ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Evaluation of the Frequency of Primary and Permanent Teeth Extraction in Children at a Dental Hospital: A Cross-Sectional Study

Bir Ağız ve Diş Sağlığı Merkezine Başvuran Çocuklarda Süt ve Daimi Diş Çekim Sıklığının Araştırılması: Kesitsel Çalışma

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ABSTRACT Objective: To evaluate cross-sectionally the frequency of tooth extraction, and the reasons for extraction, by age and gender in children and adolescents who attended an oral and dental health training and research hospital. **Material and Methods:** Pediatric patients aged between 3 and 14 years who attended the pediatric dentistry clinic of our hospital were examined between November 2021-February 2022. The age, gender and reasons for tooth extraction of the patients who were diagnosed for extractions were documented after clinical intraoral examinations were conducted and panoramic films had been taken. In addition, the presence of previous early tooth loss and mesial tipping of the adjacent teeth were recorded from the radiographs. Descriptive statistics were used for the results. **Results:** Of the 3,074 (mean age: 8.3) children who agreed to participate in the study, at least 953 required extraction of at least one tooth (31%). A total of 1,461 teeth were extracted from these 953 children. While caries, followed by physiological mobility were the main reasons for extraction in primary teeth, for permanent teeth the main reasons were caries and molar incisor hypomineralization. **Conclusion:** The study found that dental caries was the most common reason for indication for extraction. Despite all the modern advances in dentistry, caries continues to be the main reason for teeth extraction amongst children today. Given the possible negative consequences of the premature loss of primary and permanent teeth, it is important to provide access and advice about the main causes of extraction through the use of oral hygiene training and awareness programs.

Keywords: Dental caries; malocclusion; tooth extraction; tooth loss

ÖZET Amaç: Bu çalışmanın amacı, bir ağız ve diş sağlığı merkezine başvuran çocuklardaki diş çekim sıklığının ve nedenlerinin yaş ve cinsiyete göre dağılımını kesitsel olarak değerlendirmektir. **Gereç ve Yöntemler:** Kasım 2021-Şubat 2022 tarihleri arasındaki 3 aylık süreçte çocuk diş hekimliği polikliniğine rutin muayene ve tedavi amacıyla başvuran hastaların (3-14 yaş arası) intraoral muayeneleri yapılmış ve panoramik radyografları alınmıştır. Değerlendirmeler sonucunda, dişlerine çekim endikasyonu konan çocukların diş çekim sebepleri, yaş ve cinsiyetleri kaydedilmiştir. Bunlarla birlikte, daha önceden çekilmiş olan dişler ve dişsiz boşluğa komşu dişte devrilme olup olmadığı not edilmiştir. Tanımlayıcı istatistikler ve ortalama değerler hesaplanmıştır. **Bulgular:** Kliniğe başvuran 3.074 (ortalama yaş: 8,3) çocuktan 953'ünün en az bir dişine çekim endikasyonu konulmuştur (%31). Dokuz yüz elli üç çocuğun toplam 1.461 dişine çekim endikasyonu konulmuştur. Süt dişlerinde en sık çekim nedeni çürük ve takiben fizyolojik mobilite iken, daimi dişlerde ise çürük ve büyük azı-keser olarak tespit edilmiştir. **Sonuç:** Çalışma sonucunda, en sık diş çekimi endikasyon nedeninin diş çürüğü olduğu tespit edilmiştir. Diş hekimliğindeki tüm gelişmelere rağmen diş çürükleri, günümüzde çocuklarda diş çekiminin en yaygın nedeni olmaya devam etmektedir. Çocuklarda erken diş kayıplarının olası olumsuz sonuçları göz önüne alındığında, ağız hijyeni eğitimleri ve bilinçlendirme programları aracılığı ile diş çürüklerinin ve çürük sebebiyle meydana gelen diş kayıplarının önüne geçilmesi önem arz etmektedir.

Anahtar Kelimeler: Diş çürüğü; maloklüzyon; diş çekimi; diş kaybı

Primary dentition is crucial for chewing, appearance, and the prevention of harmful habits, as well as in guiding the eruption of permanent teeth.[1] The loss of a primary tooth before its normal exfoliation is referred to as early or premature loss.[2] Although caries is the leading cause of extraction of primary teeth, this may also occur as a result of dental trauma, periodontal disease, and orthodontic reasons.[3,4] As a result of early loss of primary teeth, reduced arch length and space loss, delayed or premature eruption of permanent teeth, mesial drift of posterior teeth or distal drift of anterior teeth, and lack

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of chewing may occur.[5] It is an accepted opinion today that premature loss of primary teeth will cause malocclusion in the permanent dentition.[6] Early primary tooth loss has been reported to be approximately 48-51% in several studies.[5,7] Caries are also said to be the most common reason for tooth extraction.[8,9] Although permanent tooth extraction is less common in children and adolescents, extraction can be performed for reasons such as widespread carious and/or periapical infections with poor prognosis, compensating and balancing extractions at appropriate ages, trauma, orthodontic reasons, impacted or supernumerary teeth.[10] Permanent tooth extraction rates in Turkish and Nigerian children aged 6-16 have been reported to be between 12.5 and 20.1% respectively.[3,11]

The purpose of this study was to determine the prevalence and reasons for deciding to extract primary and permanent teeth as well as previous tooth losses in children aged between 3 and 15, in order to contribute to the development of protective strategies based on its findings.

