Paediatric conscious sedation: views and experience of specialists in paediatric dentistry

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RESEARCH

IN BRIEF

- Demonstrates the differences in conscious sedation training received by specialist registrars in paediatric dentistry in the UK.
- Provides information on the patient groups treated and types of treatment provided to paediatric patients under conscious sedation during paediatric dentistry training programmes.
- Summarises the opinions of specialists in paediatric dentistry on the provision of conscious sedation.

Objectives The objectives were three-fold: to investigate the level of conscious sedation training received prior to and during specialist training in paediatric dentistry; to establish the use of conscious sedation during and following specialisation; and to determine the attitudes of specialists in paediatric dentistry to conscious sedation. **Subjects and methods** A self-administered postal questionnaire was sent to all specialists in paediatric dentistry registered with the General Dental Council in January 2008. Non-responders were contacted again after a four-week period. **Results** A response rate of 60% was achieved. Of the 122 respondents, 67 (55%) had received sedation training as an undergraduate; 89 (75%) had been trained during specialisation. All respondents performed dental treatment under sedation as a trainee and the majority used nitrous oxide inhalation sedation (NOIS). Over 90% of respondents felt that NOIS should be available to all children, both in appropriate primary care settings and in hospitals. One hundred and twenty-one (99%) respondents thought that all trainees in paediatric dentistry should have sedation training. **Conclusions** The most popular form of sedation amongst specialists in paediatric dentistry was NOIS. However, some of the respondents felt that children should have access to other forms of sedation in both the primary care and hospital settings. Additional research on other forms of sedation is required to evaluate their effectiveness and safety.

INTRODUCTION

The provision of restorative dental care for children is usually facilitated by the use of behavioural management techniques coupled with the use of local anaesthesia. Conscious sedation is not a substitute for these techniques, but may be a useful adjunct to treatment in selected cases, for example in the 4% of children with severe dental anxiety which affects dental attendance behaviour.[1] When utilised in the provision of quality dentistry for children with severe anxiety, conscious sedation can minimise both the physiological and psychological stress of treatment.[2] Conscious sedation is defined as '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'.[3,4]

The General Dental Council and the Royal College of Anaesthetists encourage the use of conscious sedation as a safe alternative to general anaesthesia for the provision of dental care.[4] In addition to the management of dental anxiety, conscious sedation is appropriately used for patients undergoing complex or unpleasant procedures, those with medical conditions potentially aggravated by stress, and for those with conditions that detrimentally affect their ability to cooperate, such as special needs and a marked gag reflex.[5]

The many different drugs and routes of administration used for paediatric conscious sedation are described in the UK National Guideline in Paediatric Dentistry *Managing anxious children: the use of conscious sedation in paediatric dentistry*.[6] Of the drugs discussed, nitrous oxide inhalation sedation (NOIS) remains the technique of choice for the pharmacological management of anxious paediatric dental patients.[3,5] NOIS can be carried out in a practice setting, its use is well documented, and studies have proven both its immediate and long-term benefits in children with mild to moderate anxiety, enabling them to better accept dental treatment both at the first and subsequent visits.[7-9] The beneficial effects of treatment with nitrous oxide sedation in children may last beyond one treatment session.[10]

Although NOIS has been widely used in paediatric patients, relatively few randomised controlled trials utilising alternative methods such as intravenous sedation (IVS) have been documented.[11] The current guidance states that intravenous paediatric sedation is an advanced technique[4] and the operator administering IVS must have received appropriate training as determined by a competent authority.[5] For dentists assuming the dual responsibility of sedationist and operator, this includes mandatory postgraduate education, training and experience and the assistance of a second

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Online article numbmer E11
Refereed Paper – accepted 19 December 2008
DOI:10.1038/sj.bdj.2009.664

appropriately trained person, who must be present throughout the procedure and be capable of monitoring the patient and assisting should complications arise.

Despite guidelines,[3,5,6] no definitive conclusions have been reached about the most effective sedation method for anxious children.[12] In July 2008 the National Institute for Health and Clinical Excellence (NICE) started a scoping exercise to develop a clinical practice guideline on sedation in infants, children and young people for use in the NHS in England, Wales and Northern Ireland.

The sedation training of specialist registrars (SpRs) and recently qualified consultants in restorative dentistry in the United Kingdom (UK) has been investigated using a postal questionnaire.[13] The authors concluded that although the majority of respondents believed that all SpRs should receive training in conscious sedation, some respondents had not received any.

