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Comparison of Inferior Dental Nerve Block Injections in Child Patients Using 30-Gauge and 25-Gauge Short Needles

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Thirty-gauge needles are generally not recommended by dental schools, yet many dentists use them. Thin needles (30 gauge) can aspirate blood, have similar deflection to thick needles (25 gauge), and resist breakage. Measurable clinical differences between inferior dental block injections using 25-gauge or 30-gauge short needles for children is addressed in this research paper. Random allocation assigned 76 cases to 30-gauge and 62 cases to 25-gauge tribeveled. Twenty-seven-gauge short needles are in routine use for inferior dental nerve block injections in our clinics. After informed written consent was obtained, inferior dental block injections were carefully administered to children (62 males and 76 females, mean age 10 years ± 3 [SD], range 4–18 years) by faculty and students in pediatric dentistry and observed by one of two trained observers. After aspiration in two planes (180°), 0.5 mL of 2% lidocaine with 1 : 100,000 epinephrine was deposited in the lingual block area then 1.0 mL in the inferior dental area after touching bone. Any aspirate was recorded and subjective pain scores were taken immediately using a visual analogue scale. Five minutes after the commencement of the injection, the efficacy was tested objectively by two light needle pricks of the mucosa adjacent to the cuspid. The comparability of groups as regards age and sex was verified. Half of the injections were effective at five minutes in each group. There were no significant differences in efficacy, or pain scores. Both 25- and 30-gauge groups had nine instances of slight aspiration and two instances of more marked aspirations. The overall aspiration rate was 16%. It is concluded that 25- and 30-gauge needles do not differ significantly with respect to efficacy, pain, or aspiration. Children do not think that inferior dental nerve block injections hurt very much, and there is no evidence to support a change from 25- to 30-gauge needles.

Historically the needle gauge recommendations for the administration of inferior dental nerve block injections in child patients largely have been empirical.[1] They have been extrapolated from studies on adults and from clinical experience. Practicing dentists prefer to use thin needles,[2] yet most dental school educators condemn them[3] because of perceived problems of deflection, breakage, and aspiration.

Repeated studies have demonstrated that thinner (30 gauge) needles are not more likely to break than thicker (25 gauge) needles,[2,4] and that the degree of needle deflection is comparable.[2,4] Short (25 mm) needles can penetrate to the inferior dental nerve block target depth (16 mm) leaving exposed cannula, and are less likely to go too deep and deviate than long needles.[5] An upright position collapses veins in the target area increasing the likelihood of false negative aspirations when compared with the supine position. Studies relative to aspiration have shown that needles thinner than 25 gauge can aspirate blood,[4,6,7] but that the rate of flow of the aspirate decreases with thinner needles.[4]

Generally it is agreed that it is desirable to attempt aspiration when administering dental injections. Negative aspiration tests do not ensure that there will be no untoward reaction,[8] and positive aspirations are possible

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with thin and thick gauge needles which are extravascular.[9] Forceful aspiration may actually collapse a vessel and cause occlusion. Repeated aspirations following rotation of 180° are necessary to ensure that a vessel wall is not occluding the needle.[9] Different rates and amount of aspirate can indicate whether the needle hole is likely to be extravascular or intravascular, and the likely size of the vessel.[9] In reviews of aspiration studies in adults, it has been found that positive aspirations occur in approximately 10% of inferior dental nerve block injections.[8,10]

Inferior dental nerve block injections are painful, and it is readily thought that thinner needles (30 gauge) may be less painful than thicker needles (25 gauge). With adult dentist subjects, no difference was found in the pain experienced by the penetration of thin and thick gauge needles,[11] but a rapid penetration was used contrary to the recommended slow gentle penetration.[1] The most reliable measurement of pain is the patient's subjective assessment of the pain as opposed to an objective interpretation.[12] Of the various methods for having patients subjectively assess pain, a visual analog scale seems to be the most sensitive[13] and has been shown to be a valid and reliable measure for subjective perception of pain[12,14] in children.[15,16] There is anecdotal agreement that inferior dental nerve block injections are not fully effective until ten minutes after commencement of the injection, yet an onset of three to five minutes for children is suggested.[1]

METHODS

Premedicated patients, handicapped patients, and patients for adjunctive nitrous oxide/oxygen sedation were eliminated from the study. Consecutive child patients (whose parents had given informed consent) requiring an inferior dental nerve block injection for treatment, were randomly assigned to the two needle gauge groups. The multiple operators[17] were faculty and students treating patients in the Department of Pediatric Dentistry of the University of Minnesota and of the Dental Department at Hennepin County Medical Center, Minneapolis, Minnesota. The test needles were disposable, tribeveled,[18,19] silicone coated,[20] Monoject® short thin (30 gauge) and thick (25 gauge) needles (Sherwood Medical) from one batch of normal clinic supplies.

A visual analogue scale[12–15,21] was devised, consisting of a horizontal rectangle 100 by 32 mm. To the left end of the rectangle a smiling face was drawn and to the right end of the scale a frowning face was drawn. These were drawn in circles of 43-mm diameter. Sufficient forms were produced such that a new print could be used for each subject (Figure 1).

