COMPARISON OF INFERIOR ALVEOLAR NERVE BLOCK AND INTRALIGAMENTARY ANESTHESIA ON THE DISCOMFORT OF CHILDREN

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Abstract

Intraligamentary anesthesia(ILA) can be an alternative to inferior alveolar nerve block(IANB) for the extraction of primary molars. To evaluate the effects of ILA and IANB on the discomfort of children during the extraction of mandibulary first primary molars.
A single-blind, randomized split mouth study.

Twenty-nine healthy children participated in this study. Dental Subscale of Children's Fear Survey Schedule(CFSS-DS) was used to evaluate the dental fear of children. Visual analog scale(VAS) scores of both ILA and IANB groups were recorded during the injection procedure. Heart rate values were recorded during the injection, decollement and extraction periods. Pain perceptions of children were evaluated with sound, eye and motor (SEM) scale by two trained observers during the injection and extraction procedures.

The mean CFSS-DS score (22.86±5.829) did not indicate significant dental fear. Altough VAS scores of IANB was higher than ILA, there was no statistically significant difference between them ($p>0.05$). A significant higher mean SEM score for IANB group was recorded in comparison to ILA during both injection and extraction periods ($p<0.05$). There were no statistically significant differences in heart rate during different procedures between two groups ($p>0.05$).

Statistical analyses were performed using the SPSS 18.0 for Windows. Chi Square test, variance analysis and Wilcoxon signed ranks tests were used.

ILA provides effective local pain control and may be an alternative method especially for children.

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Introduction

Local anesthesia (LA) is an important procedure for the control of pain and discomfort during dental treatment,[1] but fear associated with LA injection has been reported to be a factor especially in children prior to dental treatment.[2]

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To reduce the pain, administration of topical anesthetics before LA injection and prolonged injection time are helpful but not enough to complete elimination of the pain while injection.[2,3]

Inferior alveolar nerve block (IANB) is the most common technique for providing local anesthesia[4,12] before restorative and surgical procedures of the mandibular posterior teeth.[5] This technique provides the anesthesia of teeth, jaw, lip, gingiva and mucous membrane up to the midline at the related part. Generally lingual nerve block also occurs by this procedure and the lingual side of the gingiva, the base of the mouth and 2/3 front part of the tongue become numb. However, it is reported that inferior alveolar block technique was more painful than

the others[5] and besides the pain produced by tearing the mucosa, breakage of the needle in the injection, facial paralysis produced by anesthetic infiltration in the parotid region, haematoma produced by the break down of the vessels in the area to be anesthetized and lip and tongue injuries because of the extend period of anesthesia must be taken into consideration.[6,12] Therefore, it is necessary to seek alternatives to minimize the complications in the care of patients, especially in children.

Intraligamentary anesthesia (ILA) can be an alternative in the control of pain and discomfort during dental procedures and it achieves successful anesthesia for single tooth treatment.[7,13] The indications of intraligamentary injections are single tooth treatments, the anatomical variations which lead the other techniques can't be administered, children and the cases which minimal anesthetic dosage is needed.

The major advantage of this technique is that the anesthetic efficacy is limitated only for the tooth which is treated. According to this, especially in children the soft tissue injury after regional anesthesia can be eliminated. Comparing with conventional infiltration and block anesthesias, the other advantages of this technique are less anesthetic solution is used in ILA, differential diagnosis is possible in pulpitis with ILA, in pediatric patients, different teeth in different quadrants can be treated in one appointment. However, some authors reported the disavantages of ILA such as postoperative pain, potential damage to the gingival attachment and to the permanent tooth bud.[14,19]

This study analyses a simple and more painless alternative of anesthesia in children. The aim of the present study was to compare the effects of inferior alveolar nerve block and ILA injections on the discomfort of children in the extraction of mandibulary first primary molars with the indication of serial extraction.

Materials and Methods

A single-blind, randomized split mouth study was performed in 29 healthy children (female: 18; male: 11) aged between 8 to 9 years. All subjects were in good health and were not taking any medication which would alter pain perception during the anesthesia and extraction. The study was approved by the Scientific Research Ethics Committee at Ege University. The procedures, possible discomforts or risks, as well as possible benefits were explained fully to the parents of the children and their written informed consent was obtained before the study.

Inclusion Criteria

- The subjects whose mandibular first primary molar teeth were caries-free or had small lesion which was not related with pulp were included the study.
- Mandibular first primary molars which have ½ radicular physiological resorptions and minimum ½ completed root devolopment of the permanent teeth germs determined by periapical radiography.
- Neither pulpitis nor trauma history were reported at the related teeth.
- There wasn't any history of traumatic experiences about dental treatment
- No allergic reaction to an anesthetic was reported for each subject.
- All subjects were in good health.