Specialists in paediatric dentistry are expected to have acquired the necessary skills and competency for NOIS[6] and be aware of the current guidelines for the use of paediatric sedation. The aim of this study, therefore, was to investigate the level of conscious sedation training received and the use of sedation by specialists in paediatric dentistry (SPD). A questionnaire based on that used with specialists in restorative dentistry was utilised.[13]

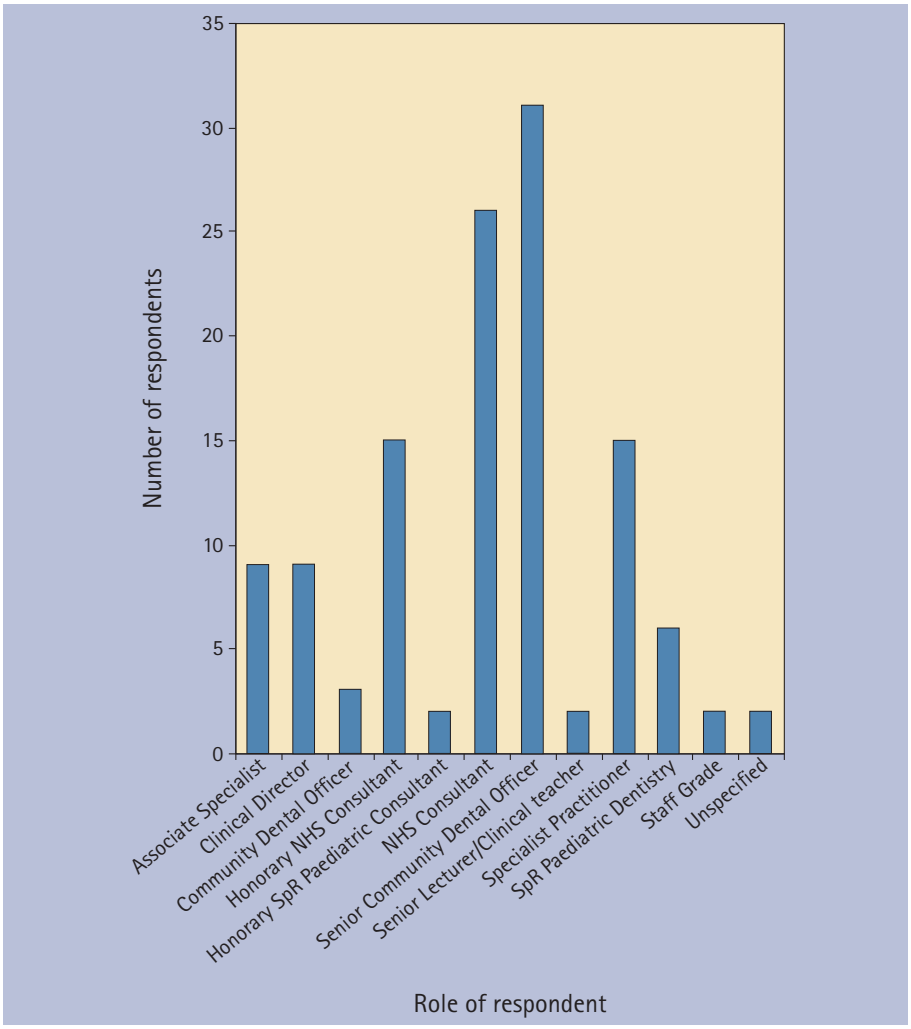

Fig. 1 Role of respondents at time of completing questionnaire

METHODS

A sedation questionnaire, based on one previously used with restorative specialists,[13] was developed specifically for SPD. The questionnaire was divided into four sections: the first comprised six questions investigating undergraduate and postgraduate training; the second included 18 questions on the conscious sedation and life support training received and whether respondents themselves teach conscious sedation; section three comprised ten questions about sedation patients, the types of sedation used and treatment provided; the final section consisted of five questions on the perceived sedation training needs of paediatric trainees.

The questionnaire was piloted using six SPD working in Cardiff University Dental Hospital, and minor changes were made. In January 2008, registered SPD were identified from a search of the General Dental Council (GDC) website. Each specialist was allocated a unique identifier code to enable identification of non-responders. A coded questionnaire, covering letter explaining the aims and nature of the survey, and a stamped and addressed return envelope were posted to all registered SPD, excluding those involved in the pilot study. After a four-week period a second questionnaire was posted to non-respondents. After a further four weeks the survey period was closed and the unique identifier codes were destroyed.

The data collected were entered into a SPSS® (SPSS Inc.) database to facilitate statistical analysis.

RESULTS

The sample

A total of 220 SPD were identified from the GDC website and contacted by postal questionnaire. Ninety completed questionnaires were returned after the first mailing and a further 42 were returned after the second mailing, representing a response rate of 60%. Ten questionnaires were excluded as either they were deemed to be incomplete or the respondents had retired or emigrated, resulting in a sample size of 122 SPD.

The occupations of the 122 respondents at the time of completing the questionnaire are shown in Figure 1; some respondents performed more than one role and so ticked multiple boxes on the questionnaire. Two respondents (2%) ticked 'other' but did not specify their role. All respondents had graduated from dental school prior to the year 2001: 45 (37%) graduated prior to 1980; 31 (25%) graduated between 1980 and 1985; 24 (20%) graduated between 1986 and 1995; 10 (8%) between 1991 and 1995; and 12 (9%) graduated between 1996 and 2000.

