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Reaction of children to dental injection with 27- or 30-gauge needles

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Aim. The purpose of this study was to assess children's reaction while receiving dental local anaesthesia with a 27- and a 30-gauge needle and to record their sensation.

Methods. Ninety-five children (43 boys and 52 girls) participated in this study. A random crossover design was used so that each child served as his or her own control, receiving each treatment on the opposite sides of the same arch (right vs. left). Each patient received an injection either with a 27- or 30-gauge needle during the first visit and during the second visit with the other needle. Objective and subjective evaluation were performed.

Results. Children's reactions to maxillary buccal infiltration either with a 27- or 30-gauge needle were similar. Significantly more children cried while receiving mandibular block injection with a 27-gauge needle than they did when receiving the injection with a 30-gauge needle ($P = 0.002$). According to subjective evaluation, most children rated both injections as a positive, nonpainful experience.

Conclusions. Mandibular block is less unpleasant, and children cry less when administered with a 30-gauge needle than they do when it is delivered with a 27-gauge needle. No difference in crying during injection is observed when maxillary infiltration is provided with 27- or 30-gauge needles.

Introduction

Dentists administer injections on a routine basis. Patients often associate pain with injections and the most anxiety-provoking procedure for both children and adults in dentistry is the local anaesthetic injection[1]. Dentists are trained in techniques that would minimize pain and discomfort while administering local anaesthesia to children. Various techniques have been suggested to alleviate pain during injection, such as the use of topical anaesthetic agents prior to the injection[2], lidocaine patches on the gingiva[3], electronic dental anaesthesia[4], and a computerized device (Wand ®)[5–9].

A short (20 mm) or a long (32 mm), 30- or 27-gauge needle may be used for most intraoral injections in children including mandibular blocks[10].

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The gauge of the needle refers to the diameter of the lumen of the needle: the smaller the number, the greater the diameter of the lumen. A 30-gauge needle has a smaller internal diameter than a 27-gauge needle, and the use of larger-gauge needles is recommended for injection into vascular areas or areas where needle deflection through soft tissue may be affected[11]. The gauge of the dental needle may influence the sensation of pain during insertion and injection of dental local anaesthesia. In a study conducted in adults, Lehtinen clinically tested (for pain insertion and penetration resistance) two types of disposable needles[12]. The 30-gauge needle required significantly less force (69 mN) than the 27-gauge needle (139 mN). No significant difference in pain was observed between the different needles.

Fuller *et al*. found no significant differences in perception of pain produced by penetrations of 25-, 27-, and 30-gauge needles in the retromolar fossa of adult patients[13].

To the best of our knowledge, no study on the influence of needle gauge in perception of

pain during local dental anaesthetic injection has ever been conducted on children. Therefore, the purpose of the present study was to assess children's reaction and to record their sensation while receiving dental local anaesthesia with a 27- and a 30-gauge needle.

Materials and methods

A total of 95 children (43 boys and 52 girls) who were undergoing routine restorative dental treatment from February 2004 to November 2005 in three paediatric dental clinics – one in Montevideo, Uruguay (35 children), another in Tel Aviv, Israel (20 children), and another in Jerusalem, Israel (40 children) – participated in the study. All patients were healthy children (ASA I) with no prior dental treatment, who needed at least two clinical sessions of similar operative procedures on both sides of the same jaw preceded by local anaesthetic injection, none of which was due to emergency.

Based on a preoperative behavioural assessment using the Frankl scale[14], all children demonstrated positive or definitely positive behaviour during pretreatment evaluation (ranking 3 or 4 in the Frankl scale), and none of them needed premedication for receiving dental treatment.

Children were assigned into two groups:
Group A: 52 children aged 5–8 years (mean age 6.7 ± 0.35 years)
Group B: 43 children aged 9–12 years (mean age 10.2 ± 0.73 years)

All parents were informed about the treatments and treatment procedures, and an informed consent was obtained (only the parents of one child refused to participate in the study). Topical anaesthetic gel (5% lidocaine) on a cotton-roll was applied to the injection site prior to injection. Injection of the local anaesthetic was slow with an average duration of nearly 2 min (approximately 1 mL per minute).

