrest (< 2% in the USA),[38] strict adherence to proper injection technique (aspirate, inject slowly); rational treatment plans (one or two quadrants per dental visit, not whole mouths, unless absolutely essential); selection of an appropriate LA (containing a vasoconstrictor); administration of LA in one quadrant at a time (inject, treat the area, inject a second quadrant, treat the area, etc.); and depositing only the appropriate dosage of LA required for the injection, not full cartridges, can prevent the development of LA overdose. Prevention is a much more gratifying experience than that of having to manage an acute medical emergency that arises in an otherwise healthy paediatric patient.

The four right-hand columns in Table 2 present maximum recommended therapeutic doses, in cartridges, of clinically available LAs for patients of varying weights (10kg, 30kg, 50kg and 70kg).

Summary

In this paper I have explored four areas of current interest to pain control in dentistry.

Articaine HCl, the most recent addition to the dental LA armamentarium, has become a favoured drug in many, if not most, countries in which it is available. Rapid onset and improved hard- and soft-tissue penetration enable articaine HCl to be administered with great success as a mandibular infiltration, precluding the need, in most situations, to employ it by inferior alveolar nerve block. The 'question' about an increased risk of paresthesia following articaine administration via IANB has been answered by careful evaluation of case reports.[9]

C-CLAD systems have enabled the administration of LA to become much more comfortable, especially in the palate, and with accessory techniques such as the periodontal ligament injection (PDL, ILI). Two highly successful techniques, the AMSA and P-ASA, have been developed as a result of C-CLAD systems.

Phentolamine mesylate (OraVerse™) allows for the reversal of residual soft-tissue anaesthesia, decreasing its duration by approximately 50%. Reversal enables patients to 'feel normal' more quickly after dental treatment and should decrease the risk of traumatic injury to soft tissues.

Knowledge of the maximum dosages of LAs to be administered to all patients, but to younger, lighter-weight patients in particular, is essential to safety. The prevention of LA overdose is more gratifying than managing this fear-inducing medical emergency.

When used properly, local anaesthetics represent the safest and most effective drugs in all of medicine for the prevention and management of pain.

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A PROSPECTIVE AUDIT TO INVESTIGATE THE LEVEL OF CONSCIOUSNESS OF CHILDREN REQUIRING CONSCIOUS SEDATION USING AN 'ALTERNATIVE TECHNIQUE'

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Abstract

The aim of this prospective pragmatic audit was to investigate the level of consciousness experienced by children requiring conscious sedation in a primary care sedation service, using an 'alternative technique' to avoid referral to hospital for general anaesthesia. This technique was only applied to children who were unable to accept treatment with the use of standard inhalation sedation. The technique involved titrated inhaled oxygen and nitrous oxide and titrated sevoflurane with intravenous fentanyl and titrated midazolam. The described technique was provided by an experienced team with appropriate facilities that complied with contemporary standards and guidance. During treatment and recovery the consciousness level of children was recorded using a modified Wilson's scale. Of the sample of 573 children who received the audited technique, 1.9% (11 children) scored level 5 on the modified Wilson scale (eyes closed but responsive to mild physical stimulus). Due to the fine control this technique offers, the duration of this level of consciousness was for mostly less than a minute and no more than five minutes. No children became unresponsive.
The results of this audit demonstrate that the technique meets current standards and guidelines for 'alternative' conscious sedation, with a wide margin of safety and the rendering of loss of consciousness unlikely. 99% of patients who would otherwise have required general anaesthetic for dental treatment successfully completed their treatment using this technique.

Introduction

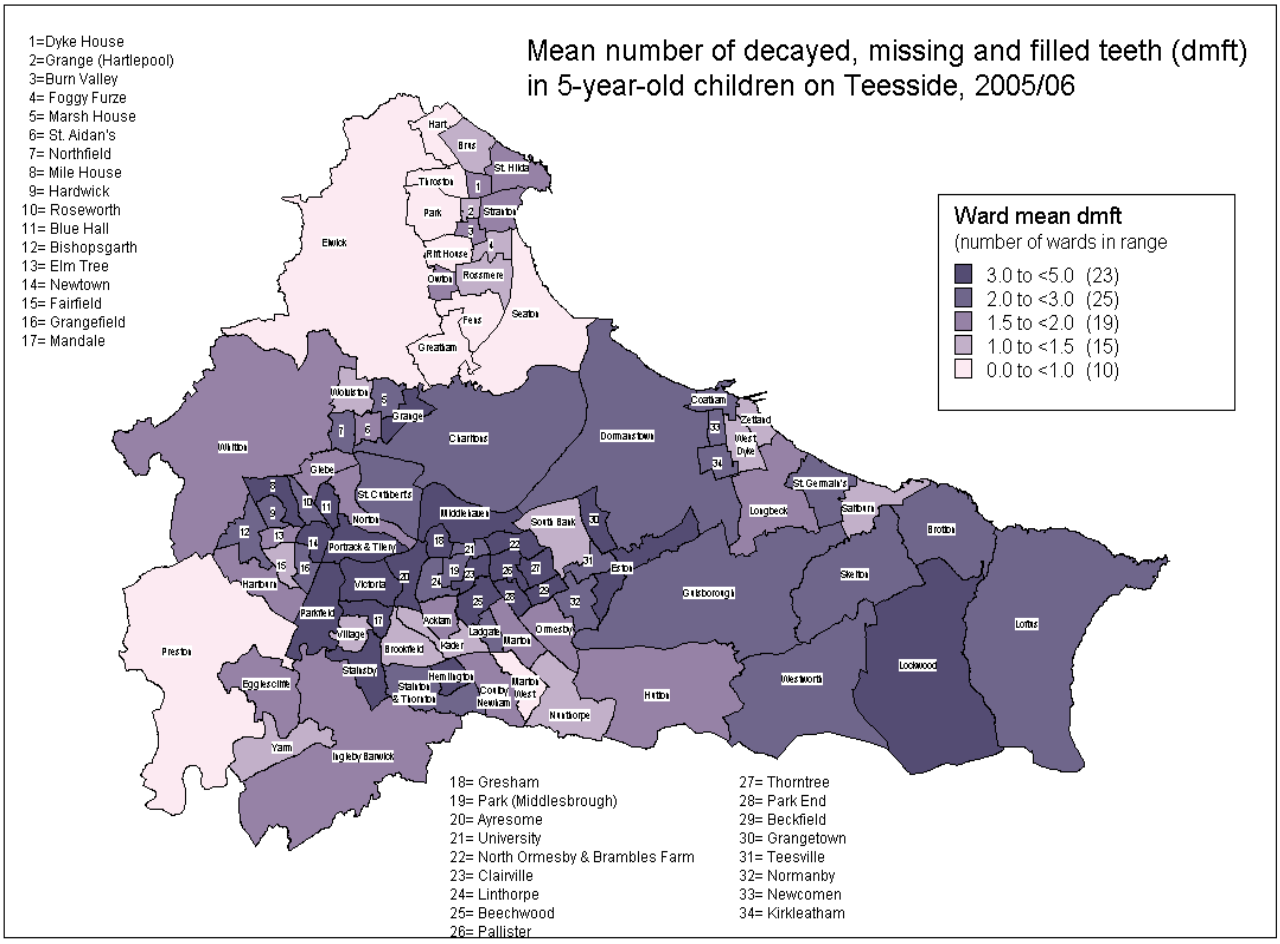
Queensway Anxiety Management Clinic (QAMC) is a primary care dental practice based in Teesside. The clinic is commissioned to provide treatment for anxious patients from across the Northeast on referral from local general dental practitioners[1].

Teesside is a deprived, largely non-fluoridated area where decay rates in children are rising at a significant rate. For example, in 1999 decay experience in five-year-old children in Gresham ward (Middlesbrough) was 2.90 decayed, missing and filled teeth (DMFT) compared with 4.18 in 2006. This represents an increase of 44%. Worryingly, there is also an upward trend in the proportion of untreated dental decay across the area[2]. The location of QAMC means there is a high need for dental treatment and a large population of potentially anxious, uncooperative patients, especially young children, who historically have been managed through the use of general anaesthetic services.

Figure 1. Map of the mean number of decayed missing and filled teeth in five-year-old children across Teesside (BASCOD 2005/6)

There is consensus that the use of dental general anaesthesia should be considered as a last resort, with the use of conscious sedation as an alternative for anxious patients[3]. Following the advent of local commissioning of services in 2006, local commissioners have been given guidance in order to further develop sedation services[4]. In Teesside this has meant a reduction in the number of

Figure 1



children requiring general anaesthetic, the latter of which has been shown to be more expensive from a commissioning perspective[5].

QAMC has a team of experienced dentists who have completed their Diploma in Conscious Sedation. These dentists deliver 'standard' sedation techniques[6]. In addition, a team of consultant anaesthetists are employed who are trained and experienced in the 'alternative' conscious sedation techniques employed[6]. The practice, therefore, is able to provide a range of both standard and alternative conscious sedation techniques to cope with a range of patients.

The practice works to the current UK definition of conscious sedation and follows the most recent guidelines from the Royal Colleges[6]. These state that sedation is:

'A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely. The level of sedation must be such that the patient remains conscious, retains protective reflexes and is able to understand and respond to verbal commands.'

The guidelines continue to state that:

"Deep sedation" in which these criteria are not met must be regarded as a general anaesthetic. In the case of patients who are unable to respond to verbal contact even when fully conscious the normal method of communication must be maintained.'

The practice also follows the Standing Dental Advisory Committee (SDAC) guidance in conscious sedation in the provision of dental care – standard techniques 2003[7]. This includes providing safe, effective care adhering to the definition of conscious sedation.

The aim is to deliver appropriate techniques matched to individual patient needs in a timely manner at a convenient location. Careful, accurate clinical assessment of patient needs is made at a separate appointment in relation to pain and anxiety management.

Sedation techniques approved by the Royal Colleges fall into two categories: 'standard' and 'alternative'. QAMC uses both 'standard' and 'alternative' techniques. These techniques include:

Standard techniques:
Inhalation sedation using nitrous oxide/oxygen
Intravenous sedation using midazolam alone.

Oral/transmucosal benzodiazepine provided adequate competence in intravenous techniques has been demonstrated.

The transmucosal administration of conscious sedation is regarded by some sedationists as falling within the category of standard techniques. Nevertheless, it is essential that strict protocols are in place.

Alternative techniques:

Any form of conscious sedation for patients under 12 years of age other than nitrous oxide/oxygen inhalation sedation
Benzodiazepine plus any other intravenous agent, for example: opioid, propofol, ketamine
Propofol either alone or with any other agent, for example: benzodiazepine, opioid or ketamine
Inhalation sedation using any agent other than nitrous oxide/oxygen alone
Combination (non-sequential) routes, for example: intravenous and inhalation agent (except the use of nitrous oxide/oxygen during cannulation).

As a consequence of the high need and demand for sedation services in Teesside, together with the desire to reduce the number of patients receiving general anaesthetics, QAMC has developed a range of techniques that it has sought to evidence[5, 8–10].

Care pathway

Following referral from a general dental practitioner, the patient's journey begins with an assessment appointment with one of the experienced dentists (this is at a separate visit prior to the treatment visit). The patient will be considered for a range of treatment options, taking account of their medical history, treatment need, age, level of cooperation and anxiety level. Treatment offered may be by using local anaesthetic only or local anaesthetic with the support of the following conscious sedation alternatives: oral sedation and local anaesthetic, relative analgesia with nitrous oxide, intravenous midazolam or treatment with an alternative technique. In cases of extreme anxiety, especially in very young children with high treatment needs, patients may be referred for treatment under general anaesthetic. This audit will focus on those patients deemed too anxious for treatment with the standard sedation techniques offered at QAMC, who were treated using an alternative technique to avoid the need for general anaesthetic. Consent is completed at the initial assessment and treatment is provided at a separate appointment. Following completion of treatment, patients are referred back to their own general dental practitioners.

Research has previously been undertaken at the practice to look at the effectiveness and safety of an alternative technique using intravenous midazolam combined with inhaled nitrous oxide or nitrous oxide and sevoflurane[5, 9, 10]. The results of this research showed this technique met the definition of conscious sedation, having a wide margin of safety and the rendering of the loss of consciousness unlikely. 93% of patients treated using this technique managed to successfully complete their treatment and were referred back to their general dental practitioners.

To try to build on the 93% success of this technique, intravenous fentanyl has now been supplemented to the technique. The addition of fentanyl aims to improve success rates, improve patient comfort and acceptance of local anaesthetic due to fentanyl's analgesic affect and to reduce the required dose of midazolam due to its synergistic effect.

This audit of the amended technique was undertaken to investigate whether the amended alternative technique meets current sedation guidelines rendering the loss of consciousness unlikely and ensuring a wide margin of safety.

Aims and objectives

The audit aim was to establish the incidence of 'oversedation' in children undergoing dental treatment under conscious sedation using a combination of inhalation and intravenous drugs. Its objective was to carry out a pragmatic prospective audit of patients receiving 'alternative' conscious sedation, delivered in a dedicated sedation environment with well trained and experienced teams.

Audit standard

The technique being audited must meet the definition of conscious sedation in the UK following the most recent guidance from the Royal Colleges[6].

The modified Wilson scale[11] was used to assess the level of consciousness during treatment and recovery. A score of 5 or above is considered to be in breach of the UK definition.

Modified Wilson scale[4]

1. Fully awake and orientated
2. Drowsy
3. Eyes open and responsive to speech (partial ptosis and/or slurred speech)
4. Eyes closed and responsive to speech
5. Eyes closed and responsive to mild physical stimulation
6. Unresponsive to mild physical stimulation.

The technique to be audited was an alternative technique comprising a combination of inhalation and intravenous sedation.

Inhalation: titrated nitrous oxide in oxygen with titrated sevoflurane (with a maximum expired end-tidal concentration of sevoflurane of no greater than 0.3%).

Intravenous sedation: fentanyl up to a maximum of 0.75µg/kg (max 50µg) with titrated midazolam at 0.5mg increments.

Sedation was administered by a consultant anaesthetist experienced in the technique, with full essential monitoring.

Method

The protocol for the prospective audit was agreed amongst dental practitioners and anaesthetists working in the primary care setting at QAMC. This was a pragmatic study to test a technique that was in current use. The practice environment meets with current guidelines for safe practice[4, 6, 7], all its staff are trained and experienced in providing dental sedation for children and all staff hold relevant postgraduate qualifications. When using an alternative technique a dedicated sedationist (a consultant anaesthetist) is present throughout the procedure.

Sedation technique

Each child was assessed according to their level of cooperation, their level of anxiety and the invasiveness of the intended procedure by an experienced dentist. Where possible, children were offered the standard inhalation sedation technique of titrated nitrous oxide in oxygen and introduced to an inhalation sedation nose mask. As part of the assessment, written informed consent was obtained, written information and advice was given and topical anaesthetic cream (Emla®) was supplied, to be placed on the dorsum of the child's hand one hour prior to the sedation visit.

At the treatment appointment the child was asked to sit in the dental chair and tolerate breathing through a nasal mask. An inhaled combination of up to 0.3% sevoflurane and up to 40% nitrous oxide in oxygen at 6l/min was titrated for 2 minutes. This was followed by intravenous cannulation using a Teflon-coated in-dwelling cannula. Intravenous administration of fentanyl followed up to a maximum of 0.75µg/kg (max 75µg) with titrated midazolam at 0.5mg increments. Sedation was administered by a consultant anaesthetist experienced in the technique, with full essential monitoring.

A Drager Julian anaesthetic machine monitored pulse oximetry, automatic non-invasive blood pressure and ECG. The nasal hood was adapted to incorporate a probe to measure fractional inspired and end-tidal oxygen, carbon dioxide, nitrous oxide, and sevoflurane.

Once the clinical end point of conscious sedation was reached, topical anaesthetic was then applied to the gum. Two minutes later the dentist injected 2% lignocaine with 1:80,000 adrenaline. During the procedure, the dentist maintained verbal contact and ensured the child remained responsive to verbal commands. The dentist chatted to the child using calming suggestions and imagery, to reassure and to distract attention.

If necessary, the concentration of sevoflurane or nitrous oxide was reduced during the procedure if the child showed signs of oversedation. Throughout the procedure the established protocols of good sedation practice were employed by the team.

The anaesthetist continuously monitored oxygen saturation, heart rate, ECG, capnography, fractional inspired sevoflurane and end-tidal sevoflurane and formally recorded them at five-minute intervals during treatment. Blood pressure was recorded once the clinical end point of sedation had been reached.

The intended dental treatment was carried out unless limited by the maximum dosage for local anaesthetic. If additional treatment was required a second visit was arranged; this visit was not included in the study.

After treatment, 100% oxygen was delivered through the nasal hood for two minutes before transfer on a trolley to the recovery room. The child was monitored during recovery by an appropriately qualified nurse.

Inclusion criteria

Patients included in the audit were all children aged between 3 and 16 with an ASA of 1 or 2, had consented and were deemed fit to undergo conscious sedation following pre-assessment with the described alternative technique.

Exclusion criteria

Children who were too uncooperative to proceed with treatment (failed sedation). Children with ASA 3 or above or children deemed too anxious for conscious sedation at pre-assessment appointment.

Audit protocol

During treatment and recovery the conscious sedation record sheet was completed and copied for the purpose of the audit. All patients meeting the inclusion criteria and treated using the alternative technique being evaluated were collected from 1 October 2007 and 26 January 2008.

Data recorded included: patient's name, sex, date of birth, ASA classification, the operating dentist and anaesthetist, patient's weight, any relevant medical history, time of last food and drink, time of start and end of procedure, the technique and drugs used, cooperation and consciousness levels during procedure and consciousness levels during recovery, time of discharge, method of transport and escort, treatment provided and finally the treatment outcome.

Pre-operative starvation requirement was equivalent to that for general anaesthesia.

Monitoring during the procedure included electrocardiogram, end arteriole oxygen saturation, fractionated inspired and expired gases (oxygen, nitrous oxide and sevoflurane, end-tidal CO2 and non-invasive blood pressure monitoring.

Consciousness using the modified Wilson scale[11] and cooperation using the Venham scale[12] were monitored and recorded on the sedation record sheet every five minutes during the procedure. Consciousness was recorded every five minutes while in recovery.

The consciousness and cooperation score was agreed by the dentist and the anaesthetist and recorded as an average value every five minutes.

If responsiveness to verbal commands was lost, its incidence and duration was recorded.

Oversedation was considered to have occurred if a score of 5 or 6 on the Wilson scale was recorded.

The audit was prospective, so training and discussion of protocols and agreed scales for levels of consciousness and cooperation was undertaken. Anaesthetists, dentists and nursing staff involved in data recording were trained and calibrated to reduce operator bias.

Results

Results were transferred from the data sheets to a spreadsheet by an independent single operator using an agreed key to standardise the input of the recorded data.

Results analysis revealed that during the audit period there were 9 dental operators and 7 consultant anaesthetists who worked in the clinic, with each clinician treating a similar number of patients.

During the audit period, 752 patients received treatment. Of these the age was recorded on the data sheet for 581 patients, of whom 9 were over the age of 16 and were therefore excluded from the analysis, giving a sample size of 743 patients. The youngest patient treated was 1 year old. The average age was 8.3 years old. 491 patients were male and 253 patients were female.

ASA was recorded for all patients: 628 were ASA 1, 112 were ASA 2 and 3 were ASA 3.

Nitrous oxide was received by 94.9% of patients; 1.6% of patients received 30% nitrous oxide, 0.13% received 35%, 86.7% received 40%, 4.4% received 50%, 1.89% received 60%, and 0.13% received 65%.

Sevoflurane was received by 93.3% of patients; 0.13% of patients received 0.1% inspired sevoflurane, 19.3% received 0.2%, 71.6% received 0.3%, 2% received 0.4% and 0.13% received 0.5%.

Fentanyl was administered to 95% of the patients; the range was 10µg to 75µg. 35% of patients were given 25µg, 1% had 20µg and 26.5% had 50µg.

Titrated intravenous midazolam was received by 95% of patients. The range was between 0.5mg and 8mg. The average dose was 1.67mg.