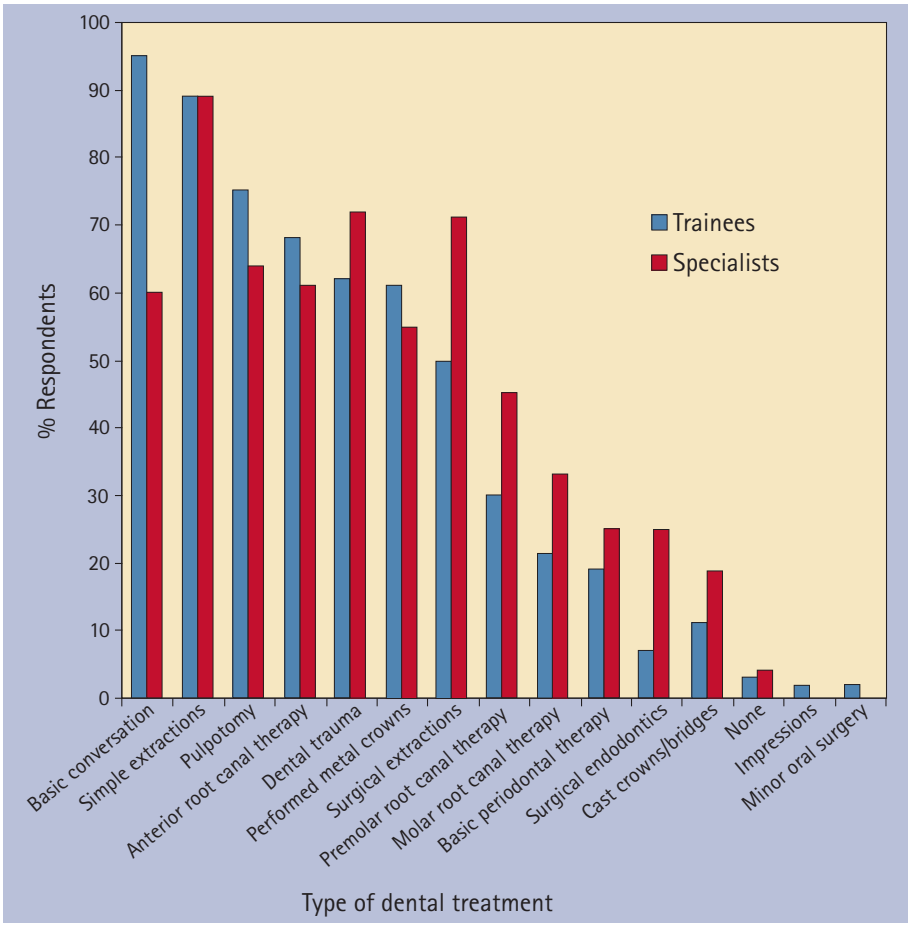

Fig. 2 Treatment provided under sedation as a trainee and post-specialisation

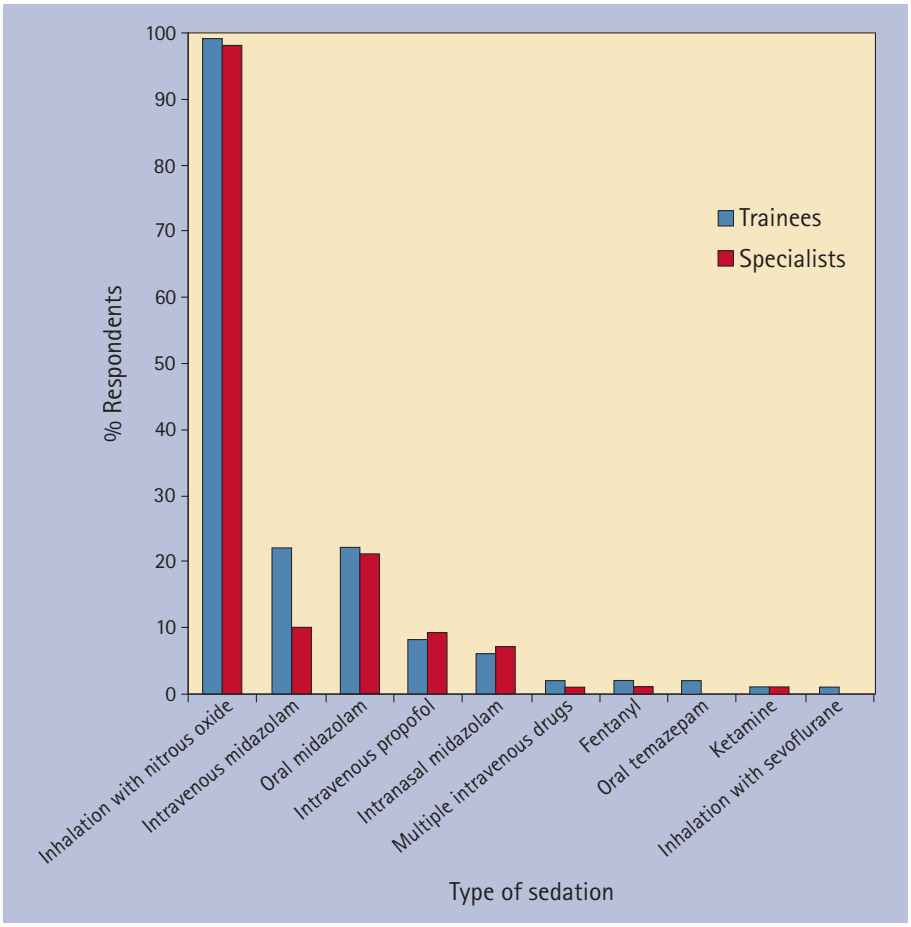

Fig. 3 Sedation provided as a trainee and post-specialisation

Undergraduate and postgraduate training

Sixty-seven specialists (55%) received sedation training as an undergraduate dental student. Of these, the theory of inhalation, intravenous and oral sedation was received by 61 (91%), 50 (75%) and 31 (46%) respondents respectively, and hands-on practical training was received in the techniques of inhalation, intravenous and oral sedation by 50 (75%), 25 (37%) and 5 (8%) respondents respectively.