Reframing techniques, i.e. using euphemistic phrases such as 'putting the tooth to sleep', were used to describe the injection to all the children. Distraction and conventional non-pharmacological techniques of behaviour management were used.

A random crossover design was used so that each child served as his or her own control, receiving each treatment on the opposite side of the same arch (right vs. left). Each patient was randomly assigned to receive the injection either with a 27- or 30-gauge needle for the first visit, while the injection with the other needle was administered during the second visit.

Rating scales for objective and subjective evaluation

During the local anaesthetic injection (2% lidocaine 1 : 100 000 epinephrine), the modified Behavioural Pain scale suggested by Taddio *et al.*[15] was used for objective evaluation of the children. The scale comprised the following parameters: (i) crying, (ii) facial display (eyes' squeezing), (iii) arm movement, (iv) leg movement, and (iv) torso movements, and it was recorded as either present or absent. The facial display followed Craig's behavioural description of facial actions, which describes pain[16]. Only two of the four of Craig's most descriptive facial actions were evident (eye brow bulge or eye squeeze), because during injection, the mouth was open and the nose was partly covered by the operator's hand.

Three trained dental assistants (one in Jerusalem, one in Tel Aviv, and another in Montevideo), who did not participate in the treatment and were blinded to the type of injection and needle used, recorded the behavioural parameters in each centre. All the injections were carried out by the same experienced paediatric dentist in each centre, who calibrated the injection techniques.

Immediately after the injections, children were asked to complete the Wong–Baker FACES Pain Rating Scale (FPS) for subjective evaluation of feeling after the injection[17]. Verbal instructions were given to the child on how to utilize the FPS. The FPS measures the unpleasantness or affective dimension of a child's pain experience. The values for this scale range between 0 and 5, where 0 is 'no hurt' and 5 is 'hurt very much'.

The objective and subjective behavioural parameters were evaluated by McNemar and chi-squared analyses, and significance was set at $P < 0.05$.

Results

A total of 52 girls and 43 boys participated in this study. No significant difference was found

Table 1. Facial expression, hands, legs, torso movements, and crying during administration of local anaesthetic injection in the mandible and in the maxilla with needle 27- and 30-gauge.

	30-gauge mandible	30-gauge maxilla	Total (30 gauge)
Eyes			
Eyes squeeze	25 (55.6%)	35 (70%)	60 (63.2%)
No expression	20 (44.4%)	15 (30%)	35 (36.8%)
Hands			
Movement	8 (17.8%)	5 (10%)	13 (13.7%)
No movement	37 (82.2%)	45 (90%)	82 (86.3%)
Torso			
Movement	4 (8.9%)	5 (10%)	9 (9.5%)
No movement	41 (91.1%)	45 (90%)	86 (90.5%)
Legs			
Movement	7 (15.6%)	6 (12%)	13 (13.7%)
No movement	38 (84.4%)	44 (88%)	82 (86.3%)
Crying			
Crying	9 (20%)**	28 (56%)	37 (38.9%)*
No crying	36 (80%)	22 (44%)	58 (61.1%)
	27-gauge mandible	**27-gauge maxilla**	**Total (27 gauge)**
Eyes			
Eyes squeeze	28 (62.2%)	38 (76%)	66 (69.5%)
No expression	17 (37.8%)	12 (24%)	29 (30.5%)
Hands			
Movement	8 (17.8%)	6 (12%)	14 (14.7%)
No movement	37 (82.2%)	44 (88%)	81 (85.3%)
Torso			
Movement	2 (4.4%)	4 (8%)	6 (6.3%)
No movement	43 (95.6%)	46 (92%)	89 (93.7%)
Legs			
Movement	9 (20%)	7 (14%)	16 (16.8%)
No movement	36 (80%)	43 (86%)	79 (83.2%)
Crying			
Crying	21 (46.7%)**	32 (64%)	53 (55.8%)*
No crying	24 (53.3%)	18 (36%)	42 (44.2%)

*$P = 0.004$, McNemar test – crying during injection with 27-gauge; **$P = 0.002$ McNemar test – when comparing crying between needle 27- and 30- gauge delivering mandibular block.

between the first and second visit. No difference was found between the operators; therefore, the results are presented together. No significant difference in either group was found between boys and girls. The distribution of the injections was 100 maxillary infiltrations and 90 mandibular blocks.

