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# Assessment of Pain Perception in Children During Local Anesthesia and Tooth Extraction Procedures: A Clinical Study

## Çocuklarda Lokal Anestezi ve Diş Çekimi İşlemlerinde Oluşan Ağrı Algısının Değerlendirilmesi: Klinik Çalışma

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**ABSTRACT Objective:** Evaluation and comparison of pain in pediatric patients following local anesthesia administration and primary tooth extraction using the Wong-Baker Faces Pain Rating Scale (WBS). **Material and Methods:** A total of 90 children (age between 4-11 years) whose teeth were indicated for extraction for various reasons were included in the study. Before dental treatments, behavioral management was given to all children with the tell-show-do technique. Following topical anesthesia, local anesthetics were applied to the relevant area, and tooth extractions were performed. Perceived pain after local anesthesia and tooth extraction was recorded separately by asking the patients using the WBS. Mean values and standard deviations were calculated and comparisons between groups were made with the Mann-Whitney U test. **Results:** The mean WBS value was 4.49, with the highest palatal infiltration anesthesia. Following this, 3.8 in the mandibular block, 3.42 in lingual, 2.3 in buccal infiltration anesthesia, and 1.2 in tooth extraction respectively. There was no statistically significant difference between the genders in the WBS values after tooth extraction, mandibular block anesthesia, buccal, palatal and lingual infiltration anesthesia (p>0.05). **Conclusion:** As a result of this study, palatal infiltration and mandibular block anesthesia were identified as the most painful anesthesia techniques perceived by children.

**Keywords:** Local anesthesia; pain perception; pain measurement; pediatric dentistry; tooth extraction

**ÖZET Amaç:** Bu çalışmanın amacı, çocuk hastalarda lokal anestezi uygulanması ve süt diş çekimi sonrası meydana gelen ağrının Wong-Baker Yüzler Ağrı Ölçeği ile değerlendirilmesi ve karşılaştırılmasıdır. **Gereç ve Yöntemler:** Çeşitli sebeplerle dişlerine çekim endikasyonu konan 90 çocuk (4-11 yaş aralığında) çalışmaya dâhil edildi. Dental tedaviler öncesi tüm çocuklara anlat-göster-uygula tekniği ile davranış yönlendirmesi yapıldı. Topikal anestezi uygulaması sonrası ilgili bölgeye lokal anestezik uygulandı ve diş çekimleri gerçekleştirildi. Lokal anestezi uygulamasını ve diş çekimlerini takiben, algılanan ağrılar Wong-Baker Yüzler Ağrı Ölçeği ile hastalara sorularak kaydedildi. Verilerin istatistiksel analizinde ortalama değerler, standart sapmalar hesaplandı, ayrıca gruplar arası karşılaştırmalar Mann-Whitney U testi ile yapıldı. **Bulgular:** Ortalama Wong-Baker Yüzler Ağrı Ölçeği skoru, en yüksek palatal infiltrasyon anestezisi uygulandığında 4,49 olarak tespit edildi. Bunu sırasıyla mandibular blok anestezisi (3,8), lingual infiltrasyon anestezisi (3,42), bukkal infiltrasyon anestezi (2,3) ve diş çekimi (1,2) takip etti. Cinsiyetler arasında, diş çekimi, mandibular blok anestezisi, bukkal, palatal ve lingual infiltrasyon anestezileri sonrası kaydedilen skorlarda istatistiksel olarak anlamlı fark bulunmadı (p>0,05). **Sonuç:** Palatal infiltrasyon ve mandibular blok anestezisi çocuklar tarafından en ağrılı hissedilen anestezi yöntemleri olarak bulundu.

