

## IN BRIEF

- Adds to the evidence for the use of intravenous conscious sedation (IVCS) as an alternative to general anaesthesia for children.
- IVCS in children under the age of 16 should only be provided by appropriately trained teams in a suitable setting.
- Further research is required if IVCS is to be safely applied outside the hospital and specialist clinic settings.

# Is intravenous conscious sedation for surgical orthodontics in children a viable alternative to general anaesthesia? – a case review

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**Aim** The aim of this case review was to describe the use of local anaesthesia (LA) and intravenous conscious sedation (IVCS) as a safe and effective means of managing patients requiring surgical orthodontic procedures as an alternative to general anaesthesia (GA) in children between the age of 11 and 15 years.

**Main outcome measures** 1) Whether treatment was completed, partially completed or not completed; 2) assessment of physiological parameters to verify safety profile of the technique.

**Methods** Records were reviewed retrospectively for all patients included in the series undergoing planned surgical orthodontic procedures between January 2001 and January 2004 under IVCS. All patients had been pre-assessed and deemed to be of sufficient mental and physical maturity to be treated with IVCS. Written informed consent was gained from patients and their parents/guardians with full discussion of the alternative pain and anxiety control methods available including GA. All cases were undertaken by experienced SAS grade surgeons assisted by two dental nurses holding the certificate in dental sedation nursing and their recovery was supervised by registered general nurses. Patients were clinically monitored throughout together with continuous pulse oximetry and intermittent recording of non invasive blood pressure and pulse at 10-15 minute intervals. Patients were reviewed post operatively and any complications or comments noted.

**Results** Over a three year period a total of 107 patients underwent surgical procedures to aid orthodontic treatment, 28 (26%) under IVCS and 79 (74%) under GA. Twenty-five out of 28 patients in the IVCS group successfully completed all of their planned treatment.

**Conclusions** Based on this case series, IVCS would appear to offer a safe and effective alternative to GA for this group of patients providing they are selected and managed by an appropriately trained team in a suitable setting. Further prospective evidence is needed if IVCS is to be recommended for general dental treatment in patients under the age of 16 years.

## BACKGROUND

There is a current lack of definitive guidance relating to orthodontic extractions as regards to use of general anaesthesia (GA),<sup>1-3</sup> although the British Society of Paediatric Dentistry (BSPD) are currently considering this. At present however, most centres still allow the use of GA for more difficult extractions including impacted canines and first molars if local anaesthesia (LA) or sedation is not deemed suitable.<sup>1-5</sup>

The technique chosen for patient management should be the most appropriate and *least interventional* means of anxiety relief for the *individual* patient.<sup>4,6</sup> In general this should be the simplest suitable technique, and LA with conscious sedation used where it is considered more clinically appropriate. Over recent years there has been a general shift away from GA for the management of third molars and it seems logical in appropriate circumstances to apply this to surgical orthodontics, a similarly unpleasant procedure.

Current guidelines limit the use of intravenous conscious sedation (IVCS) in under 16 year olds,<sup>4-6</sup> however a wide range of dentists and medically qualified sedationists provide treatment for this age group using various IVCS techniques.<sup>7-13</sup> Recent research into the use of IVCS in children has shown it to be a safe and effective technique in 12-16 year olds.<sup>7-10</sup> This is demonstrated well in the randomised controlled clinical trial carried out by Wilson *et al.*<sup>8</sup> who compared the use of IVCS with midazolam against inhalational sedation for orthodontic extractions in 12-16 year olds. As well as demonstrating the technique's efficacy, it also highlighted the inherent amnesic effects of midazolam which is obviously a bonus for this particular group of patients. Current sedation guidelines<sup>4,14</sup> limit

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IVCS in under 16 year olds to a minority of cases – surgical orthodontics would seem a reasonable group to which to apply this caveat. It would also be in the child's best interests to select patients for IVCS for such procedures, rather than restrict its use to those who have failed to cope with inhalational sedation or automatically list them for a GA.

#### AIMS

To carry out a case review of patients treated using IVCS to ascertain the safety and effectiveness of the technique for undertaking surgical orthodontic procedures such as extraction or exposure of impacted maxillary canines in appropriately selected patients under the age of 16 years as an alternative to general anaesthesia (GA).

To provide further evidence to support the use of IVCS where appropriate in children, rather than the current rather arbitrary cut-off of 16 years of age particularly in those patients for whom GA would be the only alternative.