Of the 743 patients, 573 received the audit protocol technique of titrated doses of nitrous oxide, sevoflurane, fentanyl and midazolam. One hundred and one patients were excluded from this part of the analysis because they received oral sedation prior to treatment or propofol (4 patients) or flumazenil (3 patients). The remaining 62 were excluded because they had not received all the agents in the protocol technique.

Of the 573 patients, 570 successfully completed treatment and were referred back to their own general dental practitioner, 1 patient was referred for a general anaesthetic and 2 failed to complete treatment, being referred back to their own GDP as they did not meet local general anaesthetic referral guidelines.

The average length of the procedure was 20.1 minutes, with a range of 5 minutes to 85 minutes. The average length of the recovery period was 30 minutes.

The number of teeth treated during the single visit ranged from 1 to 16 teeth, the average patient having 4.8 teeth treated.

Of the 573 patients treated with the technique without modification, 11 patients had a consciousness score of 5. No one had a consciousness score of 6. For these 11 patients the duration of a consciousness score of 5 or more was for 1 minute or less for 7 patients, 2 minutes for 3 patients and 5 minutes for 1 patient.

All of the 11 patients who had a consciousness score of 5 during treatment experienced uneventful recovery periods. There were no signs of minor morbidity, none had oxygen saturation below 95% and none received flumazenil. All 11 patients managed to complete their treatment and were referred back to their GDP. Of these 11 patients, 7 patients were male and 4 patients were female. The patients' ages were 2 patients aged 5, 1 patient aged 6, 1 patient aged 7, 1 patient aged 10, 2 patients aged 12, 1 patient aged 13, 1 patient aged 14, 1 patient aged 15 and for 1 patient the age was not recorded. The ASA was 1 for 8 patients and 2 for 3 patients.

The 11 patients with a consciousness score of 5 or above were treated by 6 different dentists and 6 anaesthetists. All patients received 40% nitrous oxide, 10 patients had 0.3% sevoflurane and 1 patient had 0.4% sevoflurane. The fentanyl dose range was 15–50µg relative to the weight of the patients. The length of procedure ranged from 15–40 minutes with an average of 20 minutes. The time in recovery before discharge ranged from 20–50 minutes with an average of 35 minutes. The number of teeth treated ranged from 1 to 13.

Recovery consciousness scores for the 573 patients receiving the audited technique revealed 2 patients had a score of 5 or above during the recovery period. Each consciousness score of 5 had a duration of less than 5 minutes. The overall recovery time was 50 and 60 minutes respectively, the patients were aged 11 years and 13 years and both had treatment completed successfully. Both had received 40% nitrous oxide, 0.3% sevoflurane, 50µg fentanyl and 4mg of midazolam.

The consciousness score was recorded during the treatment for the 170 patients excluded from the main analysis. A consciousness score of 5 was recorded for 3 patients; of these, 2 patients had a duration of 1 minute and the third patient had a duration of 2 minutes. All 3 patients had received oral sedation prior to cannulation and received all four sedative agents. One of these patients received flumazenil. During the recovery period a further 4 patients had a consciousness score of 5 or more while the duration was noted as 5 minutes.

All of these patients successfully completed their treatment, did not have oxygen saturations below 95% and were discharged uneventfully. No patient, at any point during treatment or recovery, was overly uncooperative.

Discussion

QAMC provides dental care for anxious patients in the deprived area of Teesside, where there is not only a high need but also great demand for dental treatment with conscious sedation. A range of sedation techniques is used at the clinic, each carefully tailored to suit the individual patient's needs.

QAMC aims to complete treatment for patients with the minimum dose and least number of sedative agents following the principle of minimum intervention.

This audit has focused on the cohort of patients who were deemed too anxious for treatment with standard sedation techniques and were therefore treated using alternative techniques in order to avoid the need for referral to hospital for general anaesthetic.

For the 743 patients managed with a dedicated sedationist during the audit period the alternative technique was tailored to the individual patient's requirements on the day of treatment but always within the definition of conscious sedation. Of these, 101 patients required oral sedation prior to treatment as they would not sit in the dental chair to allow inhalation sedation to be administered prior to cannulation, and 4 patients received propofol as an additional agent to the audit protocol. The technique was modified to reach the level of sedation required for individual patients and 62 patients did not require all protocol drugs in order to cooperate and complete their treatment.

Of the 743 patients 573 were treated with the audit protocol without modification and were treated with a titrated dose of inhaled oxygen, nitrous oxide, sevoflurane and titrated intravenous fentanyl and midazolam.

570 of these patients, who would otherwise have required general anaesthetic, successfully completed their treatment using this technique. Two patients were unable to tolerate treatment and were referred for treatment under general anaesthetic, and one patient failed to complete their treatment but did not meet local referral guidelines and was referred back to their general dental practitioner.

These results indicate an improved success rate, with the addition of fentanyl to the previous research technique, from 93% to 99%.

1.9% of patients treated with this technique experienced a consciousness level of 5 (eyes closed, responsive to mild physical stimulation). For all of these patients the duration was less than 5 minutes and they did not experience a drop in oxygen saturation. They had no minor morbidity nor untoward incident and all recovered uneventfully. A consciousness score of greater than 5 (unresponsive to mild physical stimulation) was not recorded for any patients during the audit period. This suggests the alternative technique fits the UK definition of conscious sedation as verbal contact is maintained and there is a margin of safety wide enough to render the loss of consciousness unlikely.

In conclusion this audit indicates that this alternative technique was tolerated by 99% of patients who would otherwise have required general anaesthetic for their dental treatment with increased costs and risks. This technique also meets the UK definition of conscious sedation.

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MANAGEMENT OF PAIN AND ANXIETY IN THE PAEDIATRIC PATIENT

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Introduction

Fear and anxiety prevent many people from seeking dental treatment, until their pain becomes unbearable[1]. Sadly these fears and anxieties are magnified in children, whose early dental experiences determine their adult behaviour. 15% of children do not seek dental treatment through fear[2]. For these patients some form of behavioural management is required to make dental treatment more acceptable. This paper will survey the issues surrounding the management of this group of patients.

Why are children afraid of the dentist?

There are many reasons why dentistry is associated with fear and anxiety. A Dutch review[3] of 67 of the most common dental-related stimuli found that most adults associated anxiety with specific procedures (e.g. 'root canal'). Very few patients ranked stimuli such as the dentist's manner, waiting room or the smell or sound of the surgery as being anxiety-provoking. Children, however, remain much more preoccupied with non-invasive stimuli, such as the dentist's manner, unfamiliar sights, smells and sounds within the surgery[17]. The reason why different stimuli provoke anxiety in children and adults is related to the cognitive development of the child. Beyond an inability to comprehend dental treatment, and a generalised fear of the unknown present in all young children, which is explored further in the next section, dental treatment place large demands on the child. The intimacy, sound and unfamiliar sensory stimuli associated with dental treatment places the child under stress, with which children vary in their ability to manage. To a large extent, this coping ability depends on the attitudes of the parents, whose parenting styles can be broadly defined as authoritarian, permissive and authoritative[4]. Children of authoritarian parents tend to be distrustful and hostile, whereas children of permissive parents are characterised by their lack of self-control. The ideal is the authoritative parent, whose children characteristically have a good level of self-control and are cooperative – i.e. are sufficiently mature to accept dental treatment[4,17]. The parent's role is manifold, in that children of dental-phobic parents can 'learn' an irrational fear of the dentist[1,12,13,14], in the same way that a fear of spiders, etc. is cultural rather than biological in origin5. Finally, the socio-economic status of the parent plays an important role[13,14,7]. Children born into a lower socio-economic bracket are shown to experience greater rates of dental disease1 necessitating more radical treatments that are often undertaken to relieve acute pain[13]; a clear co-morbidity exists between dental anxiety and dental disease[6, 7]. This contrasts with the ideal cycle of positive reinforcement of regular hygiene visits, which are pleasant for the child and maintain good oral health[7,11].

Relationship between anxiety and the cognitive development of the child

Children go through several stages of cognitive development, as first described by Piaget[8,9]. The first lasts from birth to two years of age, and is known as the sensorimotor stage. The child relies entirely on his or her sensory experience, has a strong relationship with the parents and a corresponding fear of strangers. They will automatically recoil from unfamiliar or painful stimuli, and have no abilities to reason, or understand cause and effect.

The second stage lasts from ages two to seven, and is known as the pre-operative stage. The child still has an overtly egocentric viewpoint, and is unable to relate to others. Children in this stage still display a strong fear of the unknown. They do not fully appreciate cause and effect, and still cannot reason. For example, they cannot understand that dental treatment may prevent pain in the future. The most important relationship at this stage is with the parent or caregiver.

The penultimate stage lasts from seven to 12 years and is called the concrete operational stage. Children in this stage are capable of reasoning, although their abilities to understand abstract concepts like healthcare are described as being 'rule-bound' rather than concrete.

The final stage begins at age 12 and is termed the formal operational stage. In this stage, children are capable of inductive reasoning, and are able to arrive at logical conclusions. They are able to reason from hypothetical viewpoints, and understand that actions have future consequences. The ability of a child at this age to make an informed decision about his or her own healthcare has profound implications on the topic of consent, and as such is recognised in law. Although the Family Law Reform Act 1969 sets the age at which a person may consent to medical treatment as 16, a child may be assessed as 'Gillick competent'[10] and able to provide their own consent.

When describing anxiety, Freud made a distinction between 'realistic anxiety' and 'neurotic anxiety'[9]. Realistic anxiety can be summarised as rational 'fight or flight' responses associated with external dangers. Neurotic anxiety can be described as an irrational fear or phobia. One characteristic of children is their lack of appreciation for realistic dangers (for example when crossing the road) and their preoccupation with irrational fears (for example the dark). It is clear that the child's experience of anxiety is highly dependent on his or her cognitive stage of development. The emphasis on visual and tactile sensations in the pre-operative and sensorimotor stages explains findings of children's concern with sensory stimuli in the surgery, whereas adults are more fixated upon the procedure itself[3]. For this reason, it is generally recommended that the dental environment be made as warm and child-friendly as possible, and that a positive and encouraging demeanour is adopted[11,2]. Likewise, the child's close maternal relationship corroborates the finding that children's dental anxiety is strongly associated with maternal dental anxiety[12]. Care must be taken, therefore, not only to assess the mother's dental anxiety[13], but to encourage a positive association with dental care in the child, in order to break the cycle of dental anxiety in families. Indeed, adults, when explaining the cause of their dental anxiety, frequently cite an unpleasant dental experience as a child[14].

Management of the anxious child

Anxiety has been defined by Kent as 'the vague unpleasant feeling accompanied by a premonition that something undesirable is about to happen'[15]. The goal of the dental surgeon is not only to make dental treatment possible for the anxious or fearful child, but to demonstrate that dental treatment need not be feared. This will improve the long-term prognosis for the patient's oral health, which shows a very close relationship to dental anxiety: patients showing high levels of dental anxiety were over two times more likely to be amongst those experiencing the poorest oral health related quality of life[16]. The anxiety that children feel before, during or after dental treatment can manifest itself in a number of behaviours that may be broadly interpreted as 'misbehaviour'. The child may misbehave due to fear, his or her lack of emotional development, or he or she may suffer from behavioural problems[17]. His or her behaviour can be placed into one of three categories:

Cooperative
Potentially cooperative
Uncooperative.

A number of techniques are available to the dentist to help overcome the child's fear and anxiety, allowing treatment to be carried out.

Behaviour management

Most children who are anxious or fearful at their first dental visit can be managed through a variety of non-pharmacological techniques. A variety of techniques, such as 'tell show do' and positive reinforcement of good behaviour is used to 'model' the patient's behaviour[11]. The child is slowly introduced to dental treatment, which removes an element of uncertainty, and effects a systematic de-sensitisation of the child's fears. These psychological approaches must be emphasised because pharmacological treatments are never an alternative, but are always used in conjunction with them.

Pharmacological treatments: local anaesthesia

Local anaesthesia is defined as the temporary loss of sensation or pain in one part of the body, produced by a topically applied or injected agent without depressing the level of consciousness[18]. The history of local anaesthesia

began with the isolation of pure cocaine from the coca plant, which had long been used by Bolivian and Peruvian natives. William Halstead, at Bellevue Hospital in New York, demonstrated that a mandibular nerve block can be carried out by intraoral injection of 4% cocaine[19]. Safety concerns led to the development of the ester derivative Procaine in 1904, and the amide Lignocaine in 1943 by the Swedish chemist Nils Löfgren, which remains in use to this day[20], though there have been some recent advances in the field[21]. Effective local anaesthesia has a role to play not only in the management of pain, but also in the management of the fear of that pain. 'Some people are difficult to treat, not because the dental surgeon is hurting them, but they think that he may be about to do so'[22]. In this case, local anaesthesia can help to reassure both dentist and patient that no pain will be caused, and to prevent any discomfort to the patient.

Local anaesthesia is the safest method of rendering dental operations pain-free. However, it is recognised that the needle itself causes the greatest negative response in children[23]. Furthermore, while it is the fear of pain that is the cause of much anxiety, greater levels of anxiety result in greater perception of pain[24,1]. Various topical anaesthetics can be applied to reduce the 'slight pinch' felt by the needle[23] as well as the use of various novel injection devices[23,24]. However, it is shown by Kuscu and Akyuz[24] that the child's anxiety is the largest determining factor in the amount of pain experienced. In some cases, the psychological state of the patient can result in a failure of the local anaesthetic[26]. This only highlights the importance of the effective use of non-pharmacological techniques in reducing the child's anxiety.

Pharmacological treatments: sedation and anaesthesia

The use of local anaesthesia presupposes that the child's anxieties can be controlled sufficiently to make him or her cooperative with the treatment. There are some cases where this is not possible, notably in children with behavioural problems, where there are barriers to effective communication, or in children with special needs.

For this group, dental treatment would be impossible without some further pharmacological intervention[25], which can be broadly defined as conscious sedation and anaesthesia.

General anaesthesia

General anaesthesia is an unrousable state associated with loss of airway reflexes and respiratory depression[27]. Since the work of Wells and Morton, there has been a long history of the use of general anaesthesia in dentistry. However, a number of high-profile cases of death[28,29] and concerns over facilities and training[28] led to the publication of the Poswillo report in 1990. This outlined a number of proposals to reduce the number of deaths associated with dental chair anaesthesia, which stood at two per annum at that time[30]. An inquiry into five deaths was carried out in 1998[30]. Since 2001 dental general anaesthesia can only take place in a hospital setting and be administered by a qualified anaesthetist, and access to critical care facilities should be available[31,32]. The number of dental general anaesthetics administered fell in the period 1950–2000, though a slight upward trend was noted around 1994[32]. The reasons for the fall were, amongst other things, a cited improvement in general dental health, and increased use of local anaesthesia and sedation techniques[32].

The death rate associated with general anaesthesia has been estimated to be 1 per 300,000[33]. This risk means that it is the method of last resort[32]. General anaesthesia also carries the risk of some significant side effects. The intubation process can result in damage to pharyngeal and adenoidal tissues[34]. From a psychological point of view, general anaesthesia does nothing to aid the long-term modelling of the patient's behaviour. Indeed, hospitalisation itself can be a stressful experience for up to 50% of children[23]. General anaesthesia itself, due to the inherent risks, is frequently regarded as the most dangerous medical intervention[35], and would cause much maternal anxiety[36]. Pre-operative anxiety has a definite link with post-operative morbidity[37].

Conscious sedation

'Sedation is a technique in which the used of a drug, or drugs, produces a state of depression of the central nervous system enabling treatment to be carried out, but during which communication is maintained such that the patient will respond to command throughout the period of sedation. *The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely.* Any technique which exceeds this definition of sedation and where contact with the patient is lost may be regarded as general anaesthesia with all its attendant

consequences and responsibilities.'

Definition of sedation: Guidelines for sedation by non-anaesthetists, Royal College of Surgeons of England.

The demand for dental sedation has increased following the changes to the law concerning the use of general anaesthetics[32]. Its use is indicated for those patients who are anxious but cooperative[25]. Conscious sedation enables the dentist to manage the child's apprehension and reaction to painful stimuli. Sedation must always be considered in tandem with non-pharmacological behavioural techniques, which were emphasised earlier in this paper. A positive combination of the two can render the child more receptive to future dental procedures, forming part of a behaviour modelling strategy[11]. The child remains conscious, and will respond to voice commands. For this reason, the child should be cooperative.

There are broadly two methods of sedation: inhalation nitrous oxide sedation, and oral or intravenous sedation. Nitrous oxide is used at low concentrations to reliably provide sedation and mild analgesia, though it is a weak general anaesthetic. It was first used in this manner by Lange, who used sub-anaesthetic doses of nitrous oxide coupled with copious amounts of calming and reassuring talk[19]. It has an excellent safety record, with few side effects. Less than 10% of patients suffer from nausea and vomiting post-operatively[40]. Nitrous oxide sedation is always used in conjunction with local anaesthesia for management of pain.

Sedatives are frequently administered by the oral route (per os) due to their ease of administration and safety. Furthermore, they do not rely on intravenous or intramuscular injection, which may be the child's principal source of anxiety[24]. The drug may also be given per rectum in the very young or emotionally handicapped, or those patients who may have difficulty swallowing. There are various drugs and combinations, though the most commonly encountered group of anxiolytics are the benzodiazepines, whose use is supported by various studies[41]. Narcotics are rarely used[42], though some are an accepted 'alternative technique' by the Royal College of Surgeons and Royal College of Anaesthetists[43].

Intravenous sedation was once not widely used for children in the United Kingdom but its use is now becoming more widespread[46,63,64]. The Alternative Sedation Techniques document 2007 regards children, in the context of sedation, as being younger than 12 years old. A number of children under 16 can be successfully managed by IV sedation techniques[45], and there is little evidence to suggest that this could not be used by appropriately qualified sedationists. IV sedation has a number of advantages. It has a rapid onset, the drug may be titrated to provide the appropriate level of sedation and has a shorter recovery time than drugs administered orally, and there is appropriate venous access to administer reversal drugs or emergency drugs should an emergency arise. The gag reflex is diminished (which is also true for inhalation sedation of nitrous oxide)[40]. A disadvantage of orally administered drugs, which is avoided by this technique, is the passing of the drug through the gastrointestinal tract. The presence of food in the stomach, delayed gastric emptying and hepatic-first pass effects are all 'drawbacks' of the oral route.

It was stated earlier that the use of a needle is a major cause of anxiety in children[29]. However, many patients will tolerate the placement of a venflon in the dorsum of the hand better than intraoral injections[20].

Sedation, as it is practised in the United States, is frequently divided into conscious sedation and deep sedation, which exist on a continuum between being fully alert and calm to asleep but easily aroused (verbally) for conscious sedation, and being asleep and difficult or impossible to arouse for deep sedation. In the United Kingdom, deep sedation would be defined as anaesthesia, and therefore would only be carried out by a qualified anaesthetist in the hospital setting, as defined by the Royal College of Surgeons guidelines[38].

It is now well accepted[41,42] that sedative combination (e.g. midazolam with inhalation nitrous oxide) can provide a level of sedation that allows the treatment of the cooperative but anxious child in the dental surgery (i.e. the non-hospital setting). It is a safe alternative to general anaesthesia[46,47], forming part of a long-term behaviour modelling strategy, wherein the child is exposed to a positive dental experience[48].

In summary: surgery-based sedation can provide a cost-effective and safe alternative to general anaesthesia46, which can help to widen access for socially disadvantaged groups who may otherwise have limited access to healthcare49. Furthermore, referrals under general anaesthetic tend to be limited to extraction[50,47]; sedation can be used for less radical treatments.

Can sedation plus restraint replace general anaesthesia?

There remains a group of children who are pre-cooperative, the emotionally under-developed and those with special needs, who cannot provide the level of cooperation required for conscious sedation. Under current UK guidelines, these children must be treated under general anaesthetic[32].

