Assessment of a palatal approach-anterior superior alveolar (P-ASA) nerve block with the Wand® in paediatric dental patients

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Summary. *Objectives.* The purposes of the study were to compare the reaction of children while receiving local anaesthesia for anaesthetizing maxillary incisors with a computerized device Wand®: a periodontal ligament injection (PDLi) and a palatal approach-anterior superior alveolar (P-ASA) nerve block compared with a conventional buccal infiltration (CBi), and to assess the efficacy of the anaesthesia and children's reaction after treatment.

Methods. One hundred and thirty-eight children aged 24-48 months participated in this study.

Results. More children reacted negatively during injection while receiving the CBi and positively during the injection with the Wand[®]. After treatment, significantly more children scratched the upper lip and/or the nose or complained of numbress of the region after the CBi (P = 0.000).

Conclusions. Same effectiveness was achieved with the Wand® and the CBi. Children displayed better behaviour during injection when they received local anaesthesia with the Wand® than they did when the CBi was used. They did not scratch the upper lip/nose and/or cried after treatment when they received the PDLi and the P-ASA, whereas they did when receiving a CBi.

Introduction

Administering local anaesthesia by injection is still the most common method used in dentistry. There is a constant search for ways, however, to avoid the invasive and often painful nature of the injection, and to find a more comfortable and pleasant means of producing local anaesthesia before dental procedures [1].

A computer-controlled local anaesthetic delivery (CCLAD) system with the Wand® (Milestone Scientific, Inc., Levingston, NJ, USA) has been developed as a possible solution to reduce the pain related to the local anaesthetic injection [2].

Gibson *et al.* found that a palatal injection given with the Wand® was comparable to a traditional buccal injection and was not found to produce any significant benefit over a traditional buccal injection in terms of pain of the injections [3]. Clinicians find some problems when delivering conventional infiltrative local anaesthesia to the anterior teeth of very young children, i.e., painful injection and the sensation of numbness of the upper lip after the treatment.

When a conventional buccal infiltration technique was compared with an intraligamentary injection (PDLi) with the Wand®, children displayed better behaviour when they received local anaesthesia with the Wand® rather than they did with the conventional infiltration. The same efficacy of anaesthesia was achieved with both techniques. Children did not show signs of discomfort after treatment with the Wand®, whereas they did while receiving conventional injections [4].

Another technique for anaesthetizing upper maxillary teeth was described by Friedman and Hochman [5] in adult patients, but was not compared in children with the other techniques. The palatal approach-anterior superior alveolar (P-ASA) nerve block is a new block injection technique that provides anaesthesia of the maxillary anterior teeth from a single injection without numbness of the face, lips, and muscles of facial

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Fig. 1. A view of the palatal tissue after P-ASA (palatal approachanterior superior alveolar) injection.

expression (Fig. 1) [5]. This technique allows anaesthesia of the six maxillary anterior teeth, the anterior third of the palate, and the facial gingiva from a singlesite injection. The 0.9-1.4 mL dosage recommendation for this block injection is significantly less than for a traditional supraperiosteal approach.

The purposes of the study were to compare the reaction of children while receiving local anaesthesia for anaesthetizing maxillary incisors with a computerized device (Wand®), using different techniques: a periodontal ligament injection (PDLi) and a palatal approach-anterior superior alveolar (P-ASA) nerve block compared with a conventional buccal infiltration and to assess the efficacy of the anaesthesia and children's reaction after treatment.

Materials and methods

One hundred and thirty-eight children aged 24– 48 months who were undergoing dental treatment in a paediatric dental clinic, participated in this study. They were a sample of patients who needed treatment to their anterior upper teeth. All patients were ASA I. Subjects were selected based solely on their need for treatment and meeting the age criteria. All children were sedated with hydroxyzine and nitrous oxide. All parents were informed about the treatments and treatment procedures, and an informed consent was obtained.