#### METHOD

The records were reviewed retrospectively for all patients included in the series undergoing planned surgical orthodontic procedures undertaken by experienced surgeons (a staff grade – MD, and an associate specialist – KS) between January 2001 and January 2004 under IVCS at Sunderland Royal and South Tyneside District General Hospitals. All patients were classed as day surgery cases and were undertaken in the respective out patient departments. The data was entered into a Microsoft Excel spread sheet for analysis. Data included: hospital number, age, sex, number of treatment visits, justification for sedation, American Society of Anesthesiologists (ASA) grade, drug used, dose, treatment undertaken, body mass index (BMI) and any comments at time of surgery or post operatively relating to cooperation and physiological parameters including any need for supplemental oxygen or significant change in blood pressure. All patients had been pre-assessed by either MD or KS and deemed to be of sufficient mental and physical maturity to be treated with IVCS. The assessment included measurement of blood pressure and pulse and, after November 2002, weight, height and assessment of BMI (the latter were introduced into the department protocol at that time). All patients were classified as ASA grade I or II (with some grade I patients being upgraded to grade II related to their young age). Written informed consent was gained from patients and their parents/guardians with full discussion of the alternative pain and anxiety control methods available including GA.

The subjects presented represent a series of patients who with their parents elected to undergo their planned treatment under IVCS due to either the degree of difficulty of the procedure, their anxiety or a combination of the two (rather than GA which would otherwise be the modality offered to this group of patients by consultant colleagues for such procedures). Ethical approval was not sought as the technique was already offered in the hospital departments and there was no randomisation of patients. Pre-operative instructions were provided verbally and in writing including the requirement for a suitable escort and taking a light meal up to two hours before their appointment time in keeping with current best practice.<sup>4</sup> EMLA topical anaesthetic cream was offered to all and applied at least one hour pre-operatively by their parents.

All cases were undertaken by MD or KS assisted by two dental nurses holding the certificate in dental sedation nursing and their recovery was supervised by registered general nurses. Patients were clinically monitored throughout together with continuous pulse oximetry and intermittent recording of non invasive blood pressure and pulse at 10-15 minute intervals. Patients were reviewed post-operatively and any complications or comments noted.

Outcome measures were twofold: firstly, whether treatment was completed, partially completed or not completed and secondly, assessment of physiological parameters to verify safety profile of the technique.

#### RESULTS

Over the three year period, a total of 107 patients underwent surgical procedures to aid orthodontic treatment. Twenty-eight patients were treated with IVCS during the study period (26%) and 79 patients under GA (74%). Data collected on individuals under IVCS is summarised in Table 1.

All patients were conscious (able to respond to verbal commands) throughout the procedure after titration to an appropriate end point, in accordance with the SDAC definition of conscious sedation.<sup>4</sup> All patients remained stable in respect of their physiological measures closely equating to baseline values.

Figure 1 illustrates the breakdown of patients on the basis of cooperation. Twenty patients were reported to have been co-operative and coped well with the planned procedure. Five patients became tearful during the procedure but all planned surgery was completed.

In three cases it was not possible to complete all the planned treatment. In one case the safe upper limit of local anaesthetic (LA) was reached after exposure of the impacted 13 and upper arch extractions. The patient subsequently attended their general dental practitioner for routine LA extraction of 35 and 45. In the second case the patient, a 13 year old girl, was too distressed on the day of surgery to allow cannulation (she was considered suitable and cognisant for IVCS at her assessment visit) and was re-listed for treatment under GA. In the final case, a 13 year old boy attending for extraction of an impacted 13 and 36, the latter was removed but the former was found to be so high that the risk of iatrogenic damage to adjacent teeth outweighed the benefits. The tooth was therefore left *in situ*. The patient coped well throughout and had no recollection of the surgery at follow up.

Figure 2 illustrates the breakdown of patients on the basis of procedure. A variety of surgical procedures were included, but all involved impacted teeth and the raising of a mucoperiosteal flap or difficult extractions. Sixteen cases involved exposure of impacted canines, 15 palatal and one buccal. Seven cases

**Table 1 Breakdown of data for IVCS group (n = 28)**

Average age	13.8 (range 11–15) years
Female to male ratio	22:6
Justification for sedation:	
To avoid GA	24
For anxiety related to surgical procedure	4
Dose range for IV midazolam	1.5–7 mg
Weight range (if recorded)	38–77 kg
BMI range (if recorded)	19–32