An ongoing controversy is whether this group of patients can ever be treated using conscious sedation with restraints. In the United States, 75% of paediatric dentists reported the use of some form of physical restraint during sedation[50], and this is regarded as a proper form of behaviour management by the American Association of Paediatric Dentists[51]. The goal of the treatment is to assist the patient to accept dental treatment without resort to general anaesthesia, providing a positive psychological experience, in keeping with a behaviour modelling strategy[52]. However, in the United Kingdom, any form of restraint is strongly discouraged, with few[53] practising the Hand over mouth (HOM) technique (32% versus 58% who reject HOM in all circumstances[54]). HOM is where the dentist places a hand over the hysterical child in order to establish effective communication with the child.

Furthermore, the General Dental Council firmly discourages the use of restraints[55]. It is argued that HOM and physical restraint can provide an atmosphere of intimidation or anxiety in the dental surgery, and violate the civil liberties of the child[56]. From a legal position, this latter point is uncertain and remains untested[57]. However, there is a paucity of formal evidence to suggest that physical restraint can be damaging in the long term. Kantaputra[58] found that children can prefer the use of physical restraint (papoose board) to voice control, and Wright[59] found that HOM has no reported negative psychological consequences. Clearly, explicit parental consent would be required. One impediment would be that in American studies few parents (39%[60]) would be prepared to accept HOM or physical restraint (25%[61]).

HOM and physical restraint are inappropriate for those who are either pre-cooperative or incapable of cooperation due to mental or emotional disability[59]. However, the potentially cooperative child who cannot be treated by sedation alone due to obstreperous misbehaviour could (in principle) be a candidate for physical restraint and HOM aversion techniques, forming a part of a behaviour modelling strategy. The topic remains controversial, and remains unlikely to be introduced in standard UK practice.

Conclusion

As discussed, there are a variety of methods to control the pain and anxiety of paediatric dental patients. In the long term, this can help to break the cycle of dental fear, which shows a complex interrelatedness with poor health and social disadvantage[1]. With general anaesthetics being regarded as a last resort, conscious sedation now plays a central role in the treatment of anxious children.

Dentists pioneered the field of anaesthesia, liberating the world from the pain of surgery. They continue at the forefront of sedation, which may remove the final barrier of anxiety[62].

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THE CHALLENGE OF SEDATION WITH ADOLESCENTS: CASE STUDIES AND CLINICAL RECOMMENDATIONS

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Abstract

Adolescent dental patients pose a unique challenge to providers, particularly when intravenous sedation is introduced to the treatment plan. Surveys show many adolescents are afraid of the dentist. Five to six per cent overall are fearful of dental injections and may avoid care or have irregular attendance. At the same time, adolescents may assert their independence by refusing to cooperate with providers' and parents' requests even while accepting that the goal of better health is reasonable. Successful treatment of – and rapport with – the adolescent dental patient, however, can ensure that adolescents' oral needs are met. Successful providers recognise that adolescents alternate between childlike and mature coping strategies during the course of dental treatment. Identifying an adolescent's current coping style can help the dental team select appropriate strategies to help treatment proceed more smoothly for the adolescent and clinical team. Working with adolescents' individual coping styles, rather than expecting consistently adult behaviour, will ideally help decrease frustration and improve treatment outcome.

Introduction

Adolescents are a challenging dental patient population, particularly when intravenous sedation is proposed as part of the treatment plan. Prior research has suggested that fear of both dental and medical injections occurs in approximately 15% of adolescents, with 5–6% of adolescents avoiding dental and medical care because of injection fear.[1] Because adolescents are no longer children, but not yet adults, dental providers must often modify their interaction styles in order to gain adolescents' cooperation. Behaviour management strategies used for children typically are not developmentally appropriate, yet dental providers who assume that all of their adolescent patients may be treated as adults may find themselves with non-cooperative patients. In short, adolescents may display a much wider variety of behaviour, compared with that of younger children. This paper presents some considerations for what makes some adolescent patients difficult to treat, followed by some brief case examples, and then concludes with suggestions to improve cooperation in this patient population.

The presence of dental fear in some adolescents has been noted in a number of studies.[2–4] A recent summary of population-based studies conducted in a variety of countries around the world estimated that 9% of children and adolescents experience dental fear.[5] Common fears

include the dental injection, drilling and choking.[6] In the UK, fearful patients may comprise the greatest number of child and adolescent patients seen in speciality dental clinics. For example, clinicians in Glasgow reported that behavioural management problems were the most common reason for referral to a child and adolescent speciality clinic, occurring in one-third of the patients referred.[7] In a different study, clinicians in Newcastle reported that one-fifth of the referrals were due to behaviour management problems, more than for any other reason.[8] While management techniques for fearful children and adults have been described in the literature (e.g. Milgrom, Weinstein & Getz)[9], less has been written about working with fearful adolescents. In this paper, we propose that a developmental model of adolescence that focuses on cognitive and emotional development may provide additional insight into the nature of adolescent fear and coping with the dental situation.

One of the hallmarks of adolescence is the gradual shift in cognitive style from one focusing on concrete objects and events to one marked by the increased use of abstract thinking, in a set of cognitive skills and styles Piaget termed 'formal operational thinking'.[10–11] Formal operational thinking permits adolescents to think of possibilities, rather than just 'what actually is'.[12] For example, some adolescents may be able to imagine what it would be like to receive dental treatment with little or no fear, rather than assuming that dental treatment will always be frightening and traumatic. A second hallmark of this advanced set of cognitive abilities is the ability to formulate and test hypotheses using formal logical methods,11 rather than employ the trial-and-error methods of younger children. For example, an adolescent who realises that his/her fear is exacerbated by worry that he/she 'won't be able to cope' can then logically deduce: 'If I could cope better, then I wouldn't get so frightened'.

Despite the ability to use formal logic in many instances, sometimes adolescent thinking can be less logical. Adolescents tend to have a 'sense of invincibility', believing that they are immune from the logical outcomes of certain events. This is thought to be one of the primary reasons why some adolescents engage in risky or unhealthy behaviours, as they claim that the possible negative outcomes, such as severe dental disease, 'can't happen to me'.[13–14]

Health attitudes and behaviours of adolescents undergo a transformation during this period of growth. The attitudes and behaviours of younger adolescents are largely influenced by current wants and needs, likely related to the sense of 'invincibility' in that long-term consequences are less likely to be considered. However, by late adolescence, adolescents have a better sense of time, and therefore may modify their health opinions and behaviours to be more aligned with long-term outcomes they value.[15] For example, older adolescents may be more likely than younger adolescents to respond to the rationale: 'You should have your tooth fixed now so that it doesn't cause you pain later on'.

One of the primary tasks of adolescence is the development of an individual sense of identity.[16] Parents and dentists need to recognise the adolescent's need to operate independently, while at the same time permitting him/her to depend on parents or other adults for nurturance, guidance and support. Disagreements with parents are common, especially in early adolescence,[17] and thus the exercise of adolescent independence is often frustrating to parents and other authority figures.[18–19] As a result, adolescent dental patients may respond in various ways to requests from dental providers and parents. In some cases, they may rely solely on parents and providers to make decisions for them regarding care, while in other cases they may behave illogically as they assert their independence by refusing treatment or being non-compliant.

Another developmental change occurring during adolescence involves conceptions and understanding of pain.[20–22] Young children tend to define pain concretely ('it hurts'). Adolescents are better able to define pain in more abstract terms, referring to the physiological and/or psychological nature of pain (with references to nerves, signals, the brain, etc., and/or to anxiety, suffering, and the like). Because children have had fewer painful experiences than adults, they tend to experience and rate less noxious stimuli as more painful than they appear to adults.[23] Additionally, adolescents are able to conceive of pain as something that needs to be coped with, whereas young children describe pain as something they passively endure.[21] Thus, adolescents are more likely to use a variety of cognitive coping mechanisms, such as distraction, information-seeking, problem-solving and positive self-talk, compared with younger children.[20,22–24] In addition, because adolescents have a more complex understanding of pain, they are more likely to consider positive aspects of the otherwise stressful situation ('I know that the dentist has to put a needle in my arm, so that I won't feel it when she uses the drill to fix my tooth'), which can also help with coping.[20]

Despite the ability to successfully use coping skills, adolescents – like younger children – are also likely to engage in strategies that increase anxiety, such as worrying or focusing on fear.[25–26] It appears that many adolescents make negative self-statements (e.g. 'This hurts, I hate shots') and other anxiety-increasing responses when stressed (e.g. focusing attention on increased heart rate and concluding that the situation is dangerous), while those who cope best utilise more helpful coping skills. As they grow, adolescents also are able to increasingly inhibit or cover up behavioural signs of distress, with boys more likely to suppress these behaviours compared with girls.[20] Thus, an adolescent who appears calm outwardly may actually be feeling distressed internally. Finally, adolescents – like adults – may differ as to which situations are stressful, and may utilise different coping strategies in different situations. As a general rule, adolescents are more likely to use less effective strategies when their stress is greater.

Initial evaluation

During the initial evaluation, straightforward questions such as 'How do you usually deal with stress at school, at home, or with friends?' will help the dentist learn the extent to which the adolescent tends to use more mature (e.g. distraction, positive self-talk) vs. more concrete (e.g. attempting to flee the situation) coping strategies, as well as provide ideas for strategies that can be adopted for use in the dental setting. Adolescents who are able to identify and regularly use adequate coping strategies in their daily lives are usually able to translate these skills to the dental setting when coached to use them by the dental team. This will allow for an easy sedation when such treatment is dentally needed. On the other hand, many adolescents have not developed adequate coping skills by the time they arrive in the dental office and have been impossible to treat in a typical surgery. In these cases, sedation will be less stressful for the patient, and less difficult for the clinician, if the dental team is able to teach the adolescent new coping skills. However, as described above, there may be developmental factors that make it more difficult for the adolescent to learn and use more mature skills.

The following three cases describe adolescents who received intravenous sedation as part of their treatment at the Dental Fears Research Clinic at the University of Washington in Seattle. In each case, the adolescent presented with few mature coping skills. In the first two cases, the adolescent needed curative dental treatment quickly and thus we describe the challenges that these adolescents posed to us. In the third case, there was no immediate need for extensive treatment and thus we were able to allow the adolescent time for development. Additional treatment recommendations are summarised in Table 1.

Table 1: Challenges adolescents may pose in dental treatment and suggested recommendations

Challenge	Recommendations
Patient won't proceed with treatment without parent present	Involve the parent to encourage patient to use coping skills
Patient won't interact with dental team	Have one member of the team develop rapport with patient over non-dental hobbies and interests
Patient doesn't seem to understand purpose of taking care of current problems to avoid future pain	Focus on 'here and now', such as the sense of pride and accomplishment the patient will feel when the treatment is done
Patient seems more childlike than is appropriate for his/her age	Focus on concrete coping skills, such as deep breathing; actively talk the patient through imagining pleasant scenes
Patient has few mature coping skills, but no urgent dental needs	Use intensive topical fluoride regimen to control caries and buy time for development of mature coping skills

Case no. 1: Bonnie is overwhelmed by the dental situation

Twelve-year-old Bonnie, an overweight young adolescent, had many carious teeth and needed numerous restorations. Since she expressed no interest in overcoming her fear of dental injections and her dental needs were great, she was scheduled to receive all of her dental treatment in a single clinical session under sedation. When asked what she did in other stressful situations, Bonnie shrugged and could not answer. Her mother said that she liked to look at comic books and magazines. Bonnie appeared calm and not very interested when the dental team explained the procedures to her. Once treatment began, she extended her arm as requested and sat quietly as the Emla cream (2.5% Lidocaine, 2.5% Prilocaine; AstraZeneca Pharmaceuticals LP, Wilmington, Delaware, USA) was applied. Then she sat in the waiting room for the cream to begin working. Back in the dental chair she became visibly anxious as the dentist attempted to cannulate the vein. Bonnie was hypovolemic and the veins were hard to see because of the blanching caused by the cream. When the dentist was unsuccessful in her first attempt, Bonnie turned her head and stared at the needle and the injection site on her arm. Her eyes were wide. The dentist calmly told her to look away, but she continued to stare. However, she continued to extend her arm. On the second try Bonnie stiffened and pulled her arm away. The dentist gently and matter-of-factly explained that it would be easier for her if she looked away, but Bonnie stared fixedly and appeared to become even more anxious, but did not try to escape.

At this time, the dental nurse remembered that Bonnie had been looking at magazine pictures of female movie stars wearing fancy dresses while she was in the waiting room. Upon hearing this, the dentist asked the nurse to get the magazine. At the dentist's instruction, the nurse brought the magazine into the treatment room and held it in front of Bonnie's eyes, opened to a page of the stars in dresses. The nurse animatedly described one of the dresses in the photographs and then asked Bonnie to state which dress was her favourite. Bonnie's stiffness relaxed as she answered. While continuing to describe the dresses, Bonnie calmly allowed the dentist to move her arm back into position and to palpate and successfully cannulate a vein. There was no pain because of the Emla cream.

In retrospect, Bonnie's initial calm demeanour probably hid some degree of internal distress. When the initial attempt to place the needle did not succeed, Bonnie quickly ran out of reserves and became overcome by distress. The dentist directed her to use distraction (to look away) and included an explanation as to why this would be helpful. However, Bonnie was unable to do this on her own. It was only when the nurse introduced direct distraction by placing the magazine in front of Bonnie's eyes and asking her questions about what she saw that Bonnie was able to take her eyes and mind away from the needle. Bonnie's failure to utilise distraction on her own was probably also related to her relatively young age.

This case also illustrates the need to consider the merits of using topical anaesthesia to help adolescents tolerate the discomfort of cannulation, particularly when more than one attempt to place the needle becomes necessary. While the Emla cream blanches the tissue and sometimes makes it hard to see the vein, the additional difficulty for the dental surgeon may be preferable to dealing with the upset caused by additional cannulation attempts without numbness. Because of their youth, adolescents may not have had previous experience with intravenous cannula placements and therefore there may not be information in the medical history to predict whether they may be difficult to cannulate. While Bonnie was not obese, she was overweight, and therefore in retrospect was at higher risk for needing additional attempts before cannulation was successful.

Case no. 2: Emily refuses to interact with the treatment team

Emily, aged 14, was referred by her dentist and first came with her mother to our clinic because of fear of both medical and intraoral injections. Her mother reported that when the referring dentist attempted to complete the one filling that Emily required, Emily 'wouldn't let the procedure happen', refusing to proceed due to her fear. The possible need for sedation was frustrating to the dental team, because sedation for a single filling is hardly cost-effective in the US system.

During the initial evaluation, Emily refused to speak or make eye contact with members of the dental team, deferring all questions to her mother. She was unable to identify any coping skills she used to deal with stressful events; her mother, however, noted that Emily enjoyed talking with friends on the telephone and computer as

well as listening to music. When not in her mother's presence, Emily was willing to discuss her love of movies, and tolerated the initial dental examination without difficulty. Although Emily appeared to cooperate with all steps designed to help her overcome her fear and have treatment without sedation, she seemed emotionally disengaged as though she were 'just going through the motions'. She also expressed frustration with her mother's encouragement (repeating, 'Mom, stop pushing me to do this!'), yet refused to take part in any of the treatment steps without her mother present.

After several sessions of rehearsing the injection process, Emily ultimately refused to receive an intraoral injection. To avoid having the tooth abscess because of delays, intravenous sedation was recommended. Emily was initially hesitant to proceed with this option due to her fear of medical injections. However, when it was explained that we would provide an oral sedative medication prior to the cannulation, Emily agreed.

Emily's mother, somewhat frustrated at her daughter's refusal to accept treatment without sedation, told the dental team (with Emily in a separate room), 'We only have one chance at this', as she thought that Emily was not likely to agree to return for more than one appointment. After conversations with both of her parents and the entire dental treatment team (including the anaesthetist), it was decided that deception would be used. Emily would be told that the appointment would be a practice of the placement of the cannula without any poking, and that she would be given a liquid to drink (oral midazolam syrup; Roche Pharmaceuticals, Nutley, New Jersey, USA) that would make her feel sleepy, much like what would happen on the day of treatment. It was planned to use the anterograde amnesia caused by the midazolam to allow the dental team and Emily's mother to suggest to Emily that she remained calm enough to allow the IV sedation to proceed ahead of schedule.

At the appointment, Emily drank the midazolam (0.5mg/kg) without protest and engaged in a conversation with her mother and the dental nurse about movies while sitting in the dental chair. With her mother in the treatment room, the dental anaesthetist then administered intramuscular ketamine (2mg/kg IM; Bristol-Myers Squibb, Princeton, New Jersey, USA) mixed together with the antisialagogue glycopyrrolate (0.05mg IM; Baxter Healthcare Corporation, Round Lake, Illinois, USA) without any advance warning, which allowed the successful placement of the IV and completion of the dental treatment with a minimal adjunctive use of intravenous midazolam.

After treatment, Emily's mother reported that her daughter did not recall anything about the appointment after the time when they were discussing movies with the dental nurse. Emily's mother told her that, because she was coping so well with sitting in the dental chair, it had been decided to move ahead with the sedation ahead of schedule. Emily reportedly was very relieved that the dental treatment was completed, as well as happy that she had coped well with treatment. The retrograde amnesia provided by the medications allowed Emily's mother to suggest that Emily remained calm and allowed the IV sedation to proceed.

While Emily was superficially cooperative with the initial attempts to help her overcome her fear, she was ambivalent about having her mother present in the surgery. She required that her mother be present, yet would complain that her mother was 'getting in the way' with her suggestions and encouragement. It is possible that Emily's refusal to receive an intraoral injection reflected rebellion against the wishes of authority figures (i.e. her mother and the dental team), or alternatively reflected an overwhelming of her age-limited coping skills. By relying on her mother's presence during rehearsals, Emily was not required to use or develop any of her own coping skills.

Case no. 3: Richard develops the cognitive capacities to cope

Fifteen-year-old Richard was referred to us because he had a history of severe anxiety about situations involving authority figures, secondary to having experienced physical trauma from an older relative who had been living in the home. While Richard was very quiet with us initially, the dental nurse noticed that he was willing to cooperate with her while waiting for his mother, who was talking privately with the dentist. This cooperation led us to postulate that Richard might not be overtly negative towards dentistry and oral health per se. Nevertheless, he was passive when asked to articulate his dental (and other) goals, often demurring to his mother. However, we did learn that he tended to cope with stressful situations at school by gathering more information about the situation so that he didn't feel overwhelmed – a sign of mature coping. We hypothesised that Richard's normal

development had become disrupted by the trauma he had experienced as a younger child. Fortunately, Richard had no serious oral problems and therefore we recommended waiting on any curative treatment at this point. Instead, we chose strategies to control disease progression, buy time, and permit his normal development to continue and mature.

In conjunction with frequent short visits for topical fluoride treatments by the dental nurse to control caries, we actively searched for ways to engage him about his areas of interest and accomplishments that would help build a rapport and nurture a positive view of the dental team and dental care. For example, we learned he was planning a science trip at school, and asked him to tell us why he had chosen to go. Later, we asked him to bring photographs of the trip, and then engaged him in further discussion about his choice of subjects to photograph. These conversations – coupled with games – took place over a number of visits, during which the nurse monitored his oral status. During this time he began to take an interest in cleaning his teeth better.

As we had hoped, Richard's dental anxiety diminished. In addition, his self-assertiveness increased in appropriate ways. For example, shortly after his first appointment in our clinic, Richard had been referred for orthodontic care, which he initially accepted passively ('I'm here because my mom wants me to'). When orthodontic treatment began a year later, he delighted in making choices of which colour elastics to have placed, selecting colours that referred to sports teams or the current season. While his mother sometimes rolled her eyes at his choices, she recognised that this was really minor and supported his sometimes humorous attempts at achieving autonomy.

Two years after beginning treatment in our clinic, Richard's increased maturity and cognitive development were evidenced when he was scheduled for orthognathic surgery. He elected to make a separate appointment with the surgeon to view an information video about these procedures, discussed with his mother the benefits of the procedure and also how he would handle his fears, and made some decisions about how to best handle the cannulation. He requested his mother's presence during the cannula placement (which the anaesthesiologist accepted), and his mother reported that Richard calmly accepted the preparation while thinking about playing soccer. He successfully completed the entire procedure, demonstrating mature coping strategies such as information-seeking, problem-solving, and distraction.