**Anahtar Kelimeler:** Lokal anestezi; ağrı algısı; ağrı ölçümü; çocuk diş hekimliği; diş çekimi

Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" by the International Association of the Study of Pain.[1] It has been said by the American Academy of Pediatric Dentistry that inadequate pain management can have significant physical and psychological consequences for the patient.[2] Dental anx-

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iety is a common problem that usually develops due to many factors such as negative or traumatic experiences during childhood and adolescence.[3,4] Therefore, especially in pediatric dentistry practice, proper pain control during dental treatments is one of the essential factors that can prevent dental anxiety in children. Local anesthesia is the most common method for doing this. On the other hand, local anesthesia is also one of the factors that can trigger fear and anxiety, which causes pain in pediatric patients and difficulties in behavior management.[5]

Pain assessment in children is an important part of dental treatment planning and determining the effectiveness of treatment.[6] Because pain is a subjective experience, self-report of its intensity is a desired approach to pain assessment.[7] Until today, many methods such as visual analog scale, descriptive pain scale, numerical pain scale, faces pain scale, and analogue chromatic scale have been tried and used to evaluate of pain grade in children.[8] One of these scales, the Wong-Baker Faces Pain Rating Scale (WBS), has undergone extensive psychometric evaluation and is now accepted as suitable for use in children aged 3 to 18.[6]

In contemporary practice, traditional anesthesia procedures involve the use of disposable 2.5 mL plastic syringes in conjunction with 27G-40 mm dental needles. These needles are utilized for administering infiltration and block anesthesia in both the maxilla and mandibula. However, there is a noticeable absence of literature addressing the isolated evaluation of pain experienced by children during the administration of anesthesia procedures. Additionally, there is a curiosity regarding the perception of pain in children following dental extraction procedures. Consequently, this study aims to investigate the pain experienced by pediatric patients after local anesthesia procedures and dental extractions using the WBS.

## MATERIAL AND METHODS

The present clinical study was approved by Sakarya University Clinical Research Ethics Committee (date: May 16, 2023, no: E-16214662-050.01.04-244959-51). The study was carried out by the Declaration of Helsinki and good clinical practices. At the beginning of the study, all participants and their parents were informed about the study protocol and provided informed written consent from the parents. The study included 90 pediatric patients (aged 4-11 years) who came to Sakarya University Faculty of Dentistry for routine examination and dental treatments and agreed to participate in the study. The inclusion criteria were: no systemic disease; no acute dental pain; first dental visit; absence of suspected allergy to either benzocaine or articaine; behavioral rating of Frankl's 3 or Frankl's 4 (positive and definitely positive, Figure 1).

After clinical and radiographic examinations, behavioral management was given to all patients who had an indication for tooth extraction for various reasons and would be included in the study with the tell-show-do technique before the treatment. Maxillary or mandibular primary canines and primary molars were included in the study. Indications for extraction included the presence of lesions involving more than 1/3 of the furcation region, orthodontic reasons, and atypical root resorptions. Teeth exhibiting excessive root resorption, whether of physiological or pathological origin, and those with only mucosal retention were excluded from the study. Topical anesthesia was applied for 1 minute with Ultracare 20% benzocaine gel (Ultradent Products Inc., USA) in the mucobuccal fold area closest to the extracted tooth. Next, a

| | | |
|---|---|---|
| 1 | -- | Definitely negative. Refusal of treatment, forceful crying, fearfulness, or any other overt evidence of extreme negativism. |
| 2 | - | Negative. Reluctance to accept treatment, uncooperative, some evidence of negative attitude but not pronounced (sullen, withdrawn). |
| 3 | + | Positive. Acceptance of treatment, cautious behaviour at times, willingness to comply with the dentist, at times with reservation, but patient follows the dentist's directions cooperatively. |
| 4 | ++ | Definitely positive. Good rapport with the dentist, interest in the dental procedures, laughter and enjoyment. |

**FIGURE 1:** Frankl Behavioral Rating Scale.

American Academy of Pediatric Dentistry. Behavior guidance for the pediatric dental patient. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2021. p.306-24.