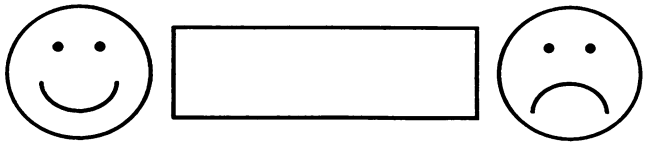

Figure 1. Visual Analog Scale, not shown in scale.

An explanatory sheet was prepared, and the operator was instructed in the experimental technique by one of the two observers who monitored the operation. After the patient was placed in the supine position and allowed to become as relaxed as possible, the mucosa surrounding the injection site was dried with cotton gauze, and a topical anesthetic (Hurricaine,® Beutlich Inc.) was applied with a cotton swab for 1.5 minutes. During the next 30 seconds, the oral cavity was evacuated, and the mucosa was wiped free of topical anesthetic. Twenty-seven gauge short needles with yellow covers are used routinely for inferior dental nerve block injections in both institutions. The distinguishing red and blue needle covers associated with 30- and 25-gauge needles, respectively, were replaced with yellow covers from 27-gauge needles when the syringes were prepared in the dispensary. The needle was introduced gently and immediately a drop of solution injected.[1] Slowly, with intermittent gentle aspiration,[9] the needle was advanced to the lingual block target area. After aspiration in two planes (180°), 0.5 mL of 2% lidocaine with 1 : 100,000 epinephrine (Xylocaine,® Astra Pharmaceuticals) was deposited. Then the needle was advanced to the inferior dental nerve block area, where bone was touched,[9] leaving exposed cannula, two plane aspiration repeated, and 1.0 mL of anesthetic deposited. The time from insertion to withdrawal was approximately two minutes.

Level 0 aspiration indicates no coloration. Any aspirate was recorded according to the four levels described by Watson and Colman.[9] Level I aspiration is a small amount of diffuse pink coloration in the end of the cartridge. Level II is a larger amount of diffuse but deeper coloration reaching anywhere up to halfway along the cartridge. Level III is a dense jet of blood that begins to diffuse before it reaches halfway along the cartridge. Level IV is a dense jet of blood that spurts halfway or further along the cartridge before diffusing.

Immediately after the needle was withdrawn,[13] the patient was asked to indicate the intensity of the pain of the injection on the visual analog scale. The patient was instructed to make a vertical line in the 100-mm scale using the guideline that the mark should be placed more to the left by the smiling face if the injection created no disconfort, and the mark should be placed more to the right by the frowning face if the injection was the worst pain they had ever felt or could imagine,[14] or the mark could be placed somewhere in between where they felt

Table 1. Level of Incidence of Aspiration by 25-Gauge Needle Compared with 30-Gauge Needle

	25 Gauge	*30 Gauge*	*Total*
Level 0	65 (86%)	51 (82%)	116 (84%)
Level I	9 (12%)	9 (15%)	18 (13%)
Level II	2 (3%)	2 (3%)	4 (3%)
Levels I & II	11 (14%)	11 (18%)	22 (16%)

Level 0 = No coloration; Level I = diffuse pink coloration at end of cartridge; Level II = diffuse red coloration up to halfway along cartridge.

appropriate. The mark was measured from the left in millimeters and recorded as the pain score.[21] To test the efficacy five minutes after the commencement time of injection,[1] an objective test of pain obturation was performed by penetrating the buccal and lingual mucogingival junction in the region of the cuspid with a sterile sharp explorer.[22]

Of the 138 cases, 68 (49%) were observed by one author, and 70 (51%) were observed by another author.

RESULTS

Of the 138 cases reported for this comparative study, the random allocation assigned 76 cases to 25-gauge needle and 62 cases to the 30-gauge needle. Age was recorded as of last birthday, ranging 4–18 years for the 25-gauge needle group and 4–16 years for the 30-gauge needle group. The median age was 10 years. The mean age for the 25-gauge needle group was 10 years (SD = 3), and the mean age group for the 30-gauge needle group was 9 years (SD = 3). A *t*-test showed no statistically significant difference between the mean ages of the two groups (t = 1.62, df = 136, p = .11).

Among the 138 cases, 62 (45%) were males and 76 (55)% were females. There were 37 males (49%) and 39 females (51%) in the 25-gauge group, and there were 25 males (40%) and 37 females (60%) in the 30-gauge group. A χ^2 test (corrected χ^2 = 0.66, df = 1, p = .42) showed no significant difference between the 25- and 30-gauge groups as regards sex distribution.

Twenty-five gauge needles had 65 incidences of level 0 aspiration and 30-gauge needles had 51 incidences of level 0 aspiration. Twenty-five and 30-gauge needle groups both had 9 incidences of level I aspiration, and 2 incidences of level II aspiration. There were no level III or IV aspirations. Table 1 shows these results. The overall rate of positive aspiration was 16%. A χ^2 test (corrected χ^2 = 0.08, df = 1, p = .77) showed no significant difference between the 25- and 30-gauge groups as regards incidence of aspiration.