This case presents an example of an adolescent who is fearful but has no urgent dental problems. In such cases, we frequently use topical fluoride treatments intensively to arrest/prevent caries and buy time for adolescent maturity to develop naturally. Whenever possible, we try to defer invasive treatments until such time as the adolescent has developed more mature coping methods.

Conclusions and recommendations

Dentists using sedation with adolescents should be aware of the complex cognitive and emotional transitions that occur during this time. Adolescents may alternatively be concrete and abstract in their thinking during this transition. To this end, dental providers must be prepared to provide both very structured coping directives (e.g. looking away from the IV site) for patients who are more concrete in their thinking while instructing more abstractly thinking adolescents to use their own coping strategies. Table 1 includes some common challenges with this population and suggested recommendations.

While establishing rapport is important with all patients, it is particularly critical that the dental staff engage with adolescent patients to make the patients 'part of the team'. Simple steps, such as taking time to learn about the adolescent patient's interests, hobbies, and even dislikes, will help the adolescent feel more valued and understood. Additionally, the dentist should have conversations with the adolescent directly (rather than relying purely on parental report, if at all possible) about his/her concerns about dental treatment. Most adolescents will respond to simple requests to open their mouths, allow the application of topical fluoride, and the like. These cooperative efforts should be praised, which will help build rapport and lay the groundwork for cooperation with future treatment.

Successful completion of dental treatment with sedation can be presented to the adolescent patient with extensive tooth decay as a chance to 'wipe the slate clean' and begin again with an opportunity to begin a sound oral healthcare regimen. Talking with adolescents about what they are and are not willing to do (e.g. using toothpaste, fluoride rinses, chlorhexidine rinses or gel, or to floss at home), rather than giving them an extensive list of instructions from the 'authority figure', will increase the likelihood of at-home compliance. As adolescents are

continually developing to become more independent and future-oriented, they are likely to take increasing responsibility for their healthcare habits. Adolescence, therefore, can be an ideal time for dental providers to help patients establish long-term preventive oral health practices.

Recommended reading

These two papers describe various positive and negative self-statements and other behaviours that fearful and non-fearful adolescents use in the dental situation:

Brown JM, O'Keefe J, Sanders SH, Baker B. Developmental changes in children's cognition to stressful and painful situations. J Pediatr Psychol 1986;11:343–357.

Prins PJM. Self-speech and self-regulation of high- and low-anxious children in the dental situation: An interview study. Behav Res Ther 1985;23:641–650.

This book describes adolescent development in detail, as well as how to tailor health-promotion interventions to this population according to their level of development:

Breinbauer C, Maddaleno M. Youth: Choices and Change: Promoting Healthy Behaviors in Adolescents. Washington, DC: Pan American Health Organization; 2005.

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CASE REPORT

An interesting case, describing an unusual post-operative complication. I'd like to share the information with SAAD members and others who are providing intravenous conscious sedation.

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My background

I am an Associate Specialist in Oral Surgery at the Edinburgh Dental Institute. I have been involved with dentally administered sedation for the last 15 years and am a member of SAAD. I am currently studying for an MSc in dental anxiety management at the University of Edinburgh. With the help of one of my colleagues, I established the dental sedation service within the Edinburgh Dental Institute.

The clinic

Oral Surgery at the Edinburgh Dental Institute is part of the maxillofacial department of St Johns Hospital Livingston. Currently we run three sessions a week, dealing mainly with ASA I and II patients requiring minor oral surgery. This involves single-agent intravenous midazolam. We also have an anaesthetist-run service that offers dual-agent sedation for the more complicated cases.

The team

Sedation is currently undertaken by myself and one other member of staff. We have three nurses with the BDNA qualification in conscious sedation. The remaining two nurses are currently undertaking this course.

Pre-assessment

A male of 21 years old presented for removal of left wisdom tooth under intravenous sedation with midazolam. There was no medical history of note, and a full explanation of procedure in written and verbal form undertaken followed by consent. The following parameters were recorded:
Blood pressure: 135/71
Pulse: 64
Weight: 80kg
ASA I
No recreational drugs
Non-smoker
No alcohol
Escort for sedation: father
No dependents
Occupation: complementary therapist.

Treatment

On the day of surgery, the patient presented with his father. His consent was confirmed and he reported no change in medical history. His blood pressure was 126/73 and pulse 62.

Intravenous sedation was undertaken using midazolam and 10mg was titrated over 10 minutes (2.55pm to 3.05pm) until a suitable end point was reached. The patient was responsive and relaxed throughout. We proceeded to surgically remove no. 38 and this was completed by 3.28pm. Throughout the procedure his pulse remained between 67 and 88 and oxygen saturation between 97% and 99%. I was assisted throughout by a sedation-qualified dental nurse and a postgraduate student.

Recovery

The patient walked aided into recovery where he was joined by his father and cared for by a sedation-qualified dental nurse. After some time, it was felt that he was not recovering well and indeed he had become more unresponsive. As a result I gave 200 micrograms flumazenil over 15 seconds followed by a further 100 micrograms 1 minute later. This appeared to improve his recovery. However, it was noted that he was unable to remember his girlfriend who lived with him and his father. The patient was, however, aware of the date and year. He could also recall his job, his boss and his shift timetable. I asked my consultant to see the patient and the decision was made to discharge him at 5.30pm. On discharge his pulse was 70 and his BP 118/82. In recovery continuous pulse oximetry had been undertaken and his oxygen saturation had remained high.

Next day

The following day the patient's father phoned to say that his son could still not remember his girlfriend. He also couldn't remember that he had a car, and when a friend visited that evening he could not remember him.

CASE HISTORIES

Referral

An emergency referral to neurology was undertaken and a diagnosis of a functional amnesic syndrome made. They reassured the patient and arranged outpatient follow-up in neurology.

Later

Subsequently the patient was reviewed regarding his surgery in our department. Again his father escorted him. His father stated that his son was now like a 10-year-old child with no improvement in his memory. He found going to the toilet difficult and all food tastes were new to him. His father did, however, report that his arithmetic and reading were much better than they had been before his memory loss. He was unable to work.

Because of his lack of improvement, he has been referred to a neuropsychiatrist and awaits further assessment.

Discussion

Functional amnesic syndrome is a disorder characterised by abnormal memory functioning in the absence of structural brain damage or a known neurobiological cause; severe cases are very rare.

I have undertaken a literature search and have failed to find any other cases associated with single-agent intravenous sedation. I have also discussed with many of my more experienced colleagues and there appears to be no other case associated with functional amnesia.

I would appreciate comments from SAAD members and other readers with regard to their experiences and their thoughts on this case.

CASE STUDY

A patient who exhibited an unusual response to inhalation sedation titrated to an end point, and reversed with 100% oxygen for 10 minutes.

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Barts and The London School of Medicine and Dentistry

A 30-year-old female of African origin and in full-time employment as a general nurse was referred by her own general dental practitioner to Barts and The London School of Medicine and Dentistry for treatment under sedation. At an initial assessment appointment, a full history was taken, her anxiety was assessed using the Corah Modified Dental Anxiety Scale (MDAS) and a treatment plan was devised. The referring dentist did not indicate any other problems apart from dental anxiety, and none were noted at this assessment appointment. She embarked on her treatment with inhalation sedation, which was administered by fourth-year dental undergraduates under supervision. Sedation was titrated in accordance with guidelines produced by DSTG. During the early stages, it became apparent that she did not respond to sedation in the normal way and exhibited an unusual response to verbal and physical stimuli. Failed attempts to rouse the patient resulted in referral to A&E at the Royal London Hospital where she recovered normally, and was later discharged into the care of an escort. Reasons for the abnormal response remain unknown.

At her first appointment for treatment, the patient arrived unaccompanied and was treatment planned to have routine scaling and one tooth investigated under inhalation sedation, with nitrous oxide (N2O) and oxygen (O2). She presented on time and was escorted into the clinic without delay. She was chatting in a relaxed fashion with the lead consultant and showed no unusual behaviour or heightened anxiety traits. She had signed a consent form at the assessment visit but her treatment was again verbally agreed and confirmed and her MDAS[1] (23/25) noted. She was asked whether she had eaten a light lunch and whether she had managed to take fluids with her meal. Many patients attending for sedation still confuse sedation with general anaesthetic, despite verbal and written instructions, and fail to have light meals and drinks.[2, 3, 4] However, the patient confirmed that she had indeed had a light lunch with water. She was made comfortable in the dental chair and was given the nasal hood to seat securely around her nose.

Sedation was started in the usual way by settling the patient on 100% oxygen for around 2 minutes and allowing her to become accustomed to breathing in and out through the mask.[5, 6] The sedation was titrated to

70% oxygen with 30% nitrous oxide, at which point she was judged as sufficiently sedated to begin dental treatment. Just prior to commencement of this treatment, the patient gave a quiet, almost inaudible whimper, a tear trickled from one eye and she began to shake for a few seconds. This was not thought to be significant at the time. A topical anaesthetic was placed using a cotton wool roll in the buccal sulcus around the upper right maxillary premolar teeth. At this point in time the student operator recognised that the patient had become unresponsive and did not react to verbal command. A clinical tutor was alerted, by the students treating the patient, immediately they realised the patient was not behaving normally. The gaseous delivery supply was moved to 100% oxygen. The tutor gently shook the patient in an attempt to rouse her, help her regain consciousness and elicit a verbal response. The patient appeared to remain unconscious for approximately 10 minutes despite being administered 100% oxygen during this period. The patient could answer questions posed by the tutor but the response was whispered and could not be clearly heard. She did not increase the volume of her speech to a normal speaking voice. She was able to nod and shake her head when asked questions but absolutely refused to open her eyes when requested. Normal reflex responses were tested by gently brushing the eyelashes and shining a bright light into the eye and observing a pupil response. These tests all elicited a positive and normal response. The patient remained unresponsive and the body appeared to lose muscular tone. She was asked repeatedly to open her eyes and try to 'wake up'. The decision to use the pressure points at the mandibular joint (TMJ) was taken to stimulate the patient's response. She became very defensive and used strength to pull the tutor's hands away from the area. Her mobile telephone was placed against her ear and its number dialled to encourage her to answer the call. She remained unresponsive despite the distinctive ring tone. Her eyelids were manually parted against her attempts to keep them closed, but she would not keep her eyes open. A pulse oximeter recorded good oxygen perfusion averaging 98% and her blood pressure was 115/78. The patient was told that the demonstrator was concerned that she was not recovering normally and she was advised that he would again attempt to stimulate her by TMJ manipulation. She became defensive, putting her hands to her head preventing the TMJ being touched. She did not respond to conversation and resolutely remained 'tight-lidded' and became 'floppy' once the tutor had given up trying to obtain a response.

After a period of one hour, the decision to contact A&E was taken in order to obtain their approval for admission. Despite being transferred onto a patient trolley and taken in a passenger lift out of the dental hospital through the street to the A&E department, she remained unresponsive. She was discharged into the care of A&E and the details of her condition narrated to the charge nurse.

The lead consultant for the sedation teaching clinic visited A&E before leaving for home, approximately 1 hour after the patient was admitted. The patient was awake, sitting in the reception area and waiting for an escort home. She appeared dazed and fatigued but no other symptoms. The nurses said she was asked to wake up and get ready to go home, at which point she opened her eyes and offered the staff in A&E the information they needed to call for an escort home from the department. The patient told the consultant that she could hear everything going on around her but was unable to respond.

Discussion

Reviewing research, articles and case studies showed that there appear to be no similar cases documented. There are several cases of patients taking longer to recover from general anaesthesia but nothing following inhalation sedation.

One documented case[7] of 'allergy to nitrous oxide', in the form of a question and answer style report, was found, but this stated that the cause was unlikely to be allergy. In this document, the person receiving nitrous oxide stated that they took a long time to recover and needed oxygen for the breathing difficulty. However, the conclusion of the text was that inhalation of nitrous oxide, like certain other chemicals, could trigger a constriction of the airways in an individual with underlying bronchial hyper-reactivity. However, nitrous oxide is generally well tolerated and is routinely used in operating theatres as a transport gas for volatile agents that produce general anaesthesia. It is not cited as a chemical with common side effects. However, in this case breathing remained normal.

Differential diagnoses

The differential diagnoses for this case could be:

A form of epilepsy/fit, although this is unlikely as the patient was able to answer questions posed in a quiet, soft and inaudible voice. All normal, involuntary

responses were present. The patient protected herself when she felt that the rousing physical stimulus was likely to be uncomfortable or unpleasant.

A type of mental health disorder. This could be possible. It could be that the patient was feeling a sensation not experienced before and did not know how to deal with it. It may be that she likes the attention and being in situations where people around her are concerned for her wellbeing.

There was no allergy to the inhalation sedation because the allergic reaction was not evident, although her response to the sedation was unusual, and it may be due to nitrous oxide in some obscure way.

Unknown cause / Most likely diagnosis

Having reviewed the case and having had discussions with the other members of the sedation team present at the time, it was a unanimous decision not to continue her treatment in the student teaching clinic. The patient had called the lead clinician to ask if her treatment could be continued at the dental school, but she was informed that her condition did not make her an easy patient to treat by 4th/5th year students. It was felt that a letter back to her referring GDP, with an explanation of why she was not suitable for treatment, would be the best course of action. It may be that the patient would need to be treated with care and compassion and without the use of sedatives if she wished to restore her teeth. The treatment needed was one simple routine dental restoration and a single course of scale and polish.

1. Corah NL. Development of a dental anxiety scale. Journal of Dental Research 1969; 48:596.
2. Guidelines for physiological monitoring of patients during dental anaesthesia or sedation. Society for the Advancement of Anaesthesia in Dentistry. London. March 1990.
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5. Standing Dental Advisory Committee: Conscious sedation in the provision of dental care: Report of an Expert Group on Sedation for Dentistry. 2003; 18 November.
6. Standards for conscious sedation. Report of an independent expert working group convened by the Society for the Advancement of Anaesthesia in Dentistry. 2000; October.
7. American Academy of Allergy: Asthma and Immunology. Question and answer format 2003; 21 May. ■

The SAAD Editorial Board are interested to receive case reports of interest to SAAD members and suitable for publication in the *SAAD Digest*

Introduction to the SAAD Annual Conference 2008 - Fundamentals of Safety Culture in Sedation Practice

From Diana Terry, President of SAAD

The views and opinions expressed throughout the conference are solely those of the individual contributors, and do not necessarily represent the view of the Board of SAAD.

All members and colleagues were welcomed to the Royal Society of Medicine.

SAAD: what do we represent? If you look up 'SAAD' on the internet, there are many non-dental entries but we are the prime organisation for dental teams. We believe in promoting safe and effective pain and anxiety control for the dental patient, and providing a forum for the dental team. When I was planning this year's conference, I was aware that safety is a priority in professional organisations, as shown by the Royal College of Anaesthetists, whose Autumn 2008 Bulletin features patient safety, and the Association of Anaesthetists of Great Britain and Ireland, whose logo bears the phrase '75 years of advancing patient safety'.

I have to thank three inspirational people for the programme you have today. Firstly, to the late Peter Baskett, who involved me in the SAAD Lifesaver Courses, putting SAAD in the forefront of safety training and introducing me to SAAD. Secondly, to the courageous Martin Bromiley, whose wife Elaine, aged 37, died during a routine anaesthetic and who has used his experience as a pilot to bring safety culture to healthcare. My third inspiration is Jan Shaw, who taught me about human factors training at an AAGBI seminar in 2004 and who spoke at the 2008 DSTG and ADA meeting in Manchester with such enthusiasm and skill.

The objectives of the programme today are to promote the skills, knowledge and attitudes that will put patient safety at the heart of our practice.

The delegates

Gerry Tryer, Martin Fulford and Leo Strunin

SAFETY CULTURE IN SEDATION PRACTICE

SAAD ANNUAL CONFERENCE 2008

The Annual Conference took place on Saturday 27 September 2008 at the Royal Society of Medicine, London and was entitled 'Fundamentals of Safety Culture in Sedation Practice'.

The meeting was once again well attended and delegates were warmly welcomed by the Society's President Diana Terry. She made no apology for the fact that, as in all areas of healthcare, the safety of patients should be our top priority.

Diana proceeded to present the first topic of the day: Safety Culture in Contemporary Dental Sedation Practice.

She highlighted the fact that, while aspiring to practise safely, being human we are prone to error – especially when an unexpected scenario develops or a distraction occurs. It was pointed out that it is difficult to find accurate data on the incidence of adverse events but that the 'tip of the iceberg' model is likely to be relevant here – in that only a small proportion of errors lead to a significant problem and that many unnoticed ones probably occur and remain unreported. The question remains: how big is the iceberg?

She mentioned that it is perhaps no surprise that human factors appear on the title page of the current bulletin from the Royal College of Anaesthetists, which emphasises the need to develop team training protocols. The comparison with air crew safety training was highlighted, and the importance for dental teams to establish 'pre-flight checklists'.

The following speaker, Lisa Howells, continued with this theme in her presentation giving us the benefits of her clinical experiences and present role in Clinical Governance Support and Development. She emphasised the importance of open dialogue between healthcare workers in reporting adverse incidents to help encourage a culture where individuals can feel able admit to mistakes in order that the profession as a whole can learn the lessons and improve standards of practice. This was demonstrated practically by delegates being encouraged to pin 'Post-it' notes to a board detailing an adverse incident – promoting a share and learn culture.

Bridget James, a Patient Safety Manager in the NHS, then supported the idea of helping eliminate the blame culture. She made the point that mistakes happen to us all, especially in modern-day healthcare where treatment is often more complex, on a larger number of patients with heightened expectations. She emphasised the need for foresight rather than hindsight in addressing safety and, using James Reason's three-bucket model as an example, encouraged us to monitor our water levels to avoid inadvertent spillage.

After a short break, Professor Leo Strunin reminded Conference about the need for keeping up to date with the latest guidelines on safe sedation practice and, with the benefit of his experience as an expert witness in real-life cases, an insight into how things can go wrong.

Martin Fulford followed with an equally provocative and entertaining update on dental decontamination. With worldwide epidemic levels of TB, rising levels of hepatitis C and the tip of a potentially very large iceberg in the form of vCJD prions, the audience were reminded about how seriously the Department of Health are viewing this matter. New guidance currently in draft and soon to be published is likely to herald unprecedented levels of regulation and inspection of dental practices. The issue of separate decontamination areas and an increased focus on cleaning prior to sterilisation is certain to feature.

The final speaker of the morning session was Gerry Tyrer, who provided us with a very vivid first-hand experience of life working in a tented dental unit in Camp Bastion, Afghanistan with the Territorial Army. Sandstorms, sweaty tunics and desert rats were just a few of the safety concerns the combined forces are facing, as if the Taliban was not enough!

Ian Alberts is congratulated by Diana Terry on Winning the SAAD Dental Student's Essay prize

Congratulations go to Ian Alberts, who was then presented with the Dental Student Essay Prize and also to Miss Michelle Woolridge, who received a prize for the highest mark achieved in the UK in the recent NEBDN examination.

Michelle Woolridge, winner of the NEBDN SAAD prize is congratulated by Diana Terry

A very nice buffet lunch was then enjoyed, with the chance to chat to colleagues and view the trade stands – to whom SAAD are very grateful in helping cover costs.

The afternoon session began with Peter Milgrom, the SAAD Visiting Professor in Pain and Anxiety Control at King's College London. He presented a current research paper undertaken at the University of Washington using sublingual administration of a short-acting benzodiazepine, triazolam. He reported a growth in the use of oral sedation, a practice currently outside US regulations. At present there are no part-time postgraduate courses available there, which Peter felt might be leading to practitioners using alternative techniques.

Tim Newton then gave an informative update on recent research at KCLDI using computer-aided relaxation and learning techniques in the management of dental anxieties. This work involves patients being shown video clips of certain dental procedures and then asked to rate the degree of anxiety caused. Participants are then encouraged to repeat viewings until anxiety levels reduce.

Peter Milgrom and Raj Rattan

The day closed with an excellent presentation by Raj Rattan on protecting your practice using the principals of Poka-Yoke (literal translation from the Japanese is 'mistake proofing'). His talk complemented those of other speakers, stressing the need to put as many safeguards in place as possible so that with a team approach the likelihood of serious errors occurring is reduced. Another reference to Swiss cheese reminded us it was nearly time for tea!