local anesthetic containing articaine HCL 4% with 1:100.000 epinephrine with Septocaine (Septodont, USA) (1.5 cc for mandibular block nerve, 0.5 cc for infiltration anesthesia) was injected through a dental needle [Genject (Genject Inc, Ankara, Türkiye) 2.5 mL, 40 mm] using for all anesthesia application. Buccal infiltration anesthesia and palatal infiltration anesthesia were administered for maxillary primary canines and molars. Palatal infiltration anesthesia was administered 2 minutes after buccal infiltration anesthesia. Following a topical application of Ultracare 20% benzocaine on the palatal mucosa for 1 minute, infiltration anesthesia was performed. For mandibular primary second molars, mandibular block, and buccal infiltration anesthesia were used, while buccal infiltration and lingual infiltration anesthesia were employed for mandibular primary canines and first molars. After the application of local anesthesia, tooth extraction was performed. All anesthesia applications and primary tooth extractions were executed by the same pediatric dentist (EGA) with ten years of clinical experience. Patients were asked to rate their pain after each dental anesthesia and tooth extraction separately on WBS (Figure 2).

### STATISTICAL ANALYSIS

All statistical analyses were performed using SPSS version 26.0 (IBM Corp., Armonk, New York, USA). Descriptive statistics and mean values were applied. Shapiro-Wilk and Kolmogorov-Smirnov tests were used to determine whether all data showed normal distribution. Mann-Whitney U test was used to evaluate the difference between groups. Statistical significance of differences was established at $p<0.05$.

## RESULTS

The overall study sample consisted of 90 patients: 40 (44.4%) males and 50 (55.6%) females and their ages ranged from 4 to 11 years (mean age: 7.7). According to the different types of anesthesia, the mean WBS value was found to be highest after palatal anesthesia (mean: 4.49). Following this, the mean WBS values were found 3.8 in mandibular block anesthesia, 3.42 in lingual infiltration anesthesia, and 2.3 in buccal infiltration anesthesia respectively. The mean WBS score after tooth extraction was determined as 1.2 (Table 1) (Figure 3).

A statistically significant difference was detected between the Wong-Baker scores determined after tooth extraction and different types of anesthesia applications ($p=0.00$) (Table 1) (Figure 3).

There was no statistically significant difference between the genders in the WBS values after tooth extraction, buccal, palatal, mandibular and lingual anesthesia. WBS values after buccal and lingual infiltration anesthesia and mandibular block anesthesia were found to be higher in females, while WBS values after palatal infiltration anesthesia and tooth extraction were found to be higher in males (Table 2).

Tooth extraction was performed from the upper jaw in 45 patients and from the lower jaw in 45 patients. There was no statistically significant difference between the lower and upper jaws in WBS values after tooth extraction ($p=0.49$). When tooth was extracted in the upper jaw higher WBS scores occurred than in the lower jaw (Table 3).

