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Management of postoperative pain in children following extractions of primary teeth under general anaesthesia: a comparison of paracetamol, Voltarol and no analgesia

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Objective. The aim of this study was to compare three different pain relief regimes and the respective levels of pain recorded by children undergoing extractions of primary teeth under general anaesthesia.

Methods. This was a tri-sited study carried out in three similar hospital settings, each with a different pain relief protocol. The subjects were 70 children from each site who were aged between 3 and 12 years, and were undergoing routine extractions of primary teeth. All children from the three centres used a self-report visual analogue scale to record pain preoperatively and postoperatively (15 min after recovery), and relevant pain-relief medication was noted. The efficacy of the three different pain relief regimes was then compared.

Results. Children reported significantly less pain when rectal Voltarol was provided prior to the extractions, as compared to paracetamol or no analgesia. The greatest amount of pain was reported by the group who had received no analgesia.

Conclusions. Voltarol appears to be the better preemptive analgesic for dental extractions under general anaesthesia when compared with paracetamol and no analgesia.

Introduction

The International Association for the Study of Pain has defined pain as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage'.

Factors other than tissue damage that have been suggested to affect or have involvement in the experience of pain include emotion, previous painful experiences, pre-existing dental pain, anxiety, gender and age[1,2]. Pain is also very subjective, and it is a private, internal event. Because of all these factors, pain cannot be directly observed by another individual with any accuracy[3]. Numerous studies have shown gross discrepancies between observational measurements of pain and self-report[4,5], and therefore, self-report visual analogue scales are recommended for recording pain in children.

General anaesthesia is used widely within paediatric dentistry in order to carry out procedures on young, anxious, special needs or medically compromised children. Primary dental extractions have been, and still are, carried out without any pain relief medication in the belief that children do not experience significant amounts of pain[6,7]. This is not the case, and numerous studies have shown that pain is one, if not the most significant, morbidity associated with such extractions[8–11]. These painful episodes could potentially lead to further dental anxiety and hinder the child's dental treatment in the future. Therefore, when carrying out dental extractions under general anaesthesia, it is important to ensure that appropriate pain relief medication is provided. There has been a great deal of interest in the provision of local anaesthesia during dental extractions[12–14], but there is limited literature regarding the efficacy of analgesia medication preoperatively or intraoperatively in extractions of primary teeth, and as to which analgesic is the most effective.

Paracetamol is a centrally acting analgesic that has little, if any, anti-inflammatory properties. It is rapidly absorbed from the gastrointestinal tract and peak plasma levels are reached within 30 min of ingestion[15]. It undergoes significant

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first-pass metabolism in the intestine and liver, with only 60% reaching the central compartment in its active form. Side effects are minimal if recommended doses are followed (15–20 mg kg^{-1}, with a maximum dose of 60 mg kg^{-1}), but hepatotoxicity can occur in children with liver damage[16]. Voltarol is a non-steroidal anti-inflammatory analgesic that undergoes little first-pass metabolism, and onset of action is 20–24 min[15]. The recommended dose for children is 1–2 mg kg^{-1} daily or 75–150 mg daily in divided doses[17]. Side effects include gastrointestinal irritation, inhibition of platelet aggregation, renal irritation and bronchospasm. The greater number of side effects limits its use in children with lung disease, severe active bleeding, renal and liver insufficiency, a history of allergy to any other non-steroidal anti-inflammatory drugs, and intestinal disorders.

The aim of this study was to investigate whether there is any difference in the levels of pain reported following dental extractions of primary teeth under general anaesthesia by patients who received preoperative paracetamol, intraoperative Voltarol or no analgesia.

Subjects and methods

The subjects consisted of 210 children in total, with 70 from each of the three hospital centres providing extractions under general anaesthesia. Collection of data was over a period of 1.5 years. Each hospital provided the following analgesia regime:

Box 1. Analgesia regime.

- Hospital A provided preoperative oral paracetamol at a dose of 20 mg kg^{-1} 30 min before the procedure.
- Hospital B provided 25 mg of rectal Voltarol after induction, just prior (1–2 min) to the extractions. Any child under 12 kg was provided with half this dose.
- Hospital C provided no pain relief.

Ethics approval was sought and obtained from the relevant ethics committees and written consent was obtained from the parents of the children involved.

The inclusion criteria are given in Box 2:

A pilot study of visual analogue pain scales was carried out on 20 children to determine which scale was the easiest and most preferred to use. The Wong and Baker Pain Scale (WBPS) (Fig. 1), the Barts and the London Paediatric Pain Ladder and a colour intensity ladder[18] were all shown to the 20 children, and they were asked to comment on ease of use and preference. The WBPS was chosen by the majority of children (85%) as being the easiest scale to use when describing pain.

Box 2. Inclusion criteria.

- fit and healthy children, i.e. American Society of Anesthesiologists (ASA) classification ASA I or II;
- a good understanding of the English language; and
- subjects aged 3–12 years who were undergoing primary extractions.