Raj ended with an appropriate summary for the whole day: 'We can't change the human condition but we can change the conditions in which we work.'

The day ended with the Annual General Meeting. ■

Andrew Wickenden
SAAD Membership Secretary

FUNDAMENTALS OF SAFETY CULTURE IN SEDATION PRACTICE

SAAD AUTUMN CONFERENCE ABSTRACTS

27 SEPTEMBER 2008

BUILDING A SAFETY CULTURE IN HEALTHCARE

Diana Terry

Diana is currently President of SAAD and works as a consultant anaesthetist in Bristol. She has an interest in the use of simulation for postgraduate education, and is a member of Resuscitation Council (UK). Diana is also a member of the ADA Council

The purpose of this presentation is to investigate aspects of the way we deliver healthcare by under-standing the three pillars: what is the relevance of patient safety, what are the theoretical factors that inform our behaviour, and finally some solutions that can be implemented.

Healthcare is said to be an area where errors are common; investigations into the magnitude of 'errors' suggest that there are at least 850,000 adverse events in the NHS each year. Why is this so important? Professor James Reason, in an analysis of human factors in error generation, suggested the 'Swiss cheese' model, whereby barriers to error often have inbuilt flaws. Under certain circumstances, all the holes in the defences will align, thus allowing the generation of an adverse event.

Research on errors has focused on comparing the pathway for errors to an iceberg, where the pinnacle is represented by the small top, but beneath the surface lie many more errors, either unnoticed or classified as 'near misses'. The National Patient Safety Agency (NPSA) has been working with all professional groups to encourage a reporting culture of all events, so patterns can be recognised and procedures put into place to prevent recurrence.

The audience was shown a video clip that demonstrated that when people are focused on a task it is possible to fail to see an event, which would have been thought to be obvious.

We need solutions to the problem that humans will inevitably make errors unless the suitable skills, knowledge, attitudes and processes are put into place.

In dental sedation, there is a wealth of expert knowledge, such as the books written by David Craig and others. Training such as that obtained on SAAD Courses will cover important processes such as infection control, cultural awareness, safer medication, safe medical devices and public and patient engagement. The NPSA (www.npsa.nhs.uk) has extensive resources on its website and links to all interested professional bodies, and you are strongly encouraged to use these to guide your practice and safety awareness.

In 2006 the document *Safety First* was strongly supported by Sir Liam Donaldson, recommending:
Implementation of risk reduction
Addressing known risks
Supporting a safety-conscious workforce
Strong leadership.

Is this relevant to dental practice? Catchpole et al. in *Surgery* 142 102–110 demonstrated that it is often the context in which the procedure is taking place rather than the lack of technical knowledge or skills that are the cause of problems identified.

The aviation industry has invested in understanding error chains and developing training for procedures similar to those used in dentistry. The dental team can benefit from crew resource management (CRM), a process by which all team members are required to point out any violations of process – which might be the error that goes through the Swiss cheese and produces a serious error chain.

Human factors training was the subject of the recent Bulletin of the Royal College of Anaesthetists, and its importance to safety in aviation is proven. Human factors refers to the way in which people interact with each other, their systems and technology, and human factors play a significant role in adverse events.

Human factors training involves:
Patterns and causes of error
Situational awareness
Communication within teams understanding the limitations of human performance.

In aviation there are seven key features used to minimise human error, and many of these could be, or are already, applied to dental sedation practice:
Revalidation for a particular type of aircraft
Competency checks six-monthly
Standards of performance clear
Rigorous training and accreditation
Non-technical and technical skills training
High-fidelity simulators used for evaluation
Safety monitoring systems.

The use of checklists has undergone scrutiny, and the World Health Organisation has produced a safety checklist for surgical teams that can be used for dental teams with some modification. This can be found at www.who.int or www.medicalprotection.org. As several sedation errors have been associated with the recovery period, documents on safe handover are available at www.bma.org and www.rcseng.ac.uk. Checklists, however, have their limitations, and this is fully explored in an editorial by Wilson and Walker in Anaesthesia 2008 63 921–923.

At Bristol we have introduced a pre-flight briefing and time out briefing for all surgical procedures as part of the safer patient initiative. The team all give a verbal review of the situation and CRM is reinforced and potential problems averted.

The University of Aberdeen has developed ANTS Courses – Anaesthetists' Non-Technical Skills training, which has four domains:
Task management
Teamwork
Situation awareness
Decision-making.

A similar format for the dental team might be appropriate, and SAAD could develop this should the membership wish.

In conclusion, I have discussed ways in which we can improve patient safety in respect of the relevance, theory and possible solutions.

A list of references is available on request; the link to NPSA is recommended. ■

THE ROUGH GUIDE TO CLINICAL GOVERNANCE AND PATIENT SAFETY

Lisa Howells

Professional Officer, Clinical Governance Support and Development Unit, Welsh Assembly. Lisa has worked as a GDP and in the CDS, including providing care under GA. She has a Masters in Community Dental Health and has been involved in dental public health, and special-care dentistry. She now with the CGSDU, linking with NHS organisations in S E Wales and working particularly with clinical teams.

Bridget James

Patient Safety Manager, NHS South West. Bridget is a qualified nurse & midwife with extensive experience in both clinical and managerial roles. Bridget has been a Supervisor of Midwives and a Clinical Risk Manager for a large Acute Trust. She has served as a member of the National Patient Safety Agency developing her interest in incident causation & investigation.

Clinical governance was first defined in Quality Care and Clinical Excellence (1999) to put a focus on safeguarding high standards, continuous improvement of clinical care and improved patient safety.

Examples of clinical governance in dentistry include improved infection control, mandatory CPD and changes in GA regulations. The report into paediatric surgery at the Bristol Royal Infirmary highlighted multiple failings – particularly failures in team working, and a failure to learn from mistakes and be open when

Bridget James and Lisa Howells

things go wrong. Improved patient safety requires clinical teams to report patient safety incidents, learn and share the learning. Open discussion of 'what happened and why' provides mutual support and identifies those areas where improvements can be made. Incident reporting may also highlight where resources are needed. National data on numbers of reported patient safety incidents from community and general dental services are increasing but remain low, making up less than 0.5% of the total number received in the National Reporting and Learning System database on an annual basis.

Many improvement initiatives in patient safety have come from other industries. In aviation, safety training focuses on non-technical skills as well as technical ones. Non-technical skills relate to team working, communication, situational awareness and leadership. In dentistry such skills are equally as important as clinical (technical) skills to undertake safe dental surgery.

Multidisciplinary dental sedation teams should consider how they focus on patient safety, and how they handle and learn from incidents and near misses. Achieving effective team working will contribute to good clinical outcomes, reduced rates of mortality and improved staff morale. ■

LEARNING FROM ADVERSE EVENTS: RECENT CONCERNS

Professor Leo Strunin

Prof Strunin has had an illustrious career having held the Chairs in Anaesthetics at King's College Hospital, the University Of Calgary, Alberta and at Barts & The Royal London Medical School. He is now Emeritus Professor of Anaesthesia at Queen Mary's. Past President of both the Royal College of Anaesthetists and the AAGBI he has had a great interest in general anaesthesia and sedation for dentistry.

Initially in 2001 the General Dental Council (GDC) recommended inhalation of nitrous oxide or incremental intravenous midazolam for conscious sedation. Regrettably, in addition to midazolam, a mixture of potent intravenous anaesthetic drugs (not developed by the manufacturers for sedation), e.g. fentanyl or alfentanil, ketamine and propofol, have been given, particularly to children, allegedly to produce conscious sedation. Such mixtures are not recommended by any standard or guideline, except in very defined circumstances. Further, there is no peer-reviewed publication on how the decision may be made for a patient as to which drugs and what doses to use, in which order to give the drugs or what end point will determine that the patient is in a state of conscious sedation.

The Professional Conduct Committee of the GDC reviews in public any dentist where there is the possibility that serious professional misconduct has occurred. A number of cases relate to conscious sedation outside hospital. The GDC takes the view that a dentist has a responsibility if things go wrong, even if the dentist did not administer the sedation. A review of the cases reveals the following problems: the referring dentists had not followed GDC guidelines, there was no proper consent process, the sedation did not follow any guideline, the record system was inadequate and there were fundamental failures during recovery. There have been a number of serious outcomes in these cases. These include lengthy periods of unconsciousness and several children requiring hospital admission, one of whom needed several days of intensive care to recover and another who regrettably has ended up with brain damage as a result of poor recovery management.

To prevent these problems, it is recommended that all dentists and sedationists review their practice and implement and follow current standards and guidelines. ■

Martin Fulford

DENTAL DECONTAMINATION - AN UPDATE.

Martin Fulford

Originally trained as a microbiologist and spent 13 years as a medical microbiologist. He retrained as a dentist & spent 17 years working as a GDP when he combined dentistry with research into infection control. Now retired from clinical

practice he is investigating the possible transmission of vCJD via dental instruments. A member of the Health and Science Committee of the BDA, with a particular interest in infection control.

A broad overview of the latest recommendation for decontamination and infection control in dental practice. ■

A DENTIST IN DIFFICULT CIRCUMSTANCES – ONE VIEW OF THE SAFETY ISSUES IN FRONTLINE MILITARY DENTISTRY

Gerry Tryer

Gerry specialty is in sedation for dentistry. He has worked in the dental salaried service, spent three years in the army & taught sedation. He has also taught on the First Response course. He was recently deployed to Afghanistan with the Territorial Army.

As a dental officer in the modern Territorial Army, one must accept the likelihood of being deployed alongside regular Army colleagues on operations including those in Afghanistan and Iraq where continuing hostilities add to the stresses of daily life. It was in that capacity that I was privileged to be able to experience three months working as an Army dentist in Camp Bastion in Afghanistan during heavy fighting in the summer of 2007, and subsequently as a colleague of Diana Terry that I was invited to offer my observations on the issues of safety in dentistry that such experiences gave me.

When I looked back at the experience, I was surprised to discover that the things I would have expected to have made the job more hazardous did not do so, by and large – and the pitfalls and hazards that did exist were in the main remarkably similar to those that occur in everyday civilian dental practice. I came to realise that in fact it was this lack of exotic hazards and dangers that was, to me, the most interesting reflection.

The things that proved to be hazardous in the busy, concentrated environment of a major military logistic base supporting war-fighting activities were largely transport to, from and within the workplace, the environment of the workplace, the need to have regard to the storage and maintenance of equipment and usables, and the human factors that arise both within the practice of dentistry, and in the routine of daily living.

All of these can be recognised as having relevance in the everyday environment in our civilian practice. And while the individual hazards I experienced varied, and in some cases were rather exotic and specific to the military (such as the profusion of weapons and ammunition), overall the strategies for managing risk that were deployed were the same strategies used at home.

And considering all the risks and hazards and the ways of managing them, the one abiding lesson for me is that the human factors – failure or inability properly to communicate, failure to understand, carelessness, stupidity and failure to learn from experience – apply equally in the so-called benign environment of civilian practice as they did in a frontline war hospital. ■

Peter Milgrom

FLUMAZENIL REVERSAL OF ORAL TRIAZOLAM: ABSTRACT

Peter Milgrom

Professor Milgrom is the SAAD Visiting Professor in Pain and Anxiety Control at King's College London. He is the Director of the Dental Fears Research Clinic, where he maintains a practice limited to the care of anxious patients, and Professor of Dental Public Health Sciences at the University of Washington, Seattle.. He trained at the University of California, San Francisco and joined the University of Washington in 1974.

Background

Incremental sublingual triazolam has emerged as a popular sedation technique. Nevertheless, little research has evaluated the technique's safety or efficacy. Given its popularity, an easily administered rescue strategy is needed.

Methods
We conducted an RCT to investigate how intraoral submucosal flumazenil (0.2mg) attenuates CNS depression produced by incremental sublingual dosing of triazolam (3 doses of 0.25mg over 90 minutes) in 14 adult subjects. Outcomes were assessed with the Observer Assessment of Alertness/Sedation (OAA/S) scale, BIS and physiological monitoring.

Results
OAA/S and BIS scores increased after flumazenil injection, peaking at the 30-minute observation point, but were not sustained. Six hours after the initial dose of triazolam (4 hours after flumazenil or placebo challenge), all could be discharged.

Conclusions
Deep sedation from sequential triazolam is incompletely reversed by a single intraoral injection. Reversal did not persist: discharge was at 360 minutes.

Clinical implications
Intraoral flumazenil cannot be used to immediately rescue oversedation with triazolam. Reversal for discharging the patient early is neither appropriate nor safe. ■

Tim Newton

RESEARCH UPDATE

Tim Newton

Tim is Professor of Psychology as Applied to Dentistry at the King's College London Dental Institute. In dentistry his particular interests include oral health-related quality of life, the working life of the dental team and patients' perceptions of treatment. Outside dentistry he has worked with people with intellectual disability.

At last year's SAAD conference Carole Boyle and I outlined our work in the development of a computerised cognitive behavioural therapy (CCBT) programme to help adults who have a marked fear of dental injections, as well as presenting the findings of a questionnaire survey of patients attending for dental care under sedation. This year's presentation built upon that previous work to illustrate how the research and service profile of the department is developing. First I presented the findings of two patients who had completed CARL – UK, the dental CCBT programme for fear of injections. Both patients completed CARL – UK within two hours and demonstrated marked reductions in self-rated fear of dental injections. Both rated the treatment as 'Very Good'. A full trial of the programme should be completed within the year. Second, I described an empirical model of the relationship between poor oral health, dental fear and use of sedation services. This model showed clearly that high levels of dental anxiety are associated with poor oral health and an irregular pattern of service use. Individuals who are dentally anxious are more likely to be female, to have had a negative experience at the dentist, and to have fewer educational qualifications than the general population. Finally, service developments in the department were presented, including the launch of the UK's first health psychology service for people with dental fear. This research and the service developments described here would not have been possible without the generous support of SAAD. ■

PROTECTING YOUR PATIENTS WITH POKA-YOKE

Raj Rattan

Raj is a GDP, Associate Dean in the London Deanery and a dento-legal adviser at Dental Protection. He has written a number of textbooks on various aspects of dental practice including clinical governance, quality and risk management. He has lectured widely on these and other aspects of general dental practice both in the UK and overseas.

All clinical dental procedures involve an element of risk. Professor James Reason, a world authority on human error, likens this latent potential to resident pathogens in the human body. In the presence of local trigger factors like stress, they are able to overcome the immune system and produce disease. The same can be said of the resident hazards of clinical practice that have the potential to harm patients.

Raj Rattan

A systems approach to safe practice
Safety systems in general practice should limit the potential for failure by putting barriers in place that protect patients from harm. In an ideal world these barriers should be impervious layers, but in reality they are more like slices of Swiss cheese – they have many holes. When the holes in successive slices are aligned, they create an open pathway for an accident that brings hazards into damaging contact with people, assets and the environment. This is represented in Reason's Swiss cheese model of accident causation.

Human error
Error is defined as the failure of a planned sequence of activities to achieve its intended outcome when these failures cannot be attributed to chance. The different types of errors are:

Slips: an unintended error of execution of a correctly intended action
Lapses: internal events that generally involve failures of memory
Mistakes: rule-based or knowledge-based
Procedural violations: may be routine or exceptional.

An analysis of error type is critical if appropriate remedial action is to be taken to prevent recurrence.

Poka-Yoke
Poka-yoke is a simple method to prevent mistakes at their source. It is Japanese for 'mistake proofing'. It relies on point of origin checking, rapid identification of failure through a range of control and warning systems that often involve equipment design and usage. The use of checklists, robust systems and processes and root cause analyses are amongst the most effective tools in this methodology. ■

SAAD AGM

The Annual General Meeting of SAAD was held after the main conference, which was extremely successful in achieving its aims.

Following the adoption of the minutes of the last AGM (2007), the President (Dr Diana Terry) reported that the Society has gone from strength to strength. There are SAAD Board members (trustees) on the NIHCE stakeholder list looking into sedation for children. The National Course in Conscious Sedation continues to provide the definitive training medium, with 240 dentists and 180 Dental Nurses attending each year.

The Secretary's report (Dr Derek Debuse) dealt with correspondence received. Approximately six emails a week arrive from members and elsewhere. He reported the death of Dr Peter Robinson, a life member. The arrangements with the Association of Anaesthetists of Great Britain and Ireland (AAGBI) were working well and thanked Fiona Wraith, the Executive Secretary for her support throughout the year.

Dr Stephen Jones presented the Treasurer's report, announcing a healthy state of affairs, enabling SAAD to contribute financially to educational projects, thus fulfilling and justifying our charitable status.

Each year, two trustees retire from the SAAD Board. This year, Dr Paul Averley and Dr Michael Wood retired. They were both re-elected. Dr Barry Devonald retired from the Board. He was thanked from the Chair for 12 years of stalwart service to SAAD. Two new trustees were elected to the Board: Dr Andrew Wickenden and Dr Darrin Robinson. Other elections were for the President-elect, Dr Nigel Robb, and for the Honorary Secretary, Dr. Derek Debuse, who stood for re-election following three years in post ■

Derek Debuse
Hon Sec SAAD

ANDREW WICKENDEN

TRUSTEE AND MEMBERSHIP SECRETARY

I am married with three children and live in Cranleigh in Surrey. I enjoy golf, skiing and walking when I get the chance! Life is hectic but great fun and I owe a lot to my wife, Gill, who enables me to devote the time necessary to the practice of dentistry.

I qualified from Guy's Dental School UMDS as it was then in 1988 and after a couple of house officer posts moved into general practice in Cranleigh in a non-VT associate post. I moved on to a new associate position in 1993 in Dorking, Surrey and completed my Diploma in General Dental Practice in 1995.

I then entered into an expense-sharing partnership with my principal in 1996 in the two-surgery practice we shared.

In 2001 I attended a SAAD weekend course where I became reacquainted with Derek Debuse, who had been one of my undergraduate tutors in restorative dentistry. He kindly agreed to mentor me through my early days of sedation, given that our practices were only a short drive away from each other.

I completed the Diploma in Dental Sedation at GKT in 2003 and continued to provide sedation back at the practice, and worked peripatetically for nearby specialist referral practices. This provided a great opportunity to develop sedation experience while meeting other colleagues in their surgeries.

In 2006 I sold my stake in the Dorking practice to join two new partners in the purchase of Derek Debuse's practice on his and his partner's retirement. In so doing we hope to carry the sedation torch burning for many years to come in the West Sussex/Surrey area.

On top of a full list of patients to treat, the management side of running a busy four-surgery practice keeps me very busy and the new partnership is working well. I enjoy all aspects of clinical dentistry and have close links with several specialist practices.

My involvement with SAAD has been a very rewarding part of my professional life for the last six years and I hope to continue to help in the training and provision of sedation services in the general practice scenario as much as time permits.

As the years roll on I am more and more aware of what a great thing it is to be involved in hands-on healthcare. Our patients become our friends and a bond of trust and dependence develops. In a sense we have a unique role in the lives of our patients, seeing them through life's ups and downs as they do us. From a Christian perspective I believe God has great work for us to do, and what a privilege it is. ■

DARRIN ROBINSON

TRUSTEE

I have a degree from University College London, qualifying in 1990 in Dentistry, and an MBA from Warwick Business School.

My experience is broad, having worked clinically in maxillofacial surgery and also fulfilled mainstream management roles within the NHS, running large parts of NHS hospitals in Leicester and Addenbrooke's in Cambridge. In Cambridge, I was responsible for operations management for all surgical specialities, looking after a team of 12 senior managers, 80 hospital consultants, 500 staff and a £30m budget, with departments including ICU, Theatres, Transplant and A&E.

I have worked at a national policy level in London within the Department of Health policy team and with Dame Margaret Seward. I led on the modernisation of NHS dentistry through pilot PDS for the NHS Modernisation Agency. And helped to turn OfC into written policy and then created the OfC Field sites between 2001 and 2003.

Just under five years ago, I joined Integrated Dental Holdings (IDH) as a director, where I head clinical services and all contracting with the NHS. Since then I have created a contracting function and has been helping to reshape the business to adapt and develop within the new NHS contract. I am responsible for clinical governance and health & safety across the business spanning around 700 dentists and 225 practices.