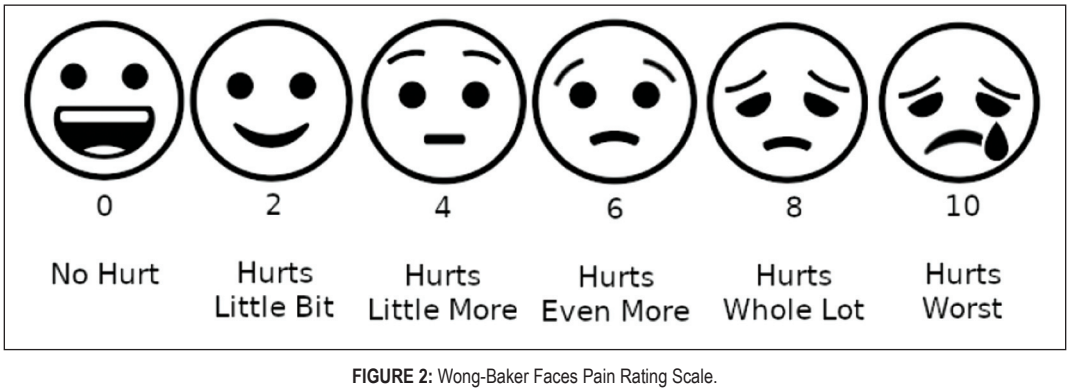


**FIGURE 2:** Wong-Baker Faces Pain Rating Scale.

**TABLE 1:** Minimum, maximum, and mean WBS values for different anesthesia applications and post-extraction.

| | n | Minimum | Maximum | $\bar{X}$ | SD | p value |
|---|---|---|---|---|---|---|
| Tooth extraction | 90 | 0.00 | 10.00 | 1.2 | 2.21 | |
| Buccal infiltration anesthesia | 90 | 0.00 | 10.00 | 2.3 | 2.12 | |
| Palatal infiltration anesthesia | 45 | 0.00 | 10.00 | 4.49 | 2.70 | **0.00*** |
| Mandibular block anesthesia | 30 | 0.00 | 10.00 | 3.8 | 2.84 | |
| Lingual infiltration anesthesia | 14 | 0.00 | 6.00 | 3.42 | 1.65 | |

*Statistically significant difference; comparison between groups was made with the Kruskal-Wallis H test; SD: Standard deviation; WBS: Wong-Baker Faces Pain Rating Scale.

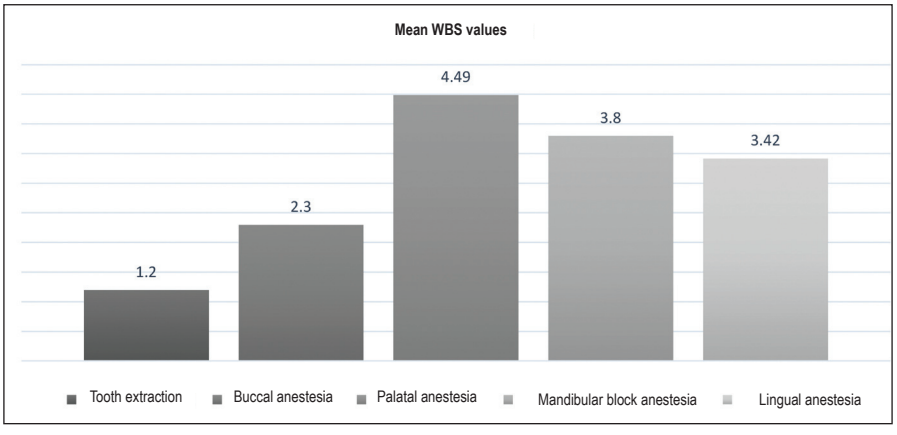


**FIGURE 3:** Mean WBS scores for different anesthesia applications and post-extraction.
WBS: Wong-Baker Faces Pain Rating Scale.

**TABLE 2:** Comparison of WBS values after extraction and different anesthesia application according to gender.

| | | n | Mean rank | p value |
|---|---|---|---|---|
| Tooth extraction | Female | 50 | 44.35 | **0.57** |
| | Male | 40 | 46.95 | |
| Buccal infiltration anesthesia | Female | 50 | 46.44 | **0.69** |
| | Male | 40 | 44.33 | |
| Palatal infiltration anesthesia | Female | 28 | 21.95 | **0.47** |
| | Male | 17 | 24.74 | |
| Mandibular block anesthesia | Female | 14 | 17.14 | **0.32** |
| | Male | 16 | 14.06 | |
| Lingual infiltration anesthesia | Female | 7 | 8.36 | **0.40** |
| | Male | 7 | 6.64 | |

Comparison between groups was made with the Mann-Whitney U test; WBS: Wong-Baker Faces Pain Rating Scale.

**TABLE 3:** Comparison of WBS values after tooth extraction according to jaws.

| | | n | Mean rank | p value |
|---|---|---|---|---|
| Tooth extraction | Upper jaw | 45 | 47.06 | **0.49** |
| | Lower jaw | 45 | 43.94 | |

WBS: Wong-Baker Faces Pain Rating Scale.