The exclusion criteria were:

- learning disabilities which would affect the child's understanding;
- patients with a poor understanding of English language;
- surgical and permanent tooth extractions;
- children complaining of pain on the day of the general anaesthetic before the extractions were carried out; and
- children who have taken analgesia self-medication on the day of the anaesthetic.

All children attending for extractions under general anaesthesia were invited to participate in this study and no parent refused.

Prior to the general anaesthetic, the child and parent were provided with verbal and written information regarding the study. During the preoperative period, all children were asked to choose from the WBPS which face best described the pain – if any – that they might have been feeling. This was carried out by the dental nurse or dentist reading the following set of instructions accompanying the WBPS:

> 'Explain to the person that each face is for a person who feels happy because he has no pain (hurt) or sad because he has some or a lot of pain. *Face 0* is very happy because he doesn't hurt at all. *Face 1* hurts just a little bit. *Face 2* hurts a little more. *Face 3* hurts even more. *Face 4* hurts a whole lot. *Face 5* hurts as much as you can imagine, although you don't have to be crying to feel this bad. Ask the person to choose the face that best describes how he is feeling.'

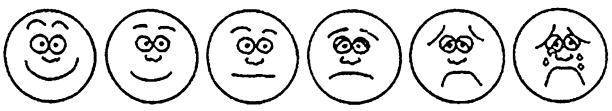

Fig. 1. Wong and Baker Pain Scale.

Children complaining of pain at this stage were eliminated from the study because of the possible influence of preoperative pain on the postoperative score. The number of teeth extracted, age/date of birth, any current medication, and the dose and drug of analgesia were recorded. All children from each site were provided with the previously stated analgesia regime. The dental surgeons at each site did not change during this study, and all were specialists in paediatric dentistry with similar levels of expertise. The type of general anaesthetic was constant within the three sites (sevofluorane/nitrous oxide open mask or laryngeal mask, with occasional intravenous propofol induction). All general anaesthetics lasted no longer than 10 min. When in recovery, 10–15 min post-anaesthetic recovery, the child was asked to choose from the WBPS the face that best described the pain (if any) that they were experiencing. This was carried out by the recovery nurse or the dentist, and once again, the standard wording provided on the scale was used. The 10–15-min delay was chosen so that the child would be recovered enough to use the scale, and so that any analgesic drug used would be active. The pain score indicated by the patient was then recorded.

Results

In total, 11 children were eliminated from the study because they had pain on the day or had taken pain relief medication on the day. Further equivalent numbers were gathered from the next general anaesthetic list to make the total for each centre 70 children.

Figure 2 shows the number of children scoring each pain rating from the three sites. For statistical analysis, however, the pain scores from each hospital were divided into two groups:

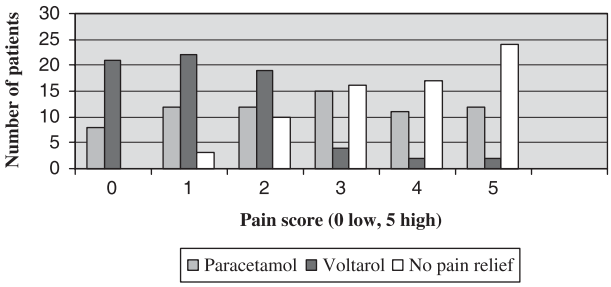

Fig. 2. Pain scores of the subjects on the three different pain regimes.

(A) patients were divided into those with no pain (pain score = 0) and some to high pain (pain score = 1–5), i.e. any pain at all; and
(B) patients were divided into those with no to moderate pain (pain score = 0, 1 or 2) and moderate to high pain (pain score = 3, 4 or 5).

Table 1 shows the distribution of male and female subjects within this study; there were very similar numbers of each sex, and no significant differences between the pain scores and sexes for any of the three groups. Children were not divided into age groups because of a lack of numbers of the very young, but the main age group of patients treated was between 5 and 8 years: the paracetamol group had 63 of 70 in this age group (90%), the Voltarol group had 55 of 70 (79%) and the no analgesia group had 61 of 70 (87%).

In the paracetamol group, eight of 70 (11·4%) scored no pain, and 62 (88.6%) scored mild to high pain. Thirty-two of 70 (45.7%) scored no pain to moderate pain and 38 (54.3%) scored moderate to high pain.

Twenty-one of 70 (30%) scored no pain and 49 (70%) scored mild to high pain in the Voltarol group. Sixty-two of 70 (88.6%) scored no to moderate pain and eight (11.4%) scored moderate to high pain.

In the no analgesia group, none of 70 (0%) scored no pain and 70 (100%) scored mild to

Table 1. Distribution of male and female patients from the three hospitals.