I work from IDH's offices in Bolton, but travels around the country. Living in north Lancashire, near Clitheroe, married to Toni, who is an NHS dentist, with two girls aged seven and four.

When not at work I occasionally participate in triathlon, and keep Koi carp. ■

RA MACHINE LOAN SCHEME

Derek Debuse, *Hon. Secretary* and **Stephen Jones,** *Hon. Treasurer*

The benefit of inhalational sedation to dentally anxious and phobic child and adult patients has been inestimable; this opinion has been formed over 30 years of sedation provision in the primary care dental setting. However, for a host of totally understandable reasons this technique is not used as extensively in routine dental practice as perhaps it should. One of the barriers most often cited by practitioners for not providing inhalational sedation is the financial outlay of the necessary dedicated equipment.

Upon appointment to SAAD's Board of Trustees three years ago, the opportunity to raise this matter with fellow Trustees arose and it was agreed that a loan scheme would be developed. As a registered charity, SAAD has a duty to promote conscious sedation to benefit the public. The proposed scheme fitted this aim admirably.

A paper that described such a loan scheme for practitioners was presented at the April 2006 Board meeting. This scheme proposed that SAAD would purchase two inhalational sedation (RA) machines that would be loaned to interested clinicians for a period of 12 months. This meant that practitioners would be able to trial this sedation technique in their practice and assess its viability without risking the initial outlay of the capital equipment if it proved unworkable in that particular clinical setting. SAAD also agreed to offer support and encouragement to the sedation team during the trial period to facilitate the development.

Additionally, the equipment would be sold to the participating practitioners at a discounted rate at the conclusion of the 12-month trial period should they wish to continue using this technique.

The specialist anaesthetic company McKesson kindly agreed to make available two machines for SAAD to purchase and, importantly, to visit the practitioners' premises to provide advice and assistance with technical aspects of the installation.

A number of conditions were attached to this scheme:

- applicants must be SAAD members
- they must have demonstrated attendance at a SAAD National Course within the previous three years
- their support staff must also have attended a SAAD Course in the last three years
- the practice would provide the gases
- the practice would arrange regular servicing of the machine
- the practice must comply with contemporary conscious sedation standards as set out in the Standing Dental Advisory Committee's Conscious Sedation in the Provision of Dental Care. Report of an Expert Group on Sedation for Dentistry, 2003'.

As part of the application requirement a basic project plan was expected that would describe the scope of the proposed service, training needs, quality standards and outcome measures that included benefit to patients. A potential nerve-wracking condition was the commitment to deliver a short presentation at the Annual Conference!

At the time this paper was placed before the Board the Trustees were considering a range of developmental schemes that would benefit patients receiving dental care and it was therefore no surprise that this scheme was given approval.

The scheme was advertised at SAAD National Courses, with details distributed via the Course packs. At first there were few applicants, then two more were received followed by many more queries following an article in BDA News.

We have allotted two machines last year and have four in the pipeline for future years. We are looking forward to receiving more applications and to getting feedback from the successful applicants.

Achal Prashad reports on his experience of the loan scheme.

RA MACHINE LOAN

Achal Prashad

On attending the SAAD sedation course last year I was happy to hear that SAAD were offering a scheme to loan an RA machine. As a new practice this was a service we were looking to provide but had hesitations as we did not want to commit to the high set-up costs until we were sure that it would prove to be a popular choice for patients.

Our application merely highlighted the reasons why we felt as a practice we could benefit from having the RA service at our premises.

On our application being successful, we were supported well by SAAD, who ensured that all of the equipment including the scavenging unit was delivered on time, from reputable suppliers who were also very happy to help with any technical issues relating to the set-up and running of the equipment. To date, we have not had any problems with the equipment, as all of it was either brand new or in very good second-hand condition.

Having not done much RA sedation since undergraduate days, it was a pleasant experience to revisit this system.

The system has been very popular with patients, and we have provided sedation for our patients as well as taking some referrals from other practitioners.

Many of our patients who previously used IV sedation to allay their dental anxiety reported positively to the use of RA and nearly all were happy to have this form of sedation again. The most popular aspect of the sedation seemed to be the fact that the patient could leave the surgery not still feeling the sedative effects associated with IV sedation. Most of our cases were genuine dental-phobic patients who needed simple oral health stabilisation, and also a small number requiring surgical extractions.

The scheme has been a great success for us and we would recommend that other practices looking to provide RA to their patients apply to take part in this scheme as the support of SAAD is invaluable. ■

LETTER TO THE EDITOR

Once again it was with great interest that I was able to enjoy the SAAD Digest and all of the relevant content that was published therein. In my review, however, I felt I would be remiss if I did not point out one particular erratum which could result in grave consequences if ignored. On page 36 of the January 2008 offering, Dr. Derek Debuse offers his comment on a number of subjects in the 'Frequently and Infrequently Asked Questions' section. In his response to the use of fentanyl, Dr. Debuse writes, 'Fentanyl should be used with caution as more profound respiratory depression can be a result of the synergistic effect with midazolam. It should be given as a 50mgm bolus before titrating the midazolam.'

While I am sure this may be a simple transcription error during the publication process, 50mgm represents a one thousandfold increase over the typical starting dose we use in treating our adult population. I believe the author's true intention is to recommend a typical adult dose of 50mcg (micrograms), which would certainly be in line with our usual prescription practices.

Thank you for the opportunity to comment. It is a true pleasure to continue to learn from all of your contributors and professional faculty.

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Dear Dr Donaldson,
Thank you for pointing out this typographical error. The Editorial Board wish to apologise for not correcting it prior to publication.
Editor ■

LETTER TO THE EDITOR

I would like to share my experiences as a practice owner with a substantial NHS sedation contract.

We have an annual sedation contract for 5,000 sedations at £55 per sedation. Out of this £55 we fund the sedationist's fee, the recovery nurse and all drugs, sedation equipment and facilities. When the original contract came out we agreed with the PCT representative that it was per sedation and not per course of treatment.

We experienced a dramatic downturn in patients arriving for sedation, not as a result of less referral, but due to patients not attending for appointments.

When the new contract was rolled out we experienced a higher than usual FTA activity. Previously we made it known in the paperwork that FTAs would attract a £30 fine and the attendance was good. After having completed year-end activity and comparing them with the figures that the BSA supplied us with, there were gross discrepancies.

Where a patient attracted two or three sedations for a course of treatment and two or three sedations were recorded on our monitoring, these had not been recorded by the BSA and the PCT (who now was on representative number three or four) only believe the figures published by the BSA.

I had a non-funded VT who required 3 months of top-up training (despite having MFDS and MSc in Prosthodontics from Eastman and having worked as an SHO at our local DGH) in practice. We were told that we had under-performed on our contract by 2,400 UDAs only to find that that they had not included 2,100 UDAs that he had done and also the 197 sedations that were provided for him by our sedationist. Imagine the amount of paperwork involved to explain this to the new number five PCT representative!

As a practice which dedicates itself to treating anxious and phobic patients, we feel that we should be 'cut some slack' when looking at these UDA and sedation targets.

- We are dealing with inherently anxious patients who take longer to manage.
- Evidence shows that avoidance of dental treatment is much higher in this population of dental patients.
- As we are also a special care referral service we know that this group of patients take more time to manage and need extra care. As a result of their disability they may not be able to attend or may have to cancel at short notice.
- Because patients having sedation need escorts, we need to consider the fact that things could also go wrong with these people and this doubles the risk of non-attendance.
- Patients often come from great distances – we have a catchment area of in excess of 50 miles radius and transport difficulties may occur on the day of the sedation.
- The fact that most patients are referred and have not built up a relationship with the dentist or practice increases the chance of non-attendance.
- The fact that the new contract has removed the ability to fine the 'offending patient' and means we are encouraged to give them another chance at wasting everybody's time.
- Many dental practices perceive us to be a dental dumping ground that promises the patient that all treatment can be completed in one session if the patients are referred for sedation, particularly if they have accepted a new patient who needs a lot of treatment.
- PCTs encourage their dentists to refer minor oral surgery that would normally done at the local DGH or on a minor Oral Surgery contract to be done on the normal GDS contract under sedation as a money-saving exercise to the PCT.
- Many of these patients have been allocated huge appointment slots to try to complete as much work as possible per sedation only for paid staff and resources to be standing idle as we wait for the next patient. (On one day last week we had 11 FTAs on 2 lists!) All the patients were sent appointments with their paperwork and asked to confirm the appointment, which they all had done.
- PCTs should make more of an effort to liaise with the BSA to get the necessary data that they require.
- As dentists are funding staff and facilities for FTA patients, surely the fair way would be to reclaim half of the sedation fee as the owner is losing out both ways – paying for the overheads and also repaying the full amount to the PCT!

We are asking for reasonable fair acknowledgement for providing an often thankless task of seeing the patients who our colleagues do not or cannot treat. Treating difficult patients under sedation is often very hard work under the present contract and I think that the time has come for some consideration for fair and reasonable compensation for this area of dentistry or else we will see standards starting to slip to try to meet PCT-imposed targets and mistakes will be made and patients and the profession will eventually suffer.

I would like to invite any other GDPs to write to me and share their negative experiences or any positive sedation commissioning tales in their patch of the wood.

Michael Wood
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LETTER TO THE EDITOR

RE: Primary care trusts and the sedation contract

A core principle of the new contract was to provide a better, more accessible and accountable NHS service to patients requiring dental treatment.

On the score of accountability, this word seems to dominate and determine all areas of healthcare (not that it is all bad).

I have great doubts and fears on the 'better' and 'more accessible' parts of this statement.

As a dentist I can see the dental needs of the patients growing daily and this is confirmed by the latest statistics for north London (our catchment area).

The referral patients are normally very anxious or require a complicated procedure. This and many other factors (i.e. recreational drug use etc.) all add up to a very stressful working environment for the dentist and the sedationist. This is certainly not helped by a PCT that does not understand patient care, with a mission to cut costs but with the power to demand better services.

I am a great believer in minimum intervention, especially considering an anaesthetic for a dental procedure. Would life not be wonderful if we could treat all our patients without local anaesthetic and the anxious with relative analgesia only. Reality is unfortunately very different in our present age and there are a large number of patients that require some form of anaesthetic agent to accept their dental treatment.

As owner of a dental practice providing a NHS sedation referral service I am forever feeling more lonely and vulnerable in the world of sedation with its abundant critics and their newest ally the PCT.

As healthcare workers we are taught and we feel a certain responsibility towards the wellbeing of our patients.

In my experience, dealing with PCTs, the responsibility towards the patient is almost non-existent and is mainly driven by budgets and patient complaints, i.e. if (a) patient(s) complain(s) enough to the PCT something will be done. The PALS (Patient Advice and Liaison Service) officers seem to change their telephone numbers every few months, thus ensuring fewer complaints and better statistics.

I strongly agree that the best and safest technique must be employed and every patient must be treated according to his/her needs. If sedation is not safe or appropriate as practised in the UK today we need to find alternatives that fulfil the criteria. PCTs are light years behind in replacing the current sedation service or finding an appropriate alternative. We must remember that many of these patients are difficult to treat and can be very demanding. The best way forward is if all concerned can approach sedation open-mindedly and keep in mind that patients requiring sedation have a great need to be treated with minimum pain and stress.

From a SAAD member who wished to remain anonymous ■

PLEASE TAKE TIME TO POSE QUESTIONS YOU MAY HAVE RELATING TO ANY ASPECT OF ANALGESIA, SEDATION, ANAESTHESIA, RESUSCITATION, ALTERNATIVE THERAPIES, ETC.

THE OPINIONS OF VARIOUS EXPERTS IN THE RELEVANT FIELDS WILL BE SOUGHT AND PUBLISHED IN THE DIGEST FORUM.

PROFILE MICHELLE WOOLRIDGE

Winner of the SAAD prize for the highest score in the NEBDN examination

At the age of 16, in January 1996, I started my first role within a NHS dental practice as a trainee dental nurse; this was on a youth training scheme. The scheme involved working at the dentist's chairside for four days a week and one day a week at college learning the theory of dental nursing and preparing to sit the NEBDN examination for dental nurses.

In 1998, exactly two years after beginning my training, I qualified as a dental nurse after successfully passing the NEBDN examination.

While working at my first practice my role not only involved dental nursing but also dental reception, which then led to becoming the assistant practice manager. During my eight and half years at the practice I loved waking up in the morning and going to work. I got great job satisfaction from this.

In 2005, to fulfil a lifelong ambition, I applied to the police force to work as a police officer. Shortly after applying I was accepted and I began my initial training period. In total I successfully completed two and half years' service, which involved the completion of a foundation degree in policing studies. After two and half years, although I enjoyed most aspects in my role as a police officer, I made a decision to leave the police force as I knew my true calling was in the dental profession. I knew that during my absence there had been very big changes to the way the NHS dental system was administered.

In September 2007, just over a year ago, I was delighted to be employed by Queensway Dental Practice in Billingham as a dental nurse. This practice is over four times larger than my first practice and has a referral facility for local dentists to refer patients for treatment that require anxiety management, oral surgery and implants.

From the day of starting this new employment I knew I had made the right decision in returning to dentistry, and in joining the team at Queensway Dental Practice, I once again enjoy every day that I get up and go to work.

During the last year at the practice they have offered me the opportunity for further training, and to complete and sit the examinations for the NEBDN sedation and radiography.

The sedation qualification I passed at Distinction level and I gained the highest mark in the country for the March 2008 examination. Shortly after this I also passed the NEBDN radiography examination.

I was thrilled to receive notification that my result in the NEBDN examination for sedation had gained me a prize that was to be awarded by the Society for the Advancement of Anaesthesia in Dentistry (SAAD) at their annual conference in London.

Upon attending the conference and presentation, I felt very proud to receive the award, and it reinforced to me how special my return to NHS dentistry has been and how much I now look forward to going to work, as it is more like a great hobby than work. ■

Photograph reproduced with the kind permission of the Association of Anaesthetists of Great Britain and Ireland

A LIFE REMEMBERED: PETER BASKETT

Consultant Anaesthetist, SAAD Faculty Member
Born 26 July 1934 – Died 18 April 2008

From Christopher G P Holden

Peter Baskett was born in Belfast in 1934. He graduated from Queens Belfast and Cambridge University in 1959.

After spending three years post registration in Belfast Peter moved to Bristol to complete his anaesthetic training at the United Bristol Hospitals and the Frenchay Hospital. By 1962 he held a consultant anaesthetist position in the same institution, which he retained until retirement. It was this long appointment that gave Peter the stability both to expand and modernise services in his own hospital as well as develop his outside interests. By 1967 he had co-established an intensive care unit at the Frenchay Hospital.

Peter's real interest was the development of pre-hospital care. It was his belief that those that were capable should be trained to provide a higher standard of pre-hospital care. It was this that drove him to become involved with SAAD. An example of this drive was Peter's determination that ambulance personnel could be trained to deliver much more than the very basic first aid that was traditional in the 1960s. He investigated the possibility of the use of Entonox by specially trained ambulance personnel. In conjunction with The British Oxygen Company, who provided the equipment, Peter provided the training of ambulance personnel to provide pain relief with Entonox at the scene of the incident. This was so successful that there became an acceptance that ambulance crews could provide far more care if specially trained and so the British version of the paramedic began to develop.

Peter understood that it was necessary not only to train people but also to provide the equipment to give adequate pre-hospital care to a standard he envisaged. Eventually he arranged for the Frenchay Hospital to be provided with a modified ambulance that had both the

facilities for oxygen administration, Entonox provision and an ECG machine. This was one of the first of so many so-called 'Flying Squads' that became attached to hospitals. This ambulance would be parked next to the Emergency Department, where the specially trained personnel would work in the Emergency Department when not on a call-out. When the mobile resuscitation unit was needed an Emergency Department doctor or an anaesthetist would accompany the ambulance crew to provide both assistance and on-site training.

At the same time some systems were being developed around the country, and in parallel a general practitioner-based facility was being developed. This ultimately led to the development of BASICS (the British Association for Immediate Care Schemes), a group with which SAAD has links today. Peter was Chairman of BASICS from 1981 to 1985. BASICS evolved and ultimately an off-shoot developed into the Resuscitation Council (UK). As a prime mover in this Peter was always proud that this was the first resuscitation council in Europe.

Professionally Peter spent many years on the Council of the Faculty of the Anaesthetists of the Royal College of Surgeons of England and subsequently the Royal College of Anaesthetists. He held high office in a number of specialist societies, including the International Trauma, Anaesthesia and Critical Care Society and the World Association for Emergency and Disaster Medicine. Peter was President of the Association of Anaesthetists of Great Britain and Ireland (AAGBI) between 1990 and 1992. He edited and wrote a number of books and it was his Resuscitation Handbook published in 1989 that brought him to the attention of SAAD.

SAAD relied heavily on the simple instruction in Basic and Advanced Cardiac Life Support that Peter had directed initially towards hospital personnel and military medical personnel. At this time SAAD had been developing the 'travelling road shows' called SAAD Seminars, with the format of short punchy lectures followed by rotating practical seminars. SAAD was leading the way for resuscitation training for dentists and Peter enthusiastically supported this. He was particularly taken with the ability of SAAD to give practical training as well as didactic teaching to a large number of people who could then go away and develop their skills. These seminars were known as Lifesaver 1 and Lifesaver 2 and provided teaching in Basic Life Support and Advanced Life Support respectively. Peter quickly became a Faculty member. He invigorated both course participants and the SAAD Faculty with his vast depth of knowledge, uncompromising standards and outstanding teaching ability.

Peter insisted that the Lifesaver seminars ran with military precision and that there was always more than adequate equipment as well as a selection of the most modern equipment available. The Lifesaver seminars were a period of renaissance for SAAD and they resulted in a close professional friendship between Peter Baskett, Peter Hunter and Myself.

Peter Baskett played hard as much as he worked hard and he actively led the social side of Lifesaver seminars. Late nights, good food and good wine were never allowed to impinge on the following morning's hard work. When Lifesaver was exported to Australia in 1990, Peter's military attitude surfaced again and he insisted we conquered our colleagues abroad in the bar as well as working alongside them clinically. Wherever we travelled, Peter's knowledge and humour entertained and taught, even if on occasion it was only how to get an upgraded flight wherever the Faculty travelled. It was on these occasions Peter expounded his love of motor sport and his particular interest with Castle Coombe circuit. This was a passion he shared with a number of BASIC's doctors.

Peter died on 18 April 2008 aged 73 in Frenchay Hospital. He is survived by his fourth wife, Fiona, three daughters and a son.

Peter was a good friend of SAAD as a Society and he was a close colleague to a number of our members. His legacy to SAAD is that anyone properly trained should be encouraged to 'do' rather than look for obstructions not to 'do'. His legacy to society is far greater. In a large part, due to his personal enthusiasm and considerable skills, many people in Europe have survived an untimely and premature death. Peter Baskett was without doubt one of the world's leaders in cardio-pulmonary resuscitation and pre-hospital care. ■

DSTG/ADA JOINT SYMPOSIUM 2008

NEW DIRECTIONS IN SEDATION

Stephen Jones

There was a 'new direction' this year as DSTG and ADA teamed up in a joint venture to deliver the programme 'New Directions in Sedation'. This two-day meeting at the University of Manchester Conference Centre had sessions devoted to teaching, research and politics.

A feature of this centre is a working model of the Foucault pendulum in the main entrance area and also a statue of Luca Pacioli, the father of accounting, who in 1494 wrote the first book on the double-entry book-keeping system. In 1851 Foucault proved that the earth rotates about its axis by demonstrating the change in the vertical plane of the pendulum's swing. A brass measurement scale permitted this phenomenon to be clearly observed on this model.

Delegates were welcomed by Professor Paul Coulthard, Chairman of DSTG, and Dr Ken Ruiz, President of ADA.