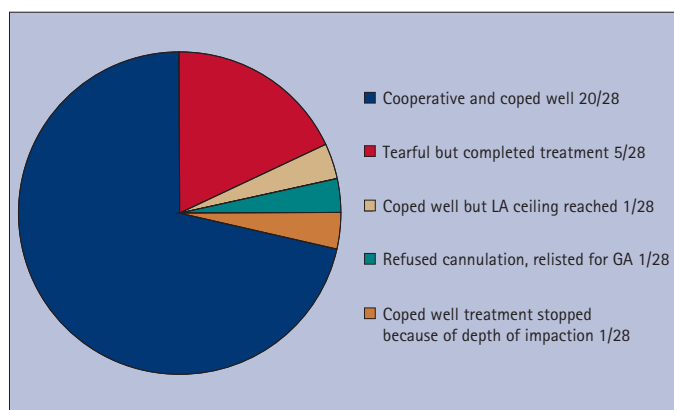


Fig. 1 Breakdown of patients on the basis of cooperation

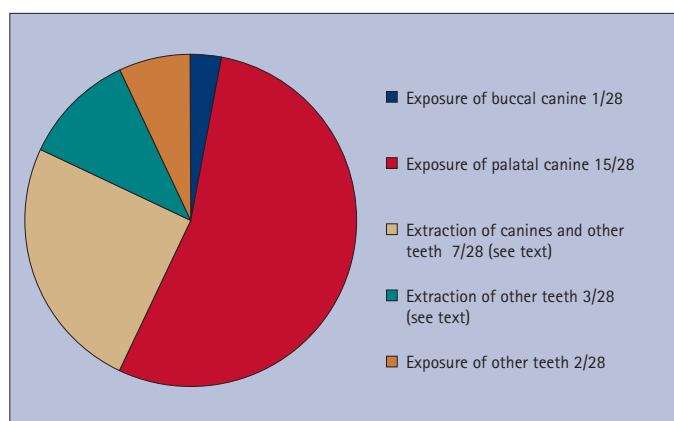


Fig. 2 Breakdown of patients on the basis of procedure

involved the surgical removal of maxillary canines and other teeth (in one case the extraction was abandoned because of the depth of impaction as described above). Three patients required extraction of other teeth; these included a mesiodons supernumerary requiring a palatal flap to gain access, surgical removal of 36 (this case was included as the patient was originally listed for exposure of 13 but the patient refused orthodontics therefore the asymptomatic tooth was left *in situ*) and extraction of palatally impacted 15 and 25.

The final cases involved exposure of other teeth; an upper central incisor obstructed by a supernumerary and a palatally impacted first premolar.

## DISCUSSION

The number of cases included in this case series was limited due to concerns raised locally in paediatric circles in relation to the setting and experience needed for the treatment. This resulted in discussions and subsequent agreement between the treating clinicians, department of paediatrics and the department of anaesthesia. The result was a modification to the standard pre-assessment and treatment monitoring sheets to include elements relating to the Climbié report<sup>14</sup> and formalisation of the departmental protocol. Twenty-five cases successfully completed all the planned treatment under IVCS. In a further two cases the sedation itself was successful but not all the planned treatment was undertaken relating to the planned surgery or number of extractions originally listed in a single visit. In all cases the surgery was undertaken by two experienced sedationists and surgeons, reflecting the nature of the surgery and in keeping with current guidance.

Pre-operatively, all remained cardio-respiratory stable; blood pressure remained within normal limits with good oxygen saturation and no requirement for the use of supplemental oxygen. This compares well with other published work.<sup>7-10</sup> There were no cases of disinhibition, often cited as a reason for not providing IVCS in under 16 year olds.<sup>15-17</sup>

No significant problems were noted by the patients or their parents at follow-up. The five patients who had become tearful at some stage during the operative procedure did not report any increase in anxiety as a result of the treatment, which may be attributed to the amnesic effect of midazolam.

All patients were asked to take a light meal up to two hours before their appointment time. No problems were encountered and the suggestion of a four to six hour starvation time by some authorities<sup>14</sup> seems unjustified. The Standing Dental Advisory Committee of the Department of Health<sup>4</sup> recommendation is rather equivocal, quoting both two hour and four to six hour starvation advice. This subject remains a point of contention, with anaesthetists often insisting on GA fasting regimes whilst the teaching in dental sedation units is two hours or no requirement to fast.

The patients included in the study were carefully and specifically selected by the two assessing and treating clinicians. Whilst from a scientific stand point the study would have more weight had randomisation been employed as advised by various authorities including the recent Cochrane review,<sup>18</sup> ethically it would be difficult to justify placing patients in the GA group unnecessarily, or equally allocating those patients who did not seem able to cope with IVCS to the IVCS group.

As a result of the case series it was decided to implement a lower age limit for treating patients, which was set at 12. This was in relation to resuscitation equipment and drugs and intellectual development. This age limiting also fits with the British National Formulary (BNF) age grouping as recommended in the Cochrane review<sup>18</sup> (0-6, 6-12 and 12-16 years of age) for future studies involving paediatric patients.

In addition, following discussion with the resuscitation officer, it was agreed that all staff with clinical contact with paediatric patients would be trained in paediatric basic life support as a minimum to supplement the immediate life support (ILS) certification already held.

The authors would suggest that while the numbers are too small to draw any firm conclusions, this case series adds to the body of evidence against the arbitrary restriction of IVCS to patients of sixteen years and over. Further research is required in the area, in keeping with the evidence-based ethos of guidelines, in particular those produced by SIGN.<sup>17</sup>

## CONCLUSIONS

IVCS offers a valuable addition to the management armamentarium for surgical orthodontics in 12-15 year olds and was effective for pain and anxiety control in 27 out of 28 cases, with 25 cases completing all the planned treatment. Patients must be assessed for suitability and treatment provided by well-motivated, appropriately trained teams. General anaesthesia will always have its place, but based on clinical efficacy, cost and best use of theatre time, IVCS may be an appropriate option for a significant number of patients. Further research is needed in this age group to allow advice given in guidelines to be based on evidence as well as expert opinion.

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