The majority of respondents (62%) had participated in a recognised training programme in paediatric dentistry; the remainder had been grand-parented onto the specialist list. Paediatric specialist training was undertaken in many clinical settings, including undergraduate and postgraduate teaching hospitals, community dental clinics, district general hospitals, specialist dental practice, children's and tertiary hospitals. Overall 9% (11) of SPD had received no sedation training, 73% (89) had received sedation training during specialist training and 18% (22) before starting training. Of the 89 SPD who received sedation training during specialisation, the theory of inhalation, intravenous and oral sedation was received by 84 (94%), 42 (47%) and 56 (63%) respondents respectively; hands-on practical training was received in the techniques of inhalation, intravenous and oral sedation by 83 (93%), 29 (33%) and 34 (38%) respondents respectively. Training in conscious sedation had been received in the first year by 85% and in the second year by 60% of those who had received sedation training.

Conscious sedation training was received from an experienced colleague by 77 (79%) paediatric trainees, 26 (27%) were trained on Section 63 courses, 25 (26%) were self-taught, 23 (24%) received training as part of an MSc, 14 (14%) were trained by the Society for the Advancement of Anaesthesia in Dentistry (SAAD), 2 (2%) were trained as part of a Diploma, and 12 (12%) received training from another source. Of those that did not receive sedation training, eight reported that they would like to undertake training. Sixty-five (57%) SPD now teach conscious sedation to

various members of the dental team in a variety of clinical settings.

Use of paediatric sedation during and after specialisation

Fifty-seven (62%) respondents who had received sedation training as a trainee were able to practise their sedation skills weekly, 17 (19%) were able to practise monthly, 13 (14%) were able to practise occasionally, 4 (4%) were rarely able to practise and 1 (1%) never practised. Thirty-one (36%) treated one patient on average per session, 22 (25%) treated two patients, 27 (31%) treated three patients and 7 (6%) treated four patients. Specific sedation sessions were undertaken by 36 (40%) trainees.

During paediatric sedation performed as a paediatric trainee, 93 (95%) respondents acted as both operator and sedationist, 4 (4%) acted as operator and 1 (1%) performed the role of sedationist. Of the respondents that acted as both operator and sedationist, 79 (85%) had a dental nurse with sedation training as the second appropriate person, 15 (16%) had a dental nurse without sedation training, 10 (11%) had a dentist with sedation training, 7 (8%) had an anaesthetist and 4 (4%) had a dentist without sedation training. An anaesthetist provided the sedation for three of the dentists that acted solely as operator and a dentist with sedation training provided sedation for the fourth. Sedation was most frequently used during the provision of basic conservation (96, 95%) and simple extractions (89, 89%). The dental treatment provided by paediatric trainees and SPD with the aid of conscious sedation is illustrated in Figure 2. Of the respondents that perform or performed sedation as a trainee, the vast majority (99%) used NOIS. Figure 3 shows types of sedation used by trainees and SPD.

In the preceding year, 84 (78%) respondents had undergone basic life support training, 72 (67%) had received paediatric life support training, 27 (25%) had been given immediate life support training, 16 (15%) were trained in advanced life support, 1 (1%) had received training on other courses and significantly, 3 (3%) had not received any life support training.