## DISCUSSION

In pediatric dentistry, dental treatment can only be considered successful when it is painless. However, the most challenging part of behavioral guidance during both restorative dental treatments and tooth extractions is anesthesia applications due to the occurrence of discomfort. Due to the difficulties of applying local anesthesia with conventional methods, especially in the pediatric patient group, various alternative techniques such as computerized injection technique Wand STA system (Milestone Scientific, Livingston, NJ), computer-controlled intraosseous anesthesia system [QuickSleeper (Dental Hi Tec® Inc, French)], vibrotactile devices are used today.[9,10]

In addition to the advantages of these techniques in reducing injection pain, conventional techniques are still the most frequently used today due to these new techniques' disadvantages such as difficulties in placing the device in the gingival tissue area and difficulties in penetration depth and their high prices.[9,11] For these reasons, the use of traditional and standard disposable plastic syringes and needles continues to be quite prevalent in contemporary practice. In this study, the pain-inducing levels of maxillary infiltration, palatal infiltration, mandibular block, and mandibular infiltration anesthesia procedures performed using traditional syringes and needles were compared.

When our study results were evaluated, the highest value of pain was detected after palatal injection. This finding was in agreement with the results of a study conducted by Aminabadi et al. This outcome is caused by the rich nerve supply of the palatal tissues, firm attachment of palatal mucosa and pressure created by injections.[12-14] It was thought that extracting teeth from the upper jaw might be done without palatal injection to avoid the agony produced by palatal injection, and many investigations were conducted on the subject in adults.[15-18] It has been determined that palatal injection is no longer absolutely necessary to obtain appropriate anesthesia for extraction of maxillary permanent teeth.[19] However, no study involving pediatric patients has been carried yet and additional research is needed. Less pain was reported by children after lingual and buccal infiltration anesthesia compared to palatal anesthesia. It can be said that, if the same procedures are used during an injection, the anatomical site, rather than the injection technique, affects the severity of the pain reaction.

Following palatal injection, the highest pain was reported in mandibular block anesthesia. This finding is consistent with earlier research.[20-22] It has been stated that mandibular block anesthesia was much more uncomfortable than infiltration anesthesia and the behavior of children became negative after block injection.[21] The reason for this can be explained by the fact that the syringe goes deeper during mandibular block anesthesia.

Although it is stated in the literature that females report fear of dental pain more than males; no statistically significant differences were found between the genders in pain perception after different anesthesia applications in our study.[23] These findings of the present study were similar to those of several authors.[12,20,24,25]

The WBS values of tooth extraction were determined to be the least. This is an expected result showing that the anesthetic efficacy is adequate. Although it was not statistically significant, more pain was reported when teeth were extracted from the upper jaw. This was most likely attributable to the children's increased anxiety as a result of the palatal injection pain.

The main limitation of this study is that it was conducted with a small study group. Despite advances in technology, local anesthesia is still administered via the most prevalent conventional approach in pediatric dental clinic routine. Similar studies with larger sample groups in the future could help pediatric dentists in selecting less uncomfortable anesthetic techniques.

## CONCLUSION

Given the numerous efforts undertaken to assure painless operations in pediatric dentistry, the findings of this study should be taken into account by pediatric dentists. Clinicians should think about choosing new anesthetic application techniques as an alternative to conventional techniques for palatal infiltration and mandibular block anesthesia given the higher pain experienced following these injections.

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### *Conflict of Interest*

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### *Authorship Contributions*

***Idea/Concept:*** *Elif Gül Aydın, Neslihan Yılmaz, Esra Ceren Tuğutlu;* ***Design:*** *Elif Gül Aydın, Neslihan Yılmaz, Esra Ceren Tuğutlu;* ***Control/Supervision:*** *Elif Gül Aydın;* ***Data Collection***

***and/or Processing:*** *Elif Gül Aydın, Neslihan Yılmaz;* ***Analysis and/or Interpretation:*** *Neslihan Yılmaz, Esra Ceren Tuğutlu;* ***Literature Review:*** *Elif Gül Aydın, Esra Ceren Tuğutlu;* ***Writing the Article:*** *Elif Gül Aydın, Neslihan Yılmaz, Esra Ceren Tuğutlu;* ***Critical Review:*** *Elif Gül Aydın, Neslihan Yılmaz;* ***References and Fundings:*** *Elif Gül Aydın;* ***Materials:*** *Elif Gül Aydın.*

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