Study Procedure

Dental Subscale of Children's Fear Survey Schedule (CFSS-DS)[8] which is shown as Table 1 was given to each patient to evaluate the dental fear of children before the dental procedures. This schedule contained 15 questions which are associated with fear, including i.e. injection, oral examination and necessity of keeping mouth open. Scale scores are calculated by summing item scores; the total score can range from 15 to 75. Scores above 38 indicate significant dental fear.[9]

All injections and extractions performed by a single dentist. Topical anesthesia was achieved with lidocaine 10% (Xylocaine pump spray; Astra- Zeneca, Sodertalje, Sweden) applied over the dried mucosa for 1 minute using a cotton applicator. Each patient randomly received (toss a coin) ILA or IANB for the extractions of the first primary molar teeth on each side at the same appointment.

The ILA was performed with a cartridge ampule syringe (Citoject, Heraeus Kulzer GmbH, Hanau, Germany) with a 30 G sterile disposable dental needle (C-K Ject, CK Dental Ind. Co., LTD., Korea). Articaine/HCl 4% with epinephrine 1/100000 (Ultracaine D-S forte, Sanofi-Aventis Deutschland GmbH, Germany) was administered with a volume of 0.3 mL via Citoject in the ILA

method and with a volume of 1.5 mL via disposable syringes in the IANB method. Needle size was 30 G and the injection rate was 1 mL/min for IANB. A successful anesthesia was supplied for the teeth, surrounding hard tissues and buccal mucosa waiting for five minutes before the extraction procedure. All teeth were extracted by forceps after the decollement procedure.

Items	not at all afraid	a little afraid	somewhat afraid	fairly much afraid	very much afraid
1. Dentists					
2. Doctors					
3. Injections					
4. Having somebody examine your mouth					
5. Having to open your mouth					
6. Having a stranger touch you					
7. Having somebody look at you					
8. The dentist drilling					
9. The sight of the dentist drilling					
10. The noise of the dentist drilling					
11. Having somebody put instruments in your mouth					
12. Choking					
13. Having to go to the hospital					
14. People in white uniforms					
15. Having the nurse clean your teeth					

Table 1. Children's Fear Survey Schedule - Dental Subscale (CFSS-DS)

Before administering the anesthetic, each child was connected to a pulse oximeter by means of a sensor attached to the nail of a forefinger. Heart rate values of children were recorded;[1] at the time that the anesthesia was being performed,[2] during decollement and[3] extraction.

Before administration of the local anesthetic, visual analog scale (VAS) was shown and explained to children for subjective pain assessment. After the ratings of the children VAS[1,10] values were recorded for both ILA and IANB groups during the injection period. The VAS scale was divided into 5 categories. No pain corresponded to 0 cm. Mild pain was defined as 0 cm to 4cm. Moderate pain was defined as 4 cm to 7 cm. Severe pain was defined as 7 cm to 10 cm. Unbearable pain corresponded to 10 cm.

Pain perceptions of each child were evaluated by using sound, eye and motor (SEM) scale.[11] The assessment criteria of the SEM scale is presented in Table 2. The sounds, eye symptoms and body movements of children were evaluated from 1.5 m distance from the dental unit by two trained observers during both injection and extraction periods. The inter-examiner aggreement was found as 0.789 weighted kappa statistic value, thus indicating a good level of agreement in scoring the SEM scale. The SEM score was determined by summing the grade values.

Parameter	Comfort	Mild discomfort	Moderate discomfort	Severe discomfort
Grade	1	2	3	4
Sound	No sound	Non-specific sound	Verbal complaint, louder sound	Verbal complaint shouting, crying
Eye	No sign	Dilated eye without tear (anxiety sign)	Tears, sudden eye movements	Crying, tears all over the face
Motor	Relaxed body and hand status	Muscular contraction, contraction of hands	Sudden body and hand movements	Hand movements for defense, turning the head to the opposite site

Table 2. Sound Eye and Motor (SEM) scale for the assessment of children's behavior

Statistical analyses were performed using the SPSS 18.0 for Windows. The gender and CFSS-DS scores were analysed using Chi Square test. The effects of administration of local anesthesia (ILA versus IANB) on heart rate were evaluated by variance analysis for repeated measures. VAS and SEM scores of IANB compared to ILA were analysed using Wilcoxon signed ranks test. Comparisons were considered significant at $p< 0.05$.

Results

The gender and CFSS-DS scores of the patients are presented in Table 3. There was no difference in fear levels between genders and none of the patients had significant dental fear (CFSS-DS scores < 38).

Value/Gender	Male (n:11)	Female (n:18)	Total (n:29)
Age	10.18±0.405	10.06±0.639	10.10±0.557
CFSS-DS* scores	24.55 ± 5.837	21.83 ± 5.742	22.86 ± 5.829

Values presented as mean ± SD.
*Dental Subscale of Children's Fear Survey Schedule

Table 3. The mean values of age and CFSS-DS scores for the injection groups.

The mean baseline heart rate value was 93.5. The mean heart rate values at different procedures for ILA and IANB groups were demonstrated in Table 4.

Altough the increase in heart rate in relation to baseline heart rate was higher in IANB method compared to ILA during both injection and extraction procedures, the differences were not statistically significant (p>0.05).