The types of patient treated with sedation are shown in Figure 4. The patients

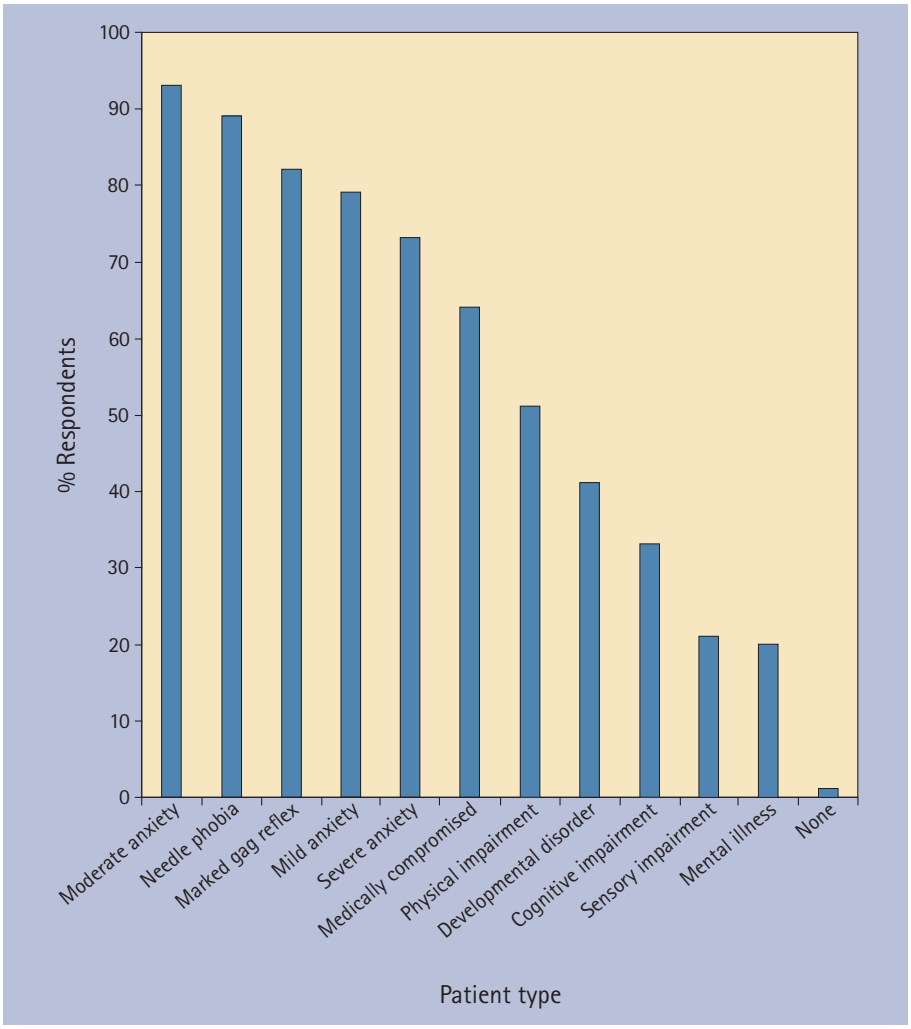

Fig. 4 Types of patient treated under sedation

Table 1 Forms of sedation that specialists in paediatric dentistry feel should be available to children in the primary care and hospital settings

Form of sedation	Percentage of specialists in paediatric dentistry			
	Primary care setting		Hospital setting	
	Children under 12	Children age 12 and over	Children under 12	Children age 12 and over
Inhalation with nitrous oxide	100	100	93	93
Oral midazolam	31	45	57	63
Intravenous midazolam	6	54	26	73
Intranasal midazolam	20	25	38	43
Intravenous propofol	7	17	22	48
Inhalation with sevoflurane	4	7	18	23
Rectal midazolam	2	1	11	9
Rectal diazepam	3	2	11	10
Continuous infusion	1	3	5	11
Multiple intravenous drugs	2	2	8	11
Ketamine	2	2	5	7
Multiple inhalation drugs	1	1	8	9
Fentanyl	1	1	5	5
None	0	0	0	0