There were three groups: 48 children received a PDL injection (group A), 40 received a palatal approach-anterior superior alveolar (P-ASA) nerve block (group B), and 40 received a conventional supraperiosteal buccal infiltration (control group).

The data of group B were compared with the data of group A and control group, both from a previous study [4].

Each patient was randomly assigned to receive either conventional buccal infiltration or any of the above described computerized local anaesthesia. All the injections were carried out by the same experienced and skilled paediatric dentist.

An ultra-short needle (12 mm, 30 gauge) and lidocaine 2% with 1 : 100,000 epinephrine was used for all the three techniques.

Conventional technique (supraperiosteal buccal infiltration)

The mucosa at the injection site was stretched, and gently placed onto the obliquely beveled edge of the needle. The injection rate of the local anaesthetic agent was slow with an average duration of nearly 1 mL/min. The delivery of the anaesthesia to the palatal zone was performed through the already anaesthetized buccal papilla. The amount of local anaesthetic solution for each tooth was 0.9 mL (1/2 cartridge).

The technique for the PDLi with the Wand®

Two insertion sites were used: the mesio-buccal and the disto-buccal transitional line angle. Similar to the traditional intraligamentary technique, the needle was inserted in the sulcus parallel to the long axis of the tooth with the bevel facing the tooth. As the needle entered the sulcus, the foot switch was activated at the slow rate of flow and maintained at that rate throughout the entire injection. The needle was advanced to the maximum (approximately 2 mm below the crest of the bone), and 0.6 mL of anaesthetic was administered. Then the foot was removed from the control for 5 s to enable the fluid pressure to dissipate. The needle was removed slowly looking for blanching around the tooth.

The palatal approach-anterior superior alveolar (P-ASA) nerve block injection technique

The technique described by Friedman and Hochman [5] was performed, and the initial P-ASA injection site was located at a groove just lateral to the incisive papilla. The injection was performed with a 30-gauge, ultra-short needle provided by the manufacturer (Becton Dickinson and Co, Franklin Lakes, NJ, USA).

For the needle insertion phase of the injection, the needle bevel was placed against the palatal tissue, without puncturing the tissue, and a plain cotton roll was firmly pressed on the needle tip for the prepuncture phase of needle insertion. The Wand® was activated at a slow rate (by partially depressing the foot pedal) and the handpiece was rotated in an axial manner (45 degrees clockwise and 45 degrees counterclockwise) for needle insertion. The needle was slowly advanced approximately 1–2 mm.

The handpiece was then reoriented to an angle parallel to the facial aspect of the maxilla to gain entrance into the incisive canal. The needle was axially rotated 45 degrees and was slowly advanced (as described for the needle insertion phase) into the canal. The aspiration cycle was activated by tapping the foot pedal. The needle was inserted to a depth of at least 3 mm and no more than 5 mm. Approximately 1 mL of anaesthetic solution was delivered. Aspiration was activated again.

No positive aspirations (blood in the microtubing) occurred. The operator waited 5 s before slowly removing the needle from the injection site. This supposedly allowed the anaesthetic solution to dissipate within the tissue and reduced the amount of solution dripping from the site before needle withdrawal.

The treatments performed were similar in the three groups and included extractions, pulpotomy, pulpectomy, and strip crowns.

During the injection, the modified Behavioural Pain Scale suggested by Tadio *et al.* [6], was used for objective evaluation of the children. The scale comprised the following parameters: (a) facial display, (b) arm/leg movements, (c) torso movements, and (d) crying. The facial display followed Craig's [7] behavioural description of facial actions describing pain. Only two of four of Craig's most descriptive facial actions could be evident (eye brow bulge or eye squeeze), because during injection the mouth was open and the nose was covered by the nitrous oxide mask.

A trained dental assistant, who did not participate in the treatment, recorded the behavioural parameters. For intraobserver calibration she evaluated, as a pilot study, 15 patients who were not included in this study.