The morning session – devoted to Politics and Postgraduate Education – was opened by Tony Jenner, Deputy Chief Dental Officer, whose presentation 'DH Policy' gave an overview of the Department of Health (DH) policy on conscious sedation. He stated that there must be a clear justification for it to be used, not just administered because primary care practitioners promoted it. Many of the various seminal documents that had been produced during the previous eight years or so on sedation were reviewed; these included A Conscious Decision, the GDC's The First Five Years, Maintaining Standards, the Academy of Medical Royal Colleges' Safe Sedation, and SDAC's Conscious Sedation in the Provision of Dental Care (2003) and Alternative Techniques (2007). This plethora of documentation provided a framework to ensure high standards in the provision of conscious sedation, including dedicated training to benchmarked quality standards.

The DH had now put conscious sedation into their framework, demonstrated by the addition of Dentists with a Special Interest in Sedation to their list of Specialist Practitioners. This fitted into the function of a PCT to secure or provide high-quality, responsive and efficient services that give best value. Tony reiterated that under the transitional arrangements existing providers would continue with the same number of sedation courses of treatment.

At the conclusion of his presentation Tony posed the question, 'How do PCTs assess the need for sedation services'? Professor Coulthard struck while the metal was hot, taking the opportunity to volunteer both Societies' assistance to determine this.

Martin Tickle, Professor of Dental Public Health & Primary Dental Care and Honorary Consultant in Dental Public Health, North West Strategic Health Authority, developed Tony's theme. Martin informed us that Tony had been his trainer during his specialist training pathway!

This lecture, entitled 'Commissioning Anaesthetic and Sedation Services', detailed the current NHS structure. The commissioner/provider split and the importance of a contract between the two parties was emphasised. Essential policy components that impacted on dental services were stated and included the Operational Framework to improve access to primary dental care services, the 18-week delivery target for orthodontics and

oral surgery and the move of services from hospitals to primary care settings under the Closer to Home philosophy.

The developing market was examined with emphasis on patient choice. The mechanism for commissioning dental conscious sedation was illustrated by analysis of need, demand and supply. The critical role of community fluoridation – especially in the North West region – to reduce the disease burden was stated. Recent oral health toolkits to improve community oral health were also alluded to.

Martin mentioned some of the ways demand might be managed, e.g. robust assessment and triage as to who requires a general anaesthetic or conscious sedation. Increased capacity would be achieved through skill-mix, a hierarchical pyramid of dental therapist, dentist, Dentist with a Special Interest, specialist and consultant.

Commissioned sedation services had to offer value for money and quality, i.e. safe, accessible, effective clinical outcomes, sustainable with good patient satisfaction. The commissioning principles for dental general anaesthesia had been laid down in A Conscious Decision, whereby this service could only be carried out in a hospital setting with a critical care facility.

Pointers for provider development were stated, which included clinical leadership with an understanding of the drivers for change, working with commissioners to be part of the change process and to understand the business plan of your local PCT. Coupled with this was the need to understand the service that one delivers – the characteristics of the patient population, who you are providing the service for and potential competitors and collaborators, i.e. manage your future.

These two presentations had outlined the framework for what the centre required and the 'by whom' was addressed by Dr David Craig, Head of Sedation & Special Care Dentistry at KCL Dental Institute, London. His paper focused on the DH document *Guidelines for the appointment of Dentists with a Special Interest (DwSI) in Sedation*, which he interpreted in the context of how it would be implemented at grassroots level. David explained that a DwSI was an enhanced practitioner that sat between a generalist and a specialist and was appointed by a PCT where there was a local need for this service – this was a key point. The DwSI was not a qualification, appointments were made at a local level dependant upon national criteria and the posts were not transferable.

The advantages of a DwSI-led service in a patient-led service were greater convenience, faster access, more choice and the avoidance of inappropriate referrals; there would also be formal recognition by the NHS of a dentist's special skills.

Key tasks involved in the production of these guidelines had been the construction of a competency and assessment framework that had required defining both generalist and specialist competencies; various DSTG documents had been helpful in the process. This DwSI would be a practitioner who could deliver the standard techniques of inhalation sedation, intravenous sedation, and oral and/or transmucosal sedation (must be competent in intravenous sedation) and also possess competencies in some or all of the alternative sedation techniques. Five domains existed in the competency framework: academic, clinical, communication, leadership and professionalism. Sources of evidence would be determined from the possession or acquisition of a relevant certificate or diploma, testimonials, clinical attachments, case presentations, relevant CPD; this evidence would need to be compiled in a portfolio as part of the accreditation process.

The DwSI would be supported by a clinical network, a peer review group, other special interest practitioners and an annual appraisal. David concluded with the hope that PCTs would now establish such posts in order to satisfy local needs.

The morning session was concluded by Professor Paul Coulthard, Chairman of DSTG, at which he launched the proposal for 'The Standard Sedation Certificate' (SSC), for practitioners of standard sedation techniques. DSTG had produced documents related to undergraduate training and advanced techniques; this proposal would focus on 'assessment' to enable practitioners to demonstrate evidence of their experience and competence.

It was envisaged that a core postgraduate programme, the SSC, could be delivered by a number of providers with an award on completion that would be valid for five years. This principle fits in with the proposed revalidation model that will soon be upon the professions. Paul detailed the range of assessment methods appropriate to achieving the aims and learning

outcomes and included an MCQ, two case presentations and a practice profile that had to be submitted prior to the assessment.

A questionnaire had been distributed prior to the Symposium to discover members' views of this proposal; there was a very favourable response for proceeding with such a scheme that would be applicable to doctors who administer standard techniques. A new group would be established to take this forward.

A lively question and answer session followed; a couple of comments worthy of recording were: 'sedation as we know it is becoming over-regulated and politicians enjoy that' and 'single high-profile accidents colour commissioners' opinion and they think that all sedation is unsafe. Sedation in good hands is safe'.

The AGM of DSTG followed. The Chairman urged members to become involved in sedation research and promote a website. The next meeting would be in Bristol with a provisional date of the last Friday in April. Lunch was taken and the opportunity to visit the stands of the main sponsors, RA Medical, Ambu, Septodont, Abbott Medical and Intersurgical was available.

The afternoon session, chaired by Lesley Longman, was dedicated to clinical teaching and free papers. Dr Jan Shaw, Consultant Anaesthetist & Course Director for Patient Safety, Central Manchester Trust and Mr Neal Jones, Manager, Cheshire and Merseyside Simulation Centre, captivated us with a touching and challenging presentation, 'Simulation in Sedation and Anaesthesia Teaching'. A video was shown that demonstrated how the philosophy and principles of untoward incident investigation in the aviation industry could be transferred to the NHS. The narrator was an airline pilot who described a catastrophic healthcare event that had occurred to his wife. Despite the ordeal that his family had been subjected to, his main concern was that healthcare organisations adopt the aviation model of root cause analysis. He described procedures that occur prior to a flight, emphasising the need to check the aircraft, to facilitate good communications between crew members and the creation of an open environment within the organisation. He stated the need to wake up to the human factor; in 75% of aviation accidents there was breakdown in leadership and assertiveness that led to sub-optimal decision making. The airline industry has a culture of no blame and no one is singled out as a culprit. Not every one had dry eyes during the viewing of this emotional video.

A 'Risk of Fatal Outcome per Exposure' table was shown that showed some remarkable statistics: nuclear power and scheduled airline flights were placed in the ultra-safe category whereas manned spaceflight and hospital admissions were placed in the dangerous category!

Neal Jones introduced the practical side by describing the facilities and set-up of the Simulation Centre at University Hospital Aintree. (This may be viewed online at www.simulationcentre.com) He stated that the power of simulation is 'team training' and that the NHS was a horrendously dangerous place. Neal quoted the figures from the DH publication *An Organisation with a Memory*: 80% of preventable accidents were due to the human factor. Simulation was an extremely useful tool as there was never any risk to the patient, a wide variety of events could be presented at will, the same event could be presented to different teams, errors were permitted to occur and to be played out and team working was enhanced; it was better to learn in a realistic environment. Elements within the 'human factor' were communication, leadership, situational awareness and distribution of workload.

The simulation scenario featured Paul Coulthard, who had manfully volunteered to be the dentist, assisted by Dr Jan Shaw as 'dental nurse'. He had not been given any induction or training, and the objective of this exercise was to check defects in the system. The technician operating the simulator ensured the direction of travel was inexorably to the worse case scenario. All felt for Paul as things went from bad to worse. However, the debriefing session brought out the learning points! (Thanks to Paul for being game to go through this ordeal.)

The afternoon continued with five free papers that covered a wide range of subjects and was chaired by Dr Tony Mellor, Senior Lecturer in Primary Dental Care and Honorary Consultant, University of Manchester School of Dentistry.

The first paper (Dr Anita Jhamatt) investigated parents' thoughts regarding restraint of children at induction of dental chair general anaesthesia. The conclusion was that 85% of parents approved restraint for urgent and also for non-urgent treatment.

The second paper (Dr Christine Battison) reported on a study – still in progress – that was investigating the relationship between ethnicity and the level of dental

anxiety in an adult population. No results were available at this stage to draw conclusions.

General anaesthesia was the theme for the third paper (Dr Lola Adewale and Dr Ian Barker), which reported on a comprehensive analysis related to exodontia in children. A host of variables were analysed that included drugs used for induction, use of cannulae, agents used to maintain anaesthesia, vital signs monitoring, airway devices, position in chair, analgesic agents including the administration of local anaesthetics by the dentist and the time to discharge. Unsurprisingly the analysis of 260 questionnaires reported on a wide variation of techniques that were employed.

This was followed by a case report of IV midazolam sedation on a patient with Ehlers Danloss syndrome who was prone to dislocate her shoulder when sedated (Dr David Tait).

The final paper (Dr Cath Potter) described an investigation to determine whether hypnosis and inhalation sedation 'work together'.

The evening dinner was a very relaxed and convivial affair; this ambiance was set by the string quartet '4 Tune' that played soothingly in the background.

Proceedings on the Saturday opened with the AGM of ADA; Ken Ruiz reported his concerns about the investigations that NICE were due to commence, 'The use of sedation during diagnostic and therapeutic procedures in infants, children and young people (age 0 to 19)'. Dr Diana Terry was installed as President-elect and, following the Secretary's and Treasurer's reports, Day Two of the conference commenced.

Christine Arnold, Senior Clinician in Special Care Dentistry, Halton and St Helens PCT, chaired the first part of the scientific session. The law was the theme. Andrew Bridgman initially graduated as a dentist in 1981. He subsequently followed a legal career and was called to the Bar in 2001. His objective was to demystify the Mental Capacity Act (MCA); Andrew outlined the ethics of healthcare, i.e. autonomy, non-maleficence, beneficence and the harm versus good balance. Common law principles were discussed in relation to the MCA and our duty to provide healthcare to those who cannot give consent. Best interest was defined with the Bolam test being cited as its test, i.e. what other professionals would do and clinical care judged to be accepted practice. Other areas of this law were described relating to restraint, promotion and maximisation of autonomy, lasting power of attorney and proxy decision making.

The key statement at the end of this erudite presentation was that the MCA will make little difference in healthcare.

Continuing with the legal theme Professor Phil Rood, Dental Clinical Director, King's College Hospital, London, addressed the question, 'Are lawyers a threat'? He declared that he was speaking from personal experience and that he was attempting to reassure us about the law with a personal focus as a dentist who practises sedation. Sedation had to be put in the context of other clinical techniques, e.g. implantology is the cause of far more legal cases than those arising from sedation. By association sedation is unfairly regarded as risky as it is coupled to general anaesthetic mishaps. Professor Rood hammered home the point that if basic sedation techniques are used the lawyers will keep away from us and that one does not need to be perfect in the clinical workplace.

Barristers who represent dental professionals are well equipped to put up a strong defence, with some excellent lawyers in our support teams. There were a number of aggressive companies who adopt a 'terrier-like approach' but dental protection societies are now adjusting to them and are prepared to challenge; for example, Dental Protection are now pursuing costs from companies who make unreasonable claims.

In conclusion, there was no doubt that the legal profession had been of benefit to us because it made us improve our standards.

The second part of the scientific session, chaired by Dr Diana Terry, ADA Honorary Secretary, Consultant Anaesthetist, focused on sedation techniques.

Mr Jonathon Green, Endoscopy Vice-President, British Society of Gastroenterology, reviewed current practice, problems and possible solutions in his presentation 'Sedation for Endoscopy'. This was a fascinating insight into how sedation had developed and continues to develop in this area of medical practice. There were some interesting tongue-twisting acronyms in this one: OGD – oesophogastroduodenoscopy and ERCP – endoscopic retrograde cholangio-pancreatography!

Jonathon stated that most surgeons and patients found the use of 50% topical anaesthetic (lignocaine) spray alone, IV midazolam with or without an opiate or an opioid with doses now being reduced to 5mg satisfactory for endoscopy. Evolution from operator/sedationist to delegating airway, oxygen saturation levels, blood pressure and pulse monitoring to a second person was now common in everyday practice; the presence of a qualified RGN is mandatory. Propofol was now being used more frequently but it had no advantage over midazolam for the average risk patient undergoing OGD.

However, there was a need for change, particularly for specialised endoscopy such as ERCP, due to the complexity of the procedure, which may take sixty minutes to perform. Coupled with this is that patients tend to be elderly with debilitating illnesses, which increases risk. Options for change include 'gas & air' and Propofol. The disadvantage of Propofol is that it is an anaesthetic agent requiring a pre-operative assessment, the continued presence of an anaesthetist during the procedure and the need for specialist equipment, which increases unit costs. In this world of tariffs and payment by results this is not good news for hospital trusts! However, the benefits to the patient include increased comfort and improved experience.

The main barriers to the introduction of Propofol for endoscopy were organisational and cultural – professional and service resistance. Jonathon outlined how these barriers could be overcome and concluded by stating that the UK was ahead of the game with regard to benzodiazepine sedation but was falling behind with Propofol sedation techniques.

The final presentation of the conference, 'Safety and Efficacy in Paediatric Sedation', was given by Professor James Roelofse, Professor and Head of Anaesthesia & Sedation, University of Western Cape, South Africa and Visiting Professor of Anaesthesiology UCL, London; polypharmacy in paediatric sedation was the theme of his paper. Polypharmacy was now commonplace and we should change our approach as some child patients are resistant to standard techniques and for painful procedures the argument for polypharmacy was obvious. He stated that the operating environment must be adequate and there was a need for an objective scale for safety and efficacy that included a measure of the post-operative effects; the four main components of such a scale were pain, movement, level of consciousness, the drugs used for sedation and their side effects.

A review of some of the drugs used in relation to sedation was illustrated, which included Midazolam, Alfentanyl, Fentanyl and Ketamine. Professor Roelofse showed drug profiles in which Alfentanyl and Fentanyl were compared; the former drug was deemed to be an excellent drug for paediatric dental sedation as there was less of a problem with accumulation than Fentanyl.

Also discussed were non-pharmacological factors that impacted on the delivery of paediatric sedation, including head position of the patient, secretions, BMI, the type of surgery involved and patient behavioural issues. It was his opinion that those who deliver this type of sedation should receive competency-based training with registration, tests and appropriate qualifications.

As regards safety, his key statement was 'it is the human factor that causes the problem, not the drug', which tied in with the evidence from the aviation industry that had been described on the first day. This had been a comprehensive, in-depth presentation that provided much food for thought.

This joint approach had ensured a very successful conference. The perpetual motion of the pendulum indicating the shift in the vertical plane should be a spur to align to a 'new direction'. During the two days there had been frequent reference to commissioning, business, tariffs and contracts that would no doubt have raised an understanding smile from Luca! ■

Mr S. G. Jones
DSTG Member and SAAD Hon. Treasurer

Bill Hamlin
SAAD ADA Representative

A PROSPECTIVE, RANDOMISED, DOUBLE-BLIND COMPARISON OF ARTICAINE AND LIDOCAINE FOR MAXILLARY INFILTRATIONS

Grace Evans, DMD, MS; John Nusstein, DDS, MS; Melissa Drum, DDS, MS; Al Reader, DDS, MS; Mike Beck, DDS, MA

Journal of Endodontics, 34 (4) : 389–393, 2008

The purpose of this prospective, randomised, double-blind crossover study was to evaluate the anaesthetic efficacy of 4% articaine with 1:100,000 epinephrine and 2% lidocaine with 1:100,000 epinephrine in maxillary lateral incisors and first molars. Eighty subjects randomly received, in a double-blind manner, maxillary lateral incisor and first molar infiltrations of one cartridge of 4% articaine with 1:100,000 epinephrine or 2% lidocaine with 1:100,000 epinephrine at two separate appointments spaced at least one week apart. In maxillary lateral incisors, articaine exhibited a significantly higher anaesthetic success rate of 88% when compared with a 62% success rate with lidocaine. In maxillary first molars, articaine had a similar success rate to lidocaine (78% vs. 73%), and there was no significant difference between the two solutions. In conclusion, a maxillary infiltration of 4% articaine with 1:100,000 epinephrine statistically improved anaesthetic success when compared with 2% lidocaine with 1:100,000 epinephrine in the lateral incisor but not in the first molar.

Michael Wood
SAAD Trustee

SEDATION IN UNCOOPERATIVE CHILDREN UNDERGOING DENTAL PROCEDURES: A COMPARATIVE EVALUATION OF MIDAZOLAM, PROPOFOL AND KETAMINE

Kavitha Rai, Amitha M. Hegde, Kukul Goel

Journal of Clinical Paediatric Dentistry 32 (1):1–4, 2007

Most children are managed with behaviour management in dental practice but a small group requires pharmacological intervention in the form of conscious sedation or general anaesthesia. Midazolam (M), Propofol (P) and Ketamine (K) are compared for intravenous sedative use in young children.

Objective
Compare the safety and effectiveness of these three sedative drugs in paediatric dental practice.

Materials and methods
30 healthy (ASA 1 and 2) anxious and uncooperative children aged 3–6 years were divided into 3 groups (10 per group) where dental treatment was carried out using sedation according to each of the drugs. Midazolam (0.5mg/kg) and Atropine (0.6mg) was administered orally as a premedication one hour prior to the procedure by an anaesthetist. Initial bolus doses were followed by a drip infusion of the drugs: M 0.1mg/kg bolus followed by 0.004mg/kg/min infusion rate dose; P 1mg/kg bolus followed by 0.06mg/kg/min infusion rate dose; K 0.5mg/kg bolus followed by infusion 0.01mg/kg/min. A

range of dental procedures were carried out with treatment not exceeding 45 minutes. Vital signs were recorded every five minutes and behaviour under sedation was scored using Houpt's sedation rating score, which measures Sleep, Crying, Movement and Overall behaviour under sedation. Recovery was measured using Aldrete's recovery rating score. All post-operative complications were noted for that specific sedation technique.

Results
Level of sedation assessed immediately after bolus, after five minutes and at the end of the sedation procedure. M showed the lowest level of sedation while P showed the highest level, while K was intermediate. Body movement occurred least with K, more with M while it was almost continuous with P. Children sedated with M&P encountered almost continuous crying throughout the sedation procedure; however, children sedated with K were calm, comfortable and without crying. Maximum level of cooperation was achieved with K. Following drug administration, immediate level of sedation was poor with M compared to P. P showed the fastest recovery followed by K, with the M group taking the longest to recover.

Discussion
Immediately after P administration none of the patients were awake, while with K nearly all the patients were drowsy and disorientated. Almost all the children sedated with M were awake and responsive.

P showed shortest duration of effect with additional boluses required every 2.5 minutes. No additional boluses were required for the M and K groups. As a result of continuous movement in the P group, dental treatment was difficult; this was slightly less in the M group. Treatment was best under K where least movement and no crying occurred. Systemic side effects were absent except for the P group where 70% of cases developed an intermittent cough during the procedure. Post-operative recovery was uneventful in all three groups.

Conclusion
Conscious sedation is safe and cost-effective in facilitating routine dental care in short dental procedures in young uncooperative children. K was the drug of choice considering ease of dental treatment and level of cooperation, followed by M. ■

SUMMARY OF: PAIN PERCEPTION DURING INFERIOR ALVEOLAR INJECTION ADMINISTERED WITH THE WAND™ OR CONVENTIONAL SYRINGE

C. Yesilyurt, G. Bulut and T. Tasdemir
Verifiable CPD paper
British Dental Journal online article number E10

Objective
This study compared a computerised device (the Wand™) with a conventional syringe in terms of the pain of needle insertion and injection during inferior alveolar nerve (IAN) block injection.