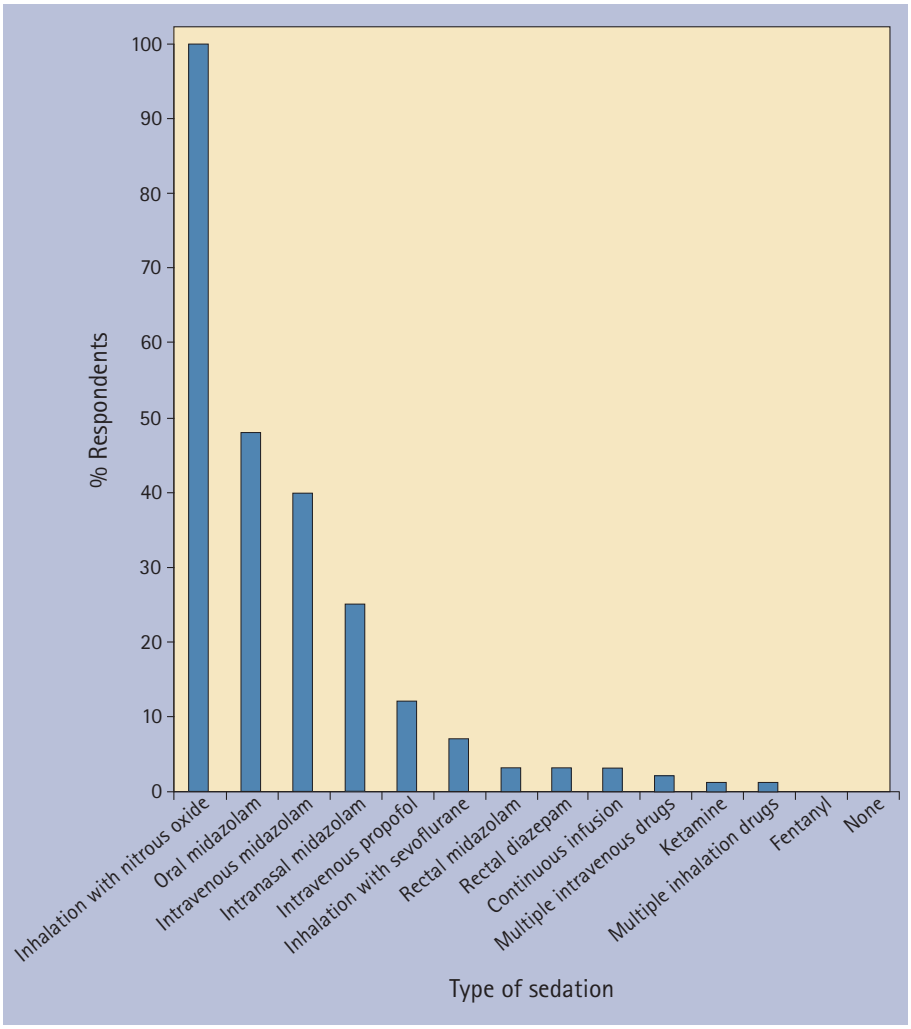

Fig. 5 Sedation methods in which SPD feel that trainees should be proficient

most frequently managed using conscious sedation by SPD are those with moderate dental anxiety (93%), followed by those suffering from needle phobia (89%) and those with a marked gag reflex (82%). Table 1 shows the views of SPD on the types of sedation that should be available to children above and below the age of twelve years from appropriately trained staff in primary care and hospital settings. All respondents felt that NOIS should be available to children within primary care, and 93% felt it should be available within a hospital setting. Advanced techniques were felt to be more appropriate for children over the age of twelve and/or in hospital settings, although midazolam was felt appropriate in children under 12 years in a practice setting by a significant minority of respondents.

Sedation training needs

Most respondents (99%) felt that all paediatric trainees should receive sedation training; only one respondent felt that an anaesthetist should provide sedation for paediatric dental treatment in a hospital setting. Figure 5 illustrates the sedation types in which respondents felt a paediatric trainee should be proficient. Respondents universally felt that trainees should be proficient in NOIS, 48% felt that trainees should be proficient in oral midazolam, 39% felt that trainees should be proficient in IV midazolam and 25% felt that trainees should be proficient in intranasal midazolam.

The majority of SPD (78%) felt that sedation training for trainees should be in the form of a SpR 'core course', or as a clinical attachment (51%). The other types of training that SPD felt would be appropriate included a SAAD course (19%), MSc (15%), diploma (14%) and theory only (0.9%). There was a wide variation in the number of clinical sessions that respondents felt a core course in sedation should comprise, with suggestions ranging from 6 to 50 sessions.

DISCUSSION

This national survey investigated the sedation training of specialists in paediatric dentistry, identified using the GDC specialist list, and their use of conscious sedation during and following specialisation.

The response rate of 60% provided an adequate sample size. Reasons for non-response could be a lack of interest, perceived poor questionnaire design (although only two negative comments were received), or inadequate training and practice of conscious sedation. To increase the response rate the questionnaire was designed to conform to previous recommendations:[14] the questions were of a 'closed' design, with tick boxes to facilitate both completion and analysis; and questions were short, specific and appropriately grouped. The questionnaire was also piloted.

Just over half (55%) of respondents received conscious sedation training as an undergraduate. Of these, the majority had received inhalation and intravenous theory and practical training. *The first five years* states that undergraduate dental students should 'have knowledge of inhalational and intravenous conscious sedation techniques' and 'have knowledge of conscious sedation techniques in clinical practice'.[15] Most respondents had graduated prior to 1995, before the guidance recommending undergraduate training in this subject.

The current national guideline states that 'Specialist paediatric dentists are expected to have acquired the necessary skills and competency for nitrous oxide inhalation conscious sedation, but such individuals are still obliged to update themselves regularly and to adhere to national and regional policy and procedure.'[6] It is therefore encouraging that three quarters of respondents received sedation training during specialisation. Most who had not received sedation training during specialisation gained the necessary knowledge and skills from other sources; usually (79%) this was teaching from an experienced colleague, but others were self-taught or trained during Section 63, MSc, SAAD or Diploma courses. Fourteen respondents had received no sedation training and of these, eight were interested

in being trained. More than half (57%) of the respondents teach conscious sedation at undergraduate or postgraduate level; this suggests that SPD are keeping up with their continuous professional development in conscious sedation techniques.

Eighty-five percent of respondents received sedation training during their first year of specialisation. Others had their training spread throughout their period of specialisation. Both of these options may be appropriate: early introduction ensures that the clinician has these skills when anxious and challenging patients are encountered; in contrast delaying the introduction of sedation training gives trainees the opportunity to develop specialist skills in paediatric dentistry prior to introducing sedation.[13] In practice it is likely that the trainees' previous experience and the programme individual units will influence when sedation training is introduced. Overall 57 (62%) respondents used sedation weekly during their training while 36 (40%) had designated sedation sessions. Early and regular introduction to sedation is advantageous as it enables the trainee to achieve competency more quickly, allowing unsupervised use of the technique at an earlier stage. Part-time training and academic commitments may also influence training programmes and the questionnaire did not identify to what extent these and other factors may have affected the provision of sedation.