Hospital	Pain relief	Sex	
		Male	Female
A	Paracetamol	34	36
B	Voltarol	38	32
C	No pain relief	35	35
Total	–	107	103

Comparisons of pain protocols	χ^2 test	*P*-value
Voltarol (PR) versus paracetamol (oral)	7.4	< 0.01
Voltarol (PR) versus no pain relief	24.7	< 0.001
Paracetamol (oral) versus no pain relief	8.5	< 0.01

Table 2. Chi-square (χ^2) test results for all three pain relief protocols, and the no pain and low to high pain categories: (PR) rectal administration.

Comparisons of pain protocols	χ^2 test	*P*-value
Voltarol (PR) versus paracetamol (oral)	29.1	< 0.001
Voltarol (PR) versus no pain relief	68.9	< 0.001
Paracetamol (oral) versus no pain relief	11.8	< 0.001

Table 3. Chi-square (χ^2) test results for all three pain relief protocols, and the no to moderate pain and moderate to high pain categories: (PR) rectal administration.

high pain. Thirteen of 70 (18.6%) scored no to moderate pain and 57 (81.4%) scored moderate to high pain.

When the results were compared between the three hospitals and analysed using the chi-square test, Voltarol significantly reduced pain scores more than paracetamol or no analgesia, and paracetamol significantly reduced pain scores more than no analgesia (see Tables 2 & 3).

Discussion

The recording of pain is difficult, especially in children, and the accuracy of recording pain can be challenged because of the subjective and personal nature of pain. Numerous pain recording devices exist, including biological measurements, behavioural observation and self-report[19,20]. Self-report is considered to be the most accurate method of recording pain, since the experience is a private event, and is different for all individuals[3]. Visual analogue scales are the easiest for children to use and have been shown to be employed successfully when testing for the effects of analgesia[21]. Many visual analogue pain scales exist, but the chosen scale was deemed the most appropriate because of the results of the pilot study, its success when used with children as young as 3 years old, its extensive use within the literature and its accuracy when measuring pain in children[22–24].

It is recognized that certain limitations within this study could have affected the results. Ideally, all operators and anaesthetists would have been constant between the three hospitals, but for ethical reasons (as a result of the deliberate withholding of analgesia for a procedure that causes pain), it was not possible to carry out this study as a randomized controlled trial in one hospital. The hospital in this study that used no analgesia was using a pre-existing protocol that is now due for reassessment. It is recognized that such a randomised controlled trial would have produced a stronger conclusion, but the large numbers of children in this study, and the similarity between the hospitals, operators and anaesthetics help to validate these results. Other factors, such as parental influence, the psychological effect of giving a child paracetamol and hence a possible anticipation of pain, and different recovery staff techniques may have influenced the results, but these types of factors would also be present if only one hospital but different pain regimes had been tested.

Age, sex and race have also been reported to influence reports of pain. The children in this study were not split into age groups because of the lack of data in the younger age groups. This group of patients varied in age, which could have affected their ability to use the visual analogue scale, but the majority of patients from all groups were between 5 and 8 years old (85%). The WBPS has also been tested extensively and been shown to be accurate when measuring pain in children as young as 3 years old[22]. An interesting finding from this study was that there was no difference in the levels of pain reported between the male and female patients. This is consistent with the findings of a similar study[5], but contradicts findings in studies carried out with adults[2]. Children are less developed socially, and males and females may be more similar at a younger age with regard to pain reporting because of the absence of social conditioning. Differences in oral pain experience in varying ethnic groups have been reported previously, but only in adults[25]. Numerous studies exist

comparing race and pain experience in children, and all state that there is no difference between ethnic groups.

Voltarol has excellent analgesic and anti-inflammatory properties, which are especially important following dental extractions because of the acute neurogenic nature of the tissue injury[26]. By being administered rectally, first-pass metabolism is avoided and the child is unaware of its administration since it is placed when unconsciousness has been induced. Irritation to the gastric mucosa is also avoided by this method of administration, and parents can provide postoperative paracetamol at home at recommended doses without worrying about overdosing. In this study, the majority of patients (68 of 70) received a bolus dose of 25 mg of Voltarol because the children did not widely vary in weights. Therefore, it is possible that the children who weighed less than the others could have experienced more pain relief, and this may have affected the results.

The results from the no analgesia group reinforce that it is unacceptable to carry out pain-inducing procedures without providing pain relief medication. This is particularly important with regard to children, whose experiences will shape their lives and possible phobias/behaviour in future. If extractions can be carried out so that children are pain-free in the post-operative period, then the psychological association of dentistry and pain may be avoided.

What this paper adds

- All children receiving no analgesia experience some level of pain following extractions of primary teeth under general anaesthesia.
- Children receiving Voltarol experienced significantly less pain than those receiving preoperative oral paracetamol or no analgesia.
- There is no difference between the levels of pain reported by male and female children.

Why this paper is important to paediatric dentists

- Children undergoing routine extractions under general anaesthesia must be provided with preoperative analgesia for a relatively pain-free recovery, which is important professionally, physically and psychologically.
- It is the responsibility of the dental surgeon and anaesthetist involved in the general anaesthetic to provide suitable pain relief preoperatively, preferably rectal Voltarol.

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