Upon completion of the treatment, children were observed for signs of discomfort in the anterior region, such as scratching the upper lip and/or the nose, or whining because of numbness of the nose, upper lip, or palatal tissue. Chi-square analysis was performed to compare the results. Level of significance chosen was P < 0.05.

Results

There were 21 girls and 23 boys between the ages of 2–4 years in the conventional injection group (mean age 3.9 ± 1.3 years), 16 girls and 29 boys (mean age 3.5 ± 1.0 years) in the PDLi group, and 22 girls and 18 boys (mean age 3.4 ± 1.1 years) in the P-ASA group.

More children reacted negatively concerning to crying, facial expression, and eyes squeeze while receiving the conventional supraperiosteal infiltrative injection (P = 0.03, 0.06, 0.03 respectively) than they did when receiving the PDLi and P-ASA with the Wand®.

None of the children scratched the upper lip and or the nose or complained about numbness of the upper lip after being treated by the local anaesthesia with the Wand® no matter which technique was used (PDLi or P-ASA). Most children (80% in the conventional buccal infiltration group), however, scratched the upper lip and or the nose or complained about numbness of the upper lip after treatment. This difference was statistically significant (P = 0.000).

Eighteen of 40 children complained about discomfort in the palatal area after receiving the P-ASA. This difference was significant (P = 0.04).

Four children who received PDLi with the Wand®, three who received P-ASA with the Wand®, and five patients who received local anaesthesia with the conventional injection technique, needed additional local anaesthesia because they showed signs of pain during the treatment. This difference was not significant.

No significant difference was found in any of the parameters for boys and girls.

Discussion

While receiving PDLi with the Wand®, children displayed better behaviour than during the traditional supraperiosteal buccal injection. Our findings seem to be in disagreement with previous studies: Assarch *et al.* [8] who found that the Wand®, when used as an identical alternative to traditional injection, did not appear to offer any benefit, as these authors tested the Wand® for limited use of the buccal infiltration and the inferior alveolar block. They used a controlled slow rate of flow to optimize the use of the Wand®

during their testing. Gibson *et al.* [3] found that a palatal injection given with the Wand® was comparable to a traditional buccal injection and was not found to produce any significant benefit over a traditional buccal injection.

Children did not display signs of pain while receiving a P-ASA injection with the Wand® and this is in agreement with the findings of Allen *et al.* [9].

There was no difference regarding the effectiveness of the anaesthesia when delivered with either the conventional syringe (buccal infiltration and palatal infiltration), the intraligamentary injection, and the P-ASA delivered with the Wand®, as only in a few cases children showed signs of pain needing more local anaesthesia in all the techniques. This is not in accordance with Burns *et al.* [10], who found in their study in permanent teeth in adults that using the computer-controlled local anaesthetic delivery system for the P-ASA injection, there was a rather modest-to-low success rates of predictable pulpal anaesthesia of the four maxillary incisors and the canines using the P-ASA technique.

In addition, our findings are not in accordance with Nusstein *et al.* [11] who treated adult patients and concluded that the P-ASA injection administered with the Wand® has the potential to be a painful injection. In their study, they found post-injection pain, temporary numbness/paresthesia, and incisive papilla swelling. All these findings are in disagreement with the results of our study conducted in children.

What this paper adds

• Knowledge about a new almost painless technique to anesthetize primary maxillary incisors.

Why this paper is important to paediatric dentists

- The results confirm that maxillary incisors could be anesthetized with only one insertion point and the same effectiveness as with a conventional injection could be achieved.
- After treatment, children do not scratch their upper lift of nose as they do after receiving a conventional injection.

Conclusions

 Same effectiveness of anaesthesia was achieved with the Wand and the conventional injection techniques.
Children displayed better behaviour during injection when they received local anaesthesia with the Wand® than they did when the conventional supraperiosteal buccal infiltration was used.

3 Children did not show signs of discomfort (scratching of the upper lip/nose and/or crying) after treatment when they received the PDLi and the P-ASA with the Wand®, whereas they did when receiving a conventional buccal infiltration injection.

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