Almost all respondents (93, 94%) acted as operator and sedationist as trainees. Many had a dental nurse with sedation training as their second appropriate person; others had a dentist with sedation training or an anaesthetist. A few were assisted by a dental nurse or dentist without sedation training, which could indicate that their assistant was undergoing training. Yearly basic life support training is mandatory for all health professionals and in dentistry these requirements are set by the General Dental Council,[16] yet 3% of respondents had not been trained in the past year, which is a cause for concern.

The most common reason for referral to specialists in paediatric dentistry is for the management of dental anxiety.[17] This study found that the majority of specialists offered sedation for the mildly, moderately and severely anxious, as well as for needle phobia and marked gag reflexes. Most respondents (94, 83%) provide or intend to provide treatment under sedation post-specialist qualification. Most respondents offer a wide range of dental treatment under sedation. In a previous study on the use of NOIS for anxious patients, dental extraction was the treatment most frequently undertaken by paediatric dentists with the aid of sedation in a hospital setting.[18] In the present study, while treatment with NOIS was generally offered (98, 80%), other forms of sedation were available, with 22 clinicians (18%) offering intravenous or oral midazolam and smaller numbers providing treatment with intranasal midazolam, multiple intravenous drugs, fentanyl, and inhalation with sevoflurane and ketamine.

As NOIS is defined as a standard technique for the provision of paediatric sedation within the United Kingdom,[4] it is reassuring to find that it was by far the most common form of sedation to be offered by the specialists in this study. Indeed, all respondents felt that children of all ages should be offered NOIS by dentists with appropriate training in a primary care setting. NOIS is non-invasive, has a quick onset and is administered by titration so that the sedation level is easily altered or discontinued. It is rapidly absorbed and eliminated and the patient has a rapid and complete recovery within five minutes. There are very few disadvantages and no absolute contraindications.[10,19] Despite this, NOIS is poorly utilised within general practice.[20] Anxiety is the main reason for treatment with sedation and given its prevalence in the general population, it might be more appropriate for non-specialists to provide this care, with specialists seeing the more difficult or challenging dental and medical cases and utilising advanced techniques. Fewer respondents felt that NOIS should be available in a hospital setting than in a primary care setting, which may reflect this attitude.

The UK National Guidelines in Paediatric Dentistry recommend that sedation techniques other than inhalation with nitrous oxide/oxygen should only be used in a hospital setting in the presence of a qualified anaesthetist,[6] but there is a growing body of research involving the use of midazolam.[12] With regard to intravenous sedation, the paediatric sedation guidelines state that 'single agent sedation with midazolam is only recommended for intravenous dental sedation in patients over 16 years of age.'[21] Children as young as 11 have been successfully treated with intravenous midazolam.[22] Randomised control trials have examined the use of intravenous midazolam as an alternative or adjunct to other sedative agents[23-25] and have found it to be a safe and effective alternative to general anaesthetic for surgical orthodontic extractions.[26] While there is insufficient scientific evidence to support the routine use of intravenous sedation for dentistry in children under the age of 16 years, it can be a useful technique in the hands of skilled operators in specialist units.[4] When appropriately used, sedation with oral midazolam can be an effective means of facilitating dental care for young children.[27] For example, intranasal midazolam is easy to administer, has a rapid onset and is safe and effective.[28] Despite these advances in paediatric sedation techniques, most respondents in this study were following current guidelines. It is interesting to note that although sedationists are treating adults and children with advanced techniques, there is currently only limited support for them amongst paediatric specialists. Further evidence and clearer guidance taking into account developments in sedation practice are therefore needed, and it is timely that NICE are developing such evidence-based guidance.

All but one respondent thought paediatric trainees should receive training in conscious sedation. Sedation training in combination with appropriate behaviour management skills can greatly reduce the need for general anaesthetic, reducing the associated risks.[16] Most of the respondents felt that they should receive training in inhalation with nitrous oxide, oral midazolam, intravenous midazolam and intranasal midazolam, and that training should be in the form of a SpR 'core course', a clinical attachment or SAAD course. The

respondents gave a varied response on how many clinical sessions they felt a 'core course' should comprise for trainees to become competent at sedation. The Dental Sedation Teachers Group recommend a clinical experience of ten cases of inhalation sedation and 20 cases of intravenous sedation for a sedationist to be competent.[29]

CONCLUSIONS

- Inhalation sedation with nitrous oxide was the most popular form of sedation amongst specialists in paediatric dentistry
- Many respondents felt that other forms of sedation should be available to children, both in a primary care and hospital setting
- Additional research needs to be carried out to identify barriers to using alternatives to NOIS among paediatric specialists
- Although a number of specialists in paediatric dentistry had not received sedation training as part of specialisation, these individuals had generally received training from other sources
- Paediatric trainees should receive sedation training in order to be able to provide comprehensive dental care for their patients.

The authors would like to extend their thanks to Mr Paul Wilson for generously providing the questionnaire used with restorative specialist registrars, initial feedback from which was used to develop the survey in this report.

