Computer-assisted intraosseous anaesthesia for molar and incisor hypomineralisation teeth

A preliminary study

C. CABASSE¹, A. MARIE-COUSIN¹, ², A. HUET¹, J.L. SIXOU¹, ²

Abstract

Anesthetizing MIH (Molar and Incisor Hypomineralisation) teeth is one of the major challenges in pediatric dentistry. Computer-assisted IO injection (CAIO) of 4% articaine with 1:200,000 epinephrine (Alphacaine, Septodont™) has been shown to be an efficient way to anesthetize teeth in children. The aim of this study was to assess the efficacy of this method with MIH teeth. This preliminary study was performed using the Quick Sleeper™ system (Dental Hi Tec™, Cholet, France) that allows computer-controlled rotation of the needle to penetrate the bone and computer-controlled injection of the anaesthetic solution. Patients (39) of the department of Paediatric Dentistry were included allowing 46 sessions (including 32 mandibular first permanent molars) to be assessed. CAIO showed efficacy in 93.5% (43/46) of cases. Failures (3) were due to impossibility to reach the spongy bone (1) and to achieve anaesthesia (2). This prospective study confirms that CAIO anaesthesia is a promising method to anesthetize teeth with MIH that could therefore be routinely used by trained practitioners.

Introduction

Molar and Incisor Hypomineralisation (MIH) has been defined as "a hypomineralisation of systemic origin of one to four permanent first molars frequently associated with affected incisors" [1]. Its aetiology remains not completely defined [2] and its prevalence varies from
2.4 to 40.2% according to the studies performed [3]. Three different impairment stages are described: mild, moderate and severe [4]. Children and adolescents with MIH teeth often report shooting pain, even during meals and brushing, leading to impairment of quality of life, poor oral hygiene, difficulties in dental anaesthesia, difficulties in restorative treatments, tooth loss and in many cases dental fear [4-7].

Dental anaesthesia of MIH teeth remains a challenge in paediatric dentistry [4, 5, 8, 9]. Usual local anaesthesia techniques may be unsuccessful or need adjuncts [8]. Computer-assisted intraosseous injection (CAIO) has been shown to be an efficient, well accepted by patients, way to anesthetize teeth in children [10, 11] and might therefore be of interest in case of painful MIH teeth. This technique is routinely used in the Department of Paediatric Dentistry of the Dental Center of the University Hospital of Rennes.

The aim of this preliminary retrospective study was to evaluate in a prospective way the efficacy of CAIO in consecutive children and adolescents presenting MIH lesions on first permanent molars by analysing their records.

Materials and methods

Population

Records from children and adolescents attending the Department of Paediatric Dentistry at Rennes University Dental Hospital (Brittany, France) were analyzed in this study. Patients were free of general pathologies and were treated for MIH lesions from moderate to severe stages. All patient had a modified Venham score [12] not exceeding 3, showing good to moderate compliance. Treatments included restorations, stainless steel crowns or endodontic treatments. All CAIO injections were performed by teachers and all treatments were performed by students.

Materials

The Quick Sleeper™ system (Dental Hi Tec™, Cholet, France) was used for this study. This device allows computer-controlled rotation of the needle to penetrate the bone and computer-controlled injection of the anesthetic solution [10].

First, the mucosa was anesthetized by inserting the needle in the mesial septum adjacent to the tooth to be anesthetized (Figure 1). In a second step the needle was inserted to reach the bone and then rotated (if needed) until it penetrated the cancellous bone (Figure 2). Anesthetic solution was then injected: 4% articaine with 1:200,000 epinephrine (Alpha-
caine, Septodont™). Two-thirds of a cartridge (1.2 mL) were initially injected. More anesthetic solution was injected if sensitivity persisted or later if the patient reported sensitivity or pain during the treatment.

Results

A total of 39 consecutive children and adolescents (11 girls and 28 boys, mean age 9.2 ± 2 years) were included in this study allowing 46 sessions to be performed (32 first mandibular permanent molars and 14 other teeth). In 68.8% of cases no or just a single rotation of the needle was required to reach the injection point (Table 1).

In most cases (80.4%), full anaesthesia of the teeth treated was achieved using a single cartridge or less (mean volume injected: 1.6 ± 0.6 mL, median: 1.8 mL), with no differences between first mandibular molars and other teeth.

CAIO showed efficacy in 93.5% (43/46) of cases (Table 2), with full anaesthesia of the teeth treated. In one of these cases, additional anaesthetic injection was needed after 40 minutes of treatment.

Failures (3/46; 6.5%) were due to impossibility to reach the spongy bone (1/46), or to achieve anaesthesia (2/46). When successful, the onset of anaesthesia was immediate after injection.

Discussion

MIH teeth are known to be difficult to anesthetize [4, 8]. Achieving easily full anaesthesia of these teeth allows better comfort for both patient and practitioner and better quality of treatment.

In the present study, CAIO was shown to be efficient in 93.5% of cases. This success rate is close to those previously described with CAIO in children for routine dental treatments: respectively 91.2% [10] and 97.2% [11]. Intraosseous anaesthesia performed in adults using various devices also showed similar success rates [13-17]. More than two-thirds of the teeth treated in this study were mandibular first permanent molars that generally represent a challenge for dental anaesthesia [18-22] especially in inflamed tissue [23]. Chronic inflammation related to MIH in first permanent molars may explain the difficulty in anaesthetizing these teeth and therefore points out the interest of CAIO in such cases. Anaesthesia was performed in this study using 4% articaine and epinephrine diluted 1:200,000. Articaine has been shown to be efficient in adults and children in both infiltration and intraosseous techniques [10, 11, 17, 24-26] whatever the dilution of epinephrine.

The efficacy of this molecule at the 4% concentration might play a role in the high success rate described here. In one case (2.2%), additional anaesthetic injection was required. This was not described in previous CAIO studies in children [10, 11] but noted with this

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<th>Table 1: Number of needle rotations required to penetrate the bone</th>
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<tr>
<td>No rotation</td>
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<tr>
<td>1 rotation</td>
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<tr>
<td>2 rotations</td>
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<tr>
<td>&gt; 2 rotations</td>
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<tr>
<td>Total</td>
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* n = 45: In one case out of 46, intraosseous penetration was not possible to perform

<table>
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<th>Table 2: Success rate of CAIO in MIH teeth</th>
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<tr>
<td>Success</td>
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<tr>
<td>Full anaesthesia until the end of the treatment performed</td>
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<td>Full anaesthesia/need of additional anaesthetics after 40 mn</td>
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| Failure | n | % |
| Intraosseous penetration impossible | 1 | 2.2 |
| Full anaesthesia not achieved | 2 | 4.3 |
technique in adults when oral surgery was performed [27]. Using a lower dilution of epinephrine (1:100,000 or 1:80,000) might have helped get a higher success rate or a longer duration of anaesthesia. However this concerned only 3 cases out of 45 when osseous penetration was possible.

Furthermore one must keep in mind that epi-nephrine has side effects including putative heart rate increase despite contradictory results in studies interesting CAIO [17, 28-30].

Conclusions

This preliminary study confirms that computer-assisted intraosseous anaesthesia is a promising method to anesthetize teeth with MIH that could therefore be routinely used by trained practitioners.

References

26. OZER, S., et al., A comparative evaluation of pain and anxiety levels