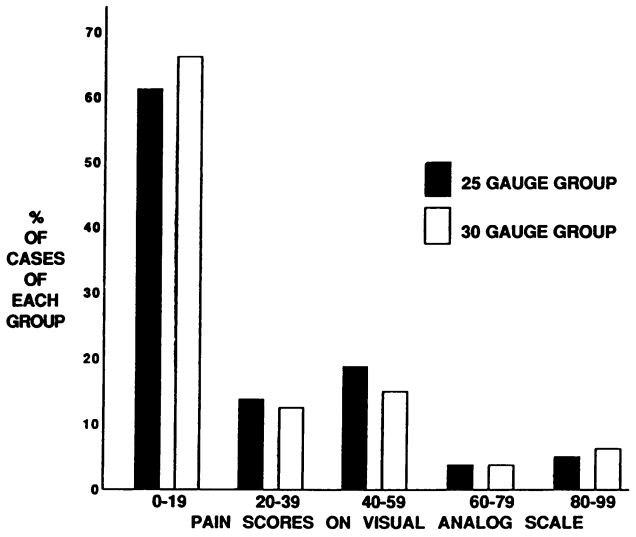

Figure 2. Comparison by Gauge Group of distribution of pain scores on the visual analog scale.

Of the 76 injections with the 25-gauge needle, 36 were judged to be effective after five minutes by the objective pain obturation test, and 40 were judged to be not effective. The 30-gauge needle had 26 effective injections and 36 that were judged to be not effective among its 62 injections. These results are presented in Table 2. A χ^2 test (corrected χ^2 = 0.22, df = 1, p = .64) showed no significant difference as regards the efficacy of the injections by these needles. No measure was made of the overall effectiveness nor the time of onset of anesthesia.

Pain scores ranged from 0–95 with a median of 13. The 25-gauge needle group had a minimum pain score of 0, a maximum score of 95 and a median score was 13. The 30 gauge needle had a minimum pain score of 0, a maximum score of 94 and a median score of 10. A Wilcoxon rank sum test showed no significant difference between the distributions of the pain scores for the gauge groups (W = 4088, z = 0.95, p = .34). Figure 2

Table 2. Results of the Objective Pain Obturation Test

	25 Gauge	*30 Gauge*	*Total*
Effective (at 5 minutes)	36 (47%)	26 (42%)	62 (45%)
Not Effective (at 5 minutes)	40 (53%)	36 (58%)	76 (55%)

compares the distributions of pain scores for the gauge groups graphically.

Pain scores also were examined by age and by sex, but no significant differences were found. The quadrant being injected and the hand which the operator used to inject were compared by gauge, and no significant difference was noted. Thus these results are not presented.

DISCUSSION

For the 138 cases reported in this study, the 25-gauge and 30-gauge groups were similar as regards to age and sex of the children. The variables measured in this study were examined for differences between injections by the two needles. Both needle groups had an equal number of positive aspirations, so both were capable of aspirating blood. The overall level of positive aspirations was considerably higher (16%) than generally expected (10%).[8,10] This may be due to the careful evaluation and attention to detail in the technique, or may be a feature of children, and it bears further investigation.

The needles were similar in their percentages of effective and ineffective injections. This comes as no surprise because the same amount of anesthetic was injected with both needles. Whether the injection would be effective or not depended little on whether a 25- or 30-gauge needle was used. This lends little support to the claim that 30-gauge needles are more likely to be deflected from the target area than 25-gauge needles. Many of the injections recorded as ineffective actually were effective after the five minutes used in the objective pain obturation test. The study did not measure the overall efficacy, but simply compared efficacy after a particular measure of time. Practitioners should wait longer than five minutes[1] before commencing operative procedures when giving inferior dental nerve block injections for children. The time of onset of operative anesthesia of inferior dental nerve block injections for children warrant further study.

The 30-gauge needle tended to have slightly lower pain scores on the visual analogue scale. The difference, however, was small and not statistically significant. This seems to suggest that patient comfort would not be compromised by the use of either a 25-gauge needle or a 30-gauge needle. The large number of very low scores in both groups indicates that children do not think that inferior dental nerve block injections hurt very much.

Taking into consideration the three variables that were measured and reported, it can be concluded logically that the 25-gauge and the 30-gauge short needles exhibit little or no clinical differences when used to give inferior dental nerve block injections in children. There is no evidence to suggest that 30-gauge needles should be used in preference to 25-gauge needles.

No untoward effects were observed in any of the patients. The major factor in any injection is the human element. It bears repeating that the patient and operator should be psychologically prepared, the equipment sterile, the anesthetic fresh, aspiration performed, and the deposition gentle, slow, and careful. There are concerns about the safety of short needles. Short needles should never be inserted to the needle hub. In circumstances where this might occur, long needles should be used.

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