Methods and materials
The subjects were 40 patients between the ages of 18 and 30 years requiring local anaesthesia for dental restoration in the mandible. Before anaesthetic administration, the patients' anxiety levels were determined. Contralateral IAN injections were administrated at two separate appointments with random use of either the Wand™ or a conventional syringe. Following the injection, the patients used both the pain rating score (PRS) and a visual analogue scale (VAS) to assess the intensity of pain.

Results
When pain was measured after the injection, the Wand™ was found to be less painful than the syringe for the pain of both needle insertion and injection ($p < 0.05$).

Conclusion
The Wand™ technique resulted in significantly lower pain scores during the IAN block injections. Most of the patients preferred the IAN injection with the Wand™ for future dental injections. ■

COMPARISON OF TRANSMUCOSAL MIDAZOLAM WITH INHALATION SEDATION FOR DENTAL EXTRACTIONS IN CHILDREN. A RANDOMISED CROSSOVER CLINICAL TRIAL

KE Wilson, RR Welbury and NM Girdler

ACTA ANAESTHESIOLOGICA SCANDINAVICA
2007;51:1062-1067

Objectives
The aim of the study was to compare the sedation created using 30% N_2O/70% O_2 with that of 0.2 mg/kg buccal midazolam in a group of 36 patients aged between 10 and 16 years. Each patient required four teeth extracted, attended on two occasions and received both types of sedation.

Method
The study design has previously been validated and ethical approval was obtained. 45 patients were recruited; 36 patients completed both arms of the trial. Subjects were children aged 10–16 ASA1 and 2 who had been referred for the extraction of four premolar teeth.

Sedation was achieved with N_2O/O_2 with a Quantiflex MDM sedation unit increasing the N2O by 10% increments to 30%. All patients received 30%; this was maintained throughout the procedure. At the end of the procedure 100% O_2 was given for three minutes.

Midazolam was used in a specially formulated syrup, Epistat. This is 10mg/ml and was given in a dose of 0.2mg/kg, the syrup being distributed equally in both buccal sulci and the patient then being asked not to swallow.

Vital signs were monitored in both groups. 10 minutes after the start of sedation the patient was asked if he or she was ready to start treatment; an adequate level of sedation was considered as the point when the patient appeared relaxed and demonstrated a slurring or slowing of speech with delayed response to commands and a willingness for treatment to proceed. Local anaesthetic was applied topically and then injected. The teeth were then extracted. Patients stayed in recovery until standard criteria for discharge were met or for a minimum of 20 minutes from the start of N_2O sedation and 60 minutes from the start of midazolam sedation.

Assessment of pre- and post-operative anxiety was determined using the Fear Survey Schedule for Children (dental subscale) and the Spielberger State Anxiety Inventory. Behaviour during extractions was rated using the Hoput scale and overall impression was recorded with a follow-up questionnaire.

Results
Vital signs were the same and remained satisfactory in both groups throughout treatment.
Two patients from each group became uncooperative and were excluded; four who received N_2O first visit requested the same for the second visit. No significant difference in behaviour was noted in either group. Amnesia for the local anaesthetic injection and extractions was greater in the midazolam group but not significantly.

There was a preference expressed for future treatments to be with N_2O over midazolam. With both sedation methods and with both of the above anxiety tests, anxiety was lower post extraction than pre-operatively and this did reach significance.

Conclusions
Buccal midazolam is as safe as N2O sedation but difficulties of administration, unpleasant taste and increased salivation, with a desire to swallow, made patient acceptability poor, and work needs to be done on the drug formulation. No disinhibition was seen in those given midazolam, which is seen as encouraging. ■

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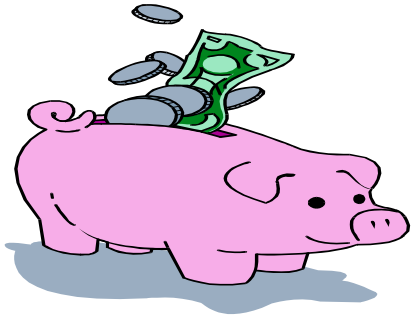

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Reference to a book

3. Craig DC, Skelly AM. Practical Conscious Sedation. London: Quintessence; 2004. pp. 1–10.

Reference to a book chapter

6. Robb ND. Conscious sedation in dentistry. In: Heasman PA, editor. Master Dentistry Vol. 2: Restorative Dentistry, Paediatric Dentistry and Orthodontics. Edinburgh: Churchill Livingstone; 2003. pp. 149–168.

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9. GDC. Reaccreditation and recertification for the dental profession. London: GDC; 1997.

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To order Rapydan®, please contact your usual Wholesaler quoting PIP Code 337-1218.

PRESCRIBING INFORMATION

Rapydan (70 mg lidocaine/70 mg tetracaine medicated plaster)

Indication: Surface anaesthesia of the normal intact skin in connection with needle puncture in adults and children from 3 years of age, and in cases of superficial surgical procedures on normal intact skin in adults. **Dosage and administration:** Adults: 1 or at most 4 plasters simultaneously; maximum 4 plasters per 24 hours. Children from 3 years of age: 1 or at most 2 plasters simultaneously; maximum 2 plasters per 24 hours. Application time: 30 minutes. Rapydan contains a heat-releasing component that may reach a temperature of up to 40°C. **Contraindications:** Hypersensitivity to the active substances, to local anaesthetics of the amide or ester type, to para-aminobenzoic acid, to sodium borate or to any of the other excipients. Not be used on mucous membranes or on areas with a compromised skin barrier. **Special warnings and precautions for use:** Caution in patients with significant hepatic, renal or cardiac impairment, and in subjects with increased sensitivity to systemic circulatory effects of lidocaine and tetracaine. Prolonged application time or application of more plasters than recommended can lead to increased absorption of lidocaine and tetracaine. Rapydan contains methyl parahydroxybenzoate and propyl parahydroxybenzoate which may cause allergic reactions. Use with caution in the proximity of the eyes. Lidocaine has bactericidal and antiviral properties; the result of intradermal injections of live vaccine should be closely monitored. Do not use under occlusive dressings. **Drug interactions:** Consider the risk when Rapydan is used in patients receiving other products containing local anaesthetic agents, or class I and class III antiarrhythmic drugs. Consider cumulative doses if used with other formulations of lidocaine or tetracaine. **Pregnancy and lactation:** Pregnancy: use with caution. Lactation: breast-feeding may continue. **Undesirable effects:** Local erythema, oedema, blanching and rash. Reactions were generally mild and transient, and disappeared after the end of treatment. Allergic or anaphylactoid reactions associated with lidocaine, tetracaine or other ingredients in Rapydan may occur. Systemic toxicity and adverse reactions following appropriate use of Rapydan are unlikely. Prescribers should consult the Summary of Product Characteristics in relation to other side effects. **Overdose:** Symptoms expected to be similar to those seen after other local anaesthetic treatment. Symptomatic treatment. Monitor for several hours.

Legal category: POM. **Presentation and basic NHS cost:** Packs containing 25 plasters. £98 per pack. **Marketing Authorisation number:** PL 31626/0001. **Marketing Authorisation holder:** EUSA Pharma (Europe) Ltd. The Magdalen Centre, Oxford Science Park, Oxford OX4 4GA, United Kingdom. **Further information available from:** EUSA Pharma, Building 3, Arlington Business Park, Whittle Way, Stevenage, Hertfordshire SG1 2FP, UK. **Date of preparation of Prescribing Information:** December 2007.

Adverse events should be reported. Reporting forms can be found at www.yellowcard.gov.uk.
Adverse events should also be reported to EUSA Pharma on tel no: 01483 685920.

Code: UK.RAP.10/08.01

Date of preparation: October 2008

1. Sethna N *et al*. A Randomized Controlled Trial to Evaluate S-Caine PatchTM [Rapydan®] for Reducing Pain Associated with Vascular Access in Children. Anesthesiology 2005; 102:403-8 **2.** Curry SE and Finkel JC. Use of the SyneraTM Patch [Rapydan®] for Local Anesthesia Before Vascular Access Procedures: A Randomized, Double-Blind, Placebo-Controlled Study. American Academy of Pain Medicine 2007; 8:497-502 Rapydan® is a registered trademark of EUSA Pharma (Europe) Ltd.

EUSAPharma

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Espestesin™
Solution for Injection
(Articaine HCI & epinephrine HCL)

Commitment to anaesthetics, committed to dentistry:

- Articaine – fast, well tolerated and reliable[1]
- Controlled delivery
- Tried, tested & trustworthy

50 YEARS OF EXPERIENCE AND COMPETENCE
50 LOCAL ANAESTHETICS

Information about adverse event reporting can be found at www.yellowcard.gov.uk.
Adverse events should also be reported to 3M Health Care Ltd on 01509 614265

Espestesin solution is to be used with either a non-aspirating or self-aspirating 1.8ml syringe.

Espestesin™ solution 1/200 000 · Espestesin™ 1/100 000 – Solution for Injection. COMPOSITION: Active substance: Espestesin 1/200 000 1 ml solution for injection contains: *Active substances*: Articaine hydrochloride 40 mg, Adrenaline hydrochloride 0.006 mg (corresponding to 5 µg adrenaline (epinephrine)). Excipients: Sodium sulphite max. 0.6 mg (equivalent to max. 0.31 mg SO2) Sodium chloride, Water for injections, Hydrochloric acid and sodiumhydroxide solution for adjusting the ph-value Espestesin 1/100 000 1 ml solution for injection contains: *Active substances*: Articaine hydrochloride 40 mg Adrenaline hydrochloride 0.012 mg (corresponding to 10 µg adrenaline (epinephrine)) *Excipients*: Sodium sulphite max. 0.6 mg equivalent to max. 0.31 mg SO2) Sodium chloride, Water for injections, Hydrochloric acid and sodiumhydroxide solution for adjusting the ph-value **CLINICAL PARTICULARS Therapeutic indications** Espestesin 1/200 000 Local anaesthesia (infiltration and nerve-block anaesthesia) in dentistry during minor procedures. Espestesin 1/100 000 Local anaesthesia (infiltration and nerve-block anaesthesia) in dentistry. Espestesin 1/100 000 is especially indicated for complicated procedures requiring prolonged anaesthesia. **Contraindications** The use in children under 4 years of age is contraindicated. Espestesin 1/200 000 / Espestesin 1/100 000 is contraindicated in case of hypersensitivity to any of the components. *Due to the local anaesthetic ingredient articaine, Espestesin 1/200 000 / Espestesin 1/100 000 is not allowed to be used in the event of*: known allergy or hypersensitivity to local anaesthetics of the amide type, severe impairment of the impulse initiation and conduction system of the heart (e.g. grade II and III AV block, pronounced bradycardia), acutely decompensated cardiac insufficiency, severe hypotension, patients who are known to have a deficiency in plasma cholinesterase activity, haemorrhagic diatheses – particularly with nerve-block anaesthesia, injection into an inflamed area. *Due to the content of adrenaline (epinephrine) as a vasoconstrictor admixture, Espestesin 1/200 000 / Espestesin 1/100 000 is not allowed to be used in the event of*: Heart diseases such as: unstable angina pectoris, recent myocardial infarction, recent coronary artery bypass surgery, refractory arrhythmias and paroxysmal tachycardia or high-frequency, continuous arrhythmia, untreated or uncontrolled severe hypertension, untreated or uncontrolled congestive heart failure, Concomitant treatment with monoamine oxidase (MAO) inhibitors or tricyclic antidepressants. *Due to the content of sulphite as excipient, Espestesin 1/200 000 / Espestesin 1/100 000 is not allowed to be used in the event of*: allergy or hypersensitivity to sulphite, severe bronchial asthma, Espestesin 1/200 000 / Espestesin 1/100 000 can provoke acute allergic reactions with anaphylactic symptoms (e.g. bronchospasm). **Special warnings and precautions for use** Espestesin 1/200 000 / Espestesin 1/100 000 must be used with particular caution in the event of: severe impairment of the renal function, angina pectoris, arteriosclerosis, considerably impaired blood coagulation, thyrotoxicosis, narrow-angle glaucoma, diabetes mellitus, lung diseases – particularly allergic asthma, pheochromocytoma. Accidental injection may be associated with convulsions, followed by central nervous system or cardiorespiratory arrest. Resuscitative equipment, oxygen, and other resuscitative drugs should be available for immediate use. Since amide-type local anaesthetics are also metabolised by the liver, Espestesin 1/200 000 / Espestesin 1/100 000 should be used with caution for patients with hepatic diseases. Patients with severe hepatic diseases are at greater risk of developing toxic plasma concentration. The product should be administered with caution in patients with impaired cardiovascular function since they may be less able to compensate for functional changes associated with the prolongation of A-V conduction produced by these drugs. The product should be administered with caution for patients with a history of epilepsy. There is a possibility of positive results in doping tests performed on sportsmen. It should be taken into consideration that during treatment with blood coagulation inhibitors (e.g. heparin or acetylsalicylic acid), an inadvertent vasopuncture when administering the local anaesthetic can lead to serious bleeding, and that in general the hemorrhagic tendency is increased. Inadvertant intravascular application must be avoided. The lower blood flow in the pulp tissue due to the content of adrenaline (epinephrine) and thus the risk to overlook an opened pulp has to be taken into account regarding cavity or crown preparations. *Precautions for use*: Each time a local anaesthetic is used the following drugs/therapy should be available: Anti-convulsant medicines (benzodiazepines or barbiturates), musclerelaxants, atropine and vasopressors or adrenaline for a severe allergic or anaphylactic reaction. Resuscitating equipment (in particular a source of oxygen) enabling artificial ventilation if necessary. Careful and constant monitoring of cardiovascular and respiratory (adequacy of ventilation) vital signs and the patient's state of consciousness should be monitored after each local anaesthetic injection. Restlessness, anxiety, tinnitus, dizziness, blurred vision, tremors, depression, or drowsiness may be early warning signs of central nervous system toxicity. Patients taking phenothiazines Phenothiazines may reduce or reverse the pressor effect of adrenaline (epinephrine). Concurrent use of these agents should generally be avoided. In situations when concurrent therapy is necessary, careful patient monitoring is essential. Patients taking non-selective betablockers The concomitant administration of non-cardioselective beta-blockers can lead to an increase in blood pressure due to adrenaline (epinephrine). **Pregnancy and lactation** No clinical experience of the use in pregnant and lactating women is available. Safe use of local anaesthetics during pregnancy has not been established with respect to adverse effects on fetal development. This medicine should only be used in pregnancy when the benefits are considered to outweigh the risks. The excretion of articaine and its metabolites in human milk is unknown. However, preclinical safety data suggest that the concentration of articaine in breast milk does not reach clinically relevant concentrations. Therefore, nursing mothers should milk and discard the first mother's milk following anaesthesia with articaine. **Effects on the ability to drive and use machines** Although test patients have shown no impairment of their normal reactions when driving a vehicle, the dentist has to assess in each case the possible impairment of safety when operating a motor vehicle or machinery. The patient should not leave the dental office earlier than at least 30 minutes after the injection. **Undesirable effects** *Due to the local anaesthetic ingredient articaine, the following adverse effects can occur*: **Cardiovascular disorders** Rare (≥ 0.01%) Decrease in heart rate, hypotension. Drop in blood pressure, cardiac impulse conduction disorders, bradycardia, asystolia, cardiovascular arrest. **Nervous system disorders** Rare (≥ 0.01%) Metallic taste, tinnitus, dizziness, nausea, vomiting, restlessness, anxiety, yawning, shaking, nervousness, nystagmus, logorrhoea, headache, increase in respiratory rate. Paresthesias (loss of sensation, burning, tingling) of the lip, tongue, or both. When these signs appear are required rapid corrective measures to prevent possible worsening. Drowsiness, confusion, tremor, muscle twitching, tonic-clonic seizures, coma and respiratory paralysis. **Respiratory disorders** Rare (≥ 0.01%) Tachypnea, then bradypnea, which could lead to apnoea. **Allergic reactions** Very rare (< 0.01%) One may observe manifestation of hypersensitivity to articaine as rash, pruritus edema, pruritus, and er thema as well as nausea, diarrhea, wheezing or anaphylaxis. Cross-reactivity to articaine has been reported in a patient with delayed hypersensitivity to prilocaine. In general, patients with demonstrated hypersensitivity to articaine or other amides should receive an ester-group local anaesthetic for subsequent procedures. The administration of large doses of articaine may produce methaemoglobinemia in patients with subclinical methaemoglobinemia. *Due to the content of adrenaline (epinephrine) as a vasoconstrictor admixture, the following undesirable effects can occur*: **Cardiovascular disorders** Rare (≥ 0.01%) Heat sensation, sweating, heart racing, migrainelike headache, blood pressure increase, angina pectoris disorders, tachycardias, tachyarrhythmias and cardiovascular arrest as well as acute oedematous thyroid swelling cannot be ruled out. *Due to the content of sulphite as excipient, the following undesirable effects can occur in very rare cases*: Allergic reactions or hypersensitivity reactions, particularly in bronchial asthmatics, which are manifested as vomiting, diarrhea, wheezing, acute asthma attack, clouding of consciousness or shock. *Due to the content of both articaine and adrenaline (epinephrine), the following undesirable effects can occur*: **Nervous system disorders** 2 weeks delayed onset of facial nerve paralysis has been described with articaine/adrenaline (epinephrine), the event still occurs 6 months later. Interferences in the clinical picture can result from the simultaneous occurrence of various complications and side effects. Prescribers should consult the Summary of Product Characteristics in relation to other side effects. **Special precautions for storage:** Do not store above 25°C. Store in original package and protect from the light. **Basic price (UK):** £14.54 per tin of 50 vials. **Legal category:** POM. Marketing authorisation number: PL 19507/0001 and PL 19507/0002. **Further information available from:** 3M ESPE, 3M House, Morley Street, Loughborough, Leicestershire LE11 1EP, www.3MESPE.co.uk, 3MESPE@mmm.com. 0845 602 5094. **Date of preparation of prescribing information:** August 2006.

[1] Malamed S F. Handbook of local anaesthesia; 5 ed. C.V. Mosby Comp. S. Louis, 2004

3M ESPE

DIARY SCAN Compiled by Dr C E Mercer

2008	DATE	ORGANISATION	THEME/TITLE	VENUE	CONTACT
JANUARY					
	14-16	WSM London		QEII Conf. Centre Westminster	WSMLondon@aagbi.org
	23	ADSA		Dayton, Ohio, USA	http://www.adsahome.org /meetings.html
FEBRUARY					
	20-21	ADSA		Las Vegas, USA	www.adsahome.org
	21-22	SAAD	Dental Nurse Part II Course		http://www.saad.org.uk/courses
MARCH					
	7-8	SAAD	National Course in Conscious Sedation for Dentistry	London	http://www.saad.org.uk/courses
	TBC	Society for Education in Anaesthesia (UK)	Annual Scientific Meeting	The Sage, Gateshead	http://www.seauk.org
APRIL					
	23-25	ADSA	Annual Session	White Sulphur Springs, WV	http://www.adsahome.org /meetings.html
	23-25	Scandinavian Update	3rd Scandinavian Update on trauma, resuscitation and emergency medicine	Stavanger, Norway	www.scandinavian-update.org/
JUNE					
	20-21	SAAD	National Course in Conscious Sedation for Dentistry	London	http://www.saad.org.uk/courses
JULY					
	1-3	GAT	Annual Scientific Meeting	Cambridge, Corn Exchange	www.aagbi.org
SEPTEMBER					
	5-6	SAAD	Dental Nurse Part II Course		http://www.saad.org.uk/courses
	9-12	ESRA	XXVIII Annual ESRA Congress	Salzburg, Austria	www.kenes.com/esra
	23-25	AAGBI GAT	Annual Scientific Meeting	Liverpool	www.aagbi.org
	26	SAAD	Annual Conference	London	www.saad.org.uk
OCTOBER					
	14-17	IFDAS	12th International Dental Congress on Modern Pain Control	Gold Coast Australia	http://www.ccm.com/au/ifdas
NOVEMBER					
	7-8	SAAD	National Course in Conscious Sedation for Dentistry	London	http://www.saad.org.uk/courses