	Heart rate at the injection	Heart rate at the decollement	Heart rate at the extraction
ILA	99.18±18.643	102.09±16.831	104.73±15.100
IANB	105.18±22.746	102.64±16.561	109.00±14.980

Values presented as mean ± SD.
ILA, intraligamentary anesthesia; IANB, inferior alveolar nerve block

Table 4. The mean heart rate values at different procedures for ILA and IANB.

The mean VAS and SEM scores for both group of patients were demonstrated in Table 5. The patients in IANB group experienced mild to moderate pain (4.14±1.1) while the patients in ILA group experienced mild pain (3.11±1.2) at the time of administration of anesthesia.

Altough the mean VAS score of the IANB group was found higher than the mean VAS score of the ILA group during the injection period, there was no signicaficant difference between two groups (p>0.05).

A significant higher mean SEM score for IANB group was recorded in comparison to ILA during both injection and extraction periods (p<0.005).

	VAS*	SEM§ Anesthesia	SEM Extraction
ILA	3.11±1.2	3.83±1.071	3.93±1.223
IANB	4.14±1.1	5.62±2.128•	5.17±1.891•

Values presented as mean ± SD. * Visual Analog Scale
§ Sound Eye and Motor Scale • **p<0.05** ILA, intraligamentary anesthesia; IANB, inferior alveolar nerve block.

Table 5. The mean VAS and SEM scores for the injection groups.

Discussion

The aim of the present study was to assess children's pain reactions to intraligamentary anesthesia compared to traditional inferior alveolar nerve block anesthesia. In the evaluation of discomfort and pain, heart rate, VAS and SEM scores were used as primary variables.

Pain control during dental procedures is very important in children to maintain a positive relationship between the child and dentist building trust and allaying fear and anxiety.[6,11,15] The administration technique of local anesthetic is also an important consideration in a pediatric patient.[6] The majority of local anesthesia procedures in pediatric dentistry involve traditional methods of infiltration or nerve block techniques with a dental syringe, disposable cartridges, and needles as described so far. Several alternative techniques, however, are available. These include computer-controlled local anesthetic delivery, periodontal injection techniques (ie, periodontal ligament [PDL], intraligamentary, and peridental injection), "needle-less" systems, and intraseptal or intrapulpal injection. These techniques may improve comfort of injection by better control of the administration rate, pressure, and location of anesthetic solutions and/or result in successful and more controlled anesthesia.[6]

The intraligamentary anesthesia was practiced before,[13,16,17] but became popular recently as the introduction new simple syringe devices that facilitate the delivery process.[7,18] It also avoids the widespread soft tissue anesthesia associated with regional block techniques and avoids the self-inflicted trauma especially in children. It is also claimed that there is less injection discomfort during intraligamentary injections, although they are not painless.[18]

One of the vital signs used in the present study was the heart rate change in the children. Its changes were recorded for both types of injection in all procedures (injection, decollement and extraction). It was found that patients who administered IANB were more likely to experience an increase in heart rate during injection and extraction procedures although this finding was not statistically significant. And this could be due to the difference in the volume of anesthesic administered between two techniques.

This result was similar to the study of Nusstein et al who reported that heart rate did not significantly increase with the ILA.[19]

At the beginning of the study, the level of dental anxiety was assessed by using CFSS-DS scores and the study was restricted to patients showing without significant dental fear (mean CFSS-DS score was 22.86 ± 5.829) to eliminate the effect of anxiety since it is important factor in the responses of children to dental anesthesia. However, this resulted with a small sample size in which many anxious and uncooperative children were excluded. Another challenge was to find cooperative children with indications of extractions of caries-free mandibular first primary molars where the physiological resorptions were at the ½ radicular part in both teeth. Because of these limitations, it was difficult to demonstrate a large sample size. Furthermore, ILA was performed by a single experienced dental surgeon to avoid the operator effect.

The VAS scores were recorded during the injection of the anesthetic solution for both groups. The mean VAS score was 3.11±1.2 in the ILA group which showed that the majority of the children had mild pain. The mean VAS score was 4.14±1.1 in the IANB group showing moderate pain which is in accordance with the other studies.[20,21,22] Mansour and Adawy[20] reported that 96% of the in patients claimed ILA was less painful than other techniques.

Marin[21] stated that patients reported hardly being aware of pain with ILA. However, in an another study, in which pain scores during local infiltration and ILA were assessed and no difference was found between the two injection techniques.[22]

During dental anesthesia and extractions, two trained observers assessed children's pain reaction according to the sound, eye and motor scale (SEM). The use of IANB method in the injection and extraction procedures exhibited significantly higher SEM scores in comparison with ILA method. However, there is a lack of information in the literatur where ILA and IANB methods were compared in children.

Conclusion

Within the limitations of the study it could be concluded that ILA provides effective local pain control with a minimal anesthesic agent and could be suggested as an alternative method especially for children in the extraction of first primary molars. Further studies with an enlarged sample size are needed to confirm these results.

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