No significant difference was found between groups A and B (children aged 5–8 and 9–12 years, respectively). The analysis was done separately for these groups and since the results pointed for both groups in the same direction, they are presented together.

Children's reactions to maxillary buccal infiltration either with a 27- or 30-gauge needle regarding crying, facial expression, and hands, legs, and torso movements were similar, with no statistical significant difference. However, significantly more children cried while receiving the injection to the mandible with a 27-gauge needle than they did when receiving the injection with a 30-gauge needle ($P = 0.002$) (Table 1).

According to children's self-rating of their pain sensation using the Wong–Baker FPS, no difference was found in rating sensation after mandibular or maxillary injections with 27- or 30-gauge needles in either group. Most children in both age groups rated both injections as a positive, nonpainful experience (rating 0–2). Only six children reported both injections as an unpleasant experience (rating 3–5). No adverse effects were found with any of the needles.

Discussion

The American Dental Association has established that needle selection should allow for profound local anaesthesia and adequate aspiration. According to the guidelines of the American Academy of Pediatric Dentistry, short needles may be used for any injection in which the thickness of soft tissue is less than 20 mm. A long needle may be used for a deeper injection into soft tissue. In addition, any 23- through 30-gauge needle may be used for intraoral injections, since blood can be aspirated through all of them[18].

This was confirmed by Delgado-Molina *et al.* who proved that no significant differences were recorded in terms of blood aspiration and internal gauge, operator, or the anaesthetic technique involved[19].

According to Malamed[11], there is a growing trend towards the use of smaller-diameter (higher-gauge) needles on the supposition that they are less traumatic to the patient than needles with larger diameters, although in clinical demonstrations performed in adult patients using 25-, 27-, and 30-gauge needles, no patient was found who could correctly determine the gauge of each needle.

In our study, patients showed significantly more objective signs of pain (by crying) during mandibular block injection with a 27-gauge needle than they did when they received the same injection with a 30-gauge needle. On the other hand, no difference was found between either gauge needles when maxillary buccal infiltration was performed. This may be due to the different tissues through which the needle passes during the different techniques.

Our study showed that the vast majority of children rated the injection experience as positive, although there were objective signs of pain like crying. This may be explained by the fact that in a good dentist–child rapport the child may want to satisfy the caregiver. In addition, the anaesthetic was delivered very slowly, children did not see the needle, and conventional, nonpharmacological behavioural management techniques like positive reinforcement and distraction were used. This is in accordance with a previous study where no significant difference was found between the self-report of the children during administration of mandibular block and maxillary infiltration, and in all cases even if objective signs of pain were observed, they ranked the injection as a positive experience[20].

Several authors did not find any difference regarding pain in adult patients when local anaesthesia was provided using different gauge needles[12,13].

In this study, we found a significant difference concerning pain when mandibular block was provided using a 27-gauge needle.

What this paper adds

- This paper adds knowledge about reaction of children when receiving dental local anaesthesia.
- The results prove that mandibular block is less unpleasant when delivered with a 30-gauge needle than it is when delivered with a 27-gauge needle.

Why this paper is important to paediatric dentists

- It is important for paediatric dentists because it demonstrates that mandibular block injection can be less painful if it is delivered using a 30-gauge needle.

Conclusions

Mandibular block is less unpleasant, and children cry less when administered with a 30-gauge needle than they do when the same injection is delivered with a 27-gauge needle. No difference in crying during injection is observed when maxillary infiltration is provided with 27- or 30-gauge needles. Children may feel inconvenience or pain and react by crying, yet may report a positive feeling to local anaesthesia in general if there is a good dentist–child rapport.

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