1. Nuttall N M, Gilbert A, Morris J. Children's dental anxiety in the United Kingdom in 2003. *J Dent* 2008; **36:** 857-860.
2. Klingberg G, Broberg A G. Dental fear/anxiety and dental behavioural management problems in children and adolescents: a review of prevalence and concomitant psychological factors. *Int J Paediatr Dent* 2007; **17:** 391-406.
3. Standing Dental Advisory Committee. *Conscious sedation in the provision of dental care: report of an expert group on sedation for dentistry.* London: Department of Health, 2003.
4. Standing Committee on Sedation for Dentistry. *Standards for conscious sedation in dentistry: alternative techniques.* London: Royal College of Surgeons of England, 2007.
5. Scottish Dental Clinical Effectiveness Programme. *Conscious sedation in dentistry – dental clinical guidance.* Dundee: Scottish Dental Clinical Effectiveness Programme, 2006.
6. Hosey M T. UK National Clinical Guidelines in Paediatric Dentistry. Managing anxious children: the use of conscious sedation in paediatric dentistry. *Int J Paediatr Dent* 2002; **12:** 359-372.
7. Blain K M, Hill F J. The use of inhalation sedation and local anaesthesia as an alternative to general anaesthesia for dental extractions in children. *Br Dent J* 1998; **184:** 608-611.
8. Bryan R A. The success of inhalation sedation for comprehensive dental care within the community dental service. *Int J Paediatr Dent* 2002; **12:** 410-414.
9. Nathan J E, Venham L L, West M S, Werboff J. The effects of nitrous oxide on anxious young pediatric patients across sequential visits: a double-blind study. *ASDC J Dent Child* 1988; **55:** 220-230.
10. Holroyd I, Roberts G J. Inhalational sedation with nitrous oxide: a review. *Dent Update* 2000; **27:** 141-146.
11. Holroyd I. Conscious sedation in pediatric dentistry. A short review of the current UK guidelines and the technique of inhalational sedation with nitrous oxide. *Paediatr Anaesth* 2008; **18:** 13-17.
12. Matharu L M, Ashley P F. Sedation of anxious children undergoing dental treatment. *Cochrane Database Syst Rev* 2005; **(2):** CD003877.
13. Wilson P H, Boyle C A, Smith B J. Conscious sedation training received by specialist registrars in restorative dentistry in the UK: a survey. *Br Dent J* 2006; **201:** 373-377.
14. Edwards P, Roberts I, Clarke M. Increasing response rates to postal questionnaires: a systematic review. *BMJ* 2002; **324:** 1183-1185.
15. General Dental Council. *The first five years: a framework for undergraduate dental education.* London: General Dental Council, 2002.
16. General Dental Council. *Maintaining standards. Guidance to dentists on professional and personal conduct.* London: General Dental Council, 1998.
17. Hosey M T, Makin A, Jones R M, Gilchrist F, Carruthers M. Propofol intravenous conscious sedation for anxious children in a specialist paediatric dentistry unit. *Int J Paediatr Dent* 2004; **14:** 2-8.
18. Foley J. A prospective study of the use of nitrous oxide inhalation sedation for dental treatment in anxious children. *Eur J Paediatr Dent* 2005; **6:** 121-128.
19. Paterson S A, Tahmassebi J F. Paediatric dentistry in the new millennium: 3. Use of inhalation sedation in paediatric dentistry. *Dent Update* 2003; **30:** 350-358.
20. Chadwick B L, Thompson S, Treasure E T. Sedation in Wales: a questionnaire. *Br Dent J* 2006; **201:** 453-456.
21. Scottish Intercollegiate Guidelines Network. *Safe sedation of children undergoing diagnostic and therapeutic procedures.* Edinburgh: SIGN, 2004.
22. Robb N D, Hosey M T, Leitch J A. Intravenous conscious sedation in patients under 16 years of age. Fact or fiction? *Br Dent J* 2003; **194:** 469-471.
23. Averley P A, Girdler N M, Bond S, Steen N, Steele J. A randomised controlled trial of paediatric conscious sedation for dental treatment using intravenous midazolam combined with inhaled nitrous oxide or nitrous oxide/sevoflurane. *Anaesthesia* 2004; **59:** 844-852.
24. Mikhael M S, Wray S, Robb N D. Intravenous conscious sedation in children for outpatient dentistry. *Br Dent J* 2007; **203:** 323-331.
25. Wilson K E, Girdler N M, Welbury R R. Randomized, controlled, cross-over clinical trial comparing intravenous midazolam sedation with nitrous oxide sedation in children undergoing dental extractions. *Br J Anaesth* 2003; **91:** 850-856.
26. Dorman M L, Wilson K, Stone K, Stassen L F A. Is intravenous conscious sedation for surgical orthodontics in children a viable alternative to general anaesthesia? - a case review. *Br Dent J* 2007; **202:** E30.
27. Day P F, Power A M, Hibbert S A, Paterson S A. Effectiveness of oral midazolam for paediatric dental care: a retrospective study in two specialist centres. *Eur Arch Paediatr Dent* 2006; **7:** 228-235.
28. Al-Rakaf H, Bello L L, Turkustani A, Adenubi J O. Intra-nasal midazolam in conscious sedation of young paediatric dental patients. *Int J Paediatr Dent* 2001; **11:** 33-40.
29. Dental Sedation Teachers Group. *Sedation in dentistry: the competent graduate.* London: Dental Sedation Teachers Group, 2000.