MATERIAL AND METHODS

STUDY DESIGN

The study included pediatric patients aged between 3 and 15 years old who attended the Tepebaşı Oral and Dental Health Training and Research Hospital at the Ankara Yıldırım Beyazıt University Faculty of Dentistry for routine examination and dental treatments for a period of three months (November 2021-February 2022). A total of 3,074 patients were admitted to the clinic for dental examination and treatment, and 953 patients whose teeth were diagnosed as requiring extraction were included in the study.

This study was approved by the Ankara Yıldırım Beyazıt University Yenimahalle Research and Training Hospital Clinical Research Ethics Committee (date: October 27, 2021, no: E-2021-60). The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice. At the beginning of the study, participants (both children and parents) were informed about the study protocol and consent was obtained from the parents.

Intraoral examinations of each patient were carefully performed by the same pediatric dentist. A disposable dull explorer, a dental mirror, and a UNC periodontal probe were used for clinical evaluations. All the patients were also examined with panoramic radiographs. Demographic parameters, such as age and gender and the number of teeth to be extracted, reasons for extraction, previous tooth loss, space loss, and decayed, missed, filled teeth (DMFT)/dmft/dft scores, were recorded. The reasons for tooth extraction were documented as dental caries, physiological mobility, orthodontic reasons, trauma, failure of previous treatment, periodontal reasons or molar-incisor hypomineralization (MIH) as identified by Alsheneifi and Hughes.[12] Dentitions were noted as primary, mixed or permanent.

Space losses due to extracted teeth were captured through panoramic films using Image J program (National Institutes of Health, Bethesda, Maryland, USA) according to Canpolat's study.[13] The axis of the tooth adjacent to the edentulous space and the axis of the symmetrical tooth were drawn. A mirror image of the axis of the symmetrical tooth was drawn. Then, the difference between axes was recorded as tipping (Figure 1).

STATISTICAL ANALYSIS

The obtained data was collected and systemized using Microsoft Office Excel 16.56 and then processed with IBM SPSS (IBM Corp., Armonk, New York, USA) Statistics 26. Descriptive statistics and mean values were applied with crosstabs.

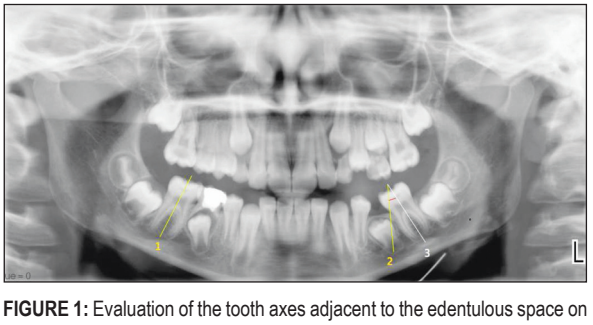

FIGURE 1: Evaluation of the tooth axes adjacent to the edentulous space on panoramic film with Image J program. (1) Axes of the symmetrical tooth, (2) Mirror image of the axes of the symmetrical tooth, (3) The current axes of the tooth.

RESULTS

A total of 3,074 patients attended to the pediatric dentistry clinic during the 3-month period. Indications for extraction were made for one or more teeth of 953 (31%) children aged 3-14 [mean age: 8.3; 447 (47%) females and 506 (53%) males] years for various reasons. The diagnoses for tooth extraction were highest in the 7-11 (62.8%) age group, followed by the 3-6 (25.2%) age group, and the 12-14 (12%) age group (Table 1).

The diagnoses for tooth extraction were highest in mixed dentition (69.5%), followed by primary (23%), and permanent dentition (7.5%). The mean dmft value was 8.8 in primary dentition, dft 8.0 and DMFT 6.0 in mixed dentition, and DMFT 6.7 in permanent dentition (Table 2).

A total of 1,461 teeth from 953 patients were diagnosed as requiring extraction for various reasons. Dental caries was the most common reason of indication for extraction with a rate of 50.7%, followed by physiological mobility (26.1%), failed restorations (9.1%), and periodontal problems (6.5%).

The tooth types with the most frequent indication for extraction were primary molars (75.1%), followed by the primary incisors (16.1%), permanent molars (7.3%), permanent premolars (1.1%), and permanent incisors (0.4%) (Table 3).

TABLE 1: Distribution of patients with teeth extraction indications according to age groups and gender.

	Gender			
Age	**Female (n)**	**Male (n)**	**Total (n)**	**Total (%)**
3-6	104	136	240	25.2
7-11	292	307	599	62.8
12-14	51	63	114	12

TABLE 2: Distribution of patients with extraction indication according to their dentition and mean dmft/dft/DMFT values.

Dentition type	**n**	**%**	**Mean dmft value**	**Mean dft value**	**Mean DMFT value**
Primary dentition	219	23	8.8	-	-
Mixed dentition	662	69.5	-	8.0	6.0
Permanent dentition	72	7.5	-	-	6.7
Total	953	100	-		-

DMFT: Decayed, missing, filled teeth.

TABLE 3: Tooth types and reasons for extraction indications.

	Teeth types					
Reasons	**Primary incisors (n)**	**Primary molars (n)**	**Permanent incisors (n)**	**Permanent premolar (n)**	**Permanent molar (n)**	**Total n (%)**
Caries	116	552	-	11	55	734 (50.3)
Failed restoration	14	111	-	2	5	132 (9.1)
Physiological mobility	81	299	1	-	-	381 (26.1)
Orthodontics	3	51	-	3	3	60 (4.1)
MIH	-	6	-	-	40	46 (3.1)
Periodontal problems	12	78	2	-	4	96 (6.5)
Trauma	9	-	-	-	-	9 (0.6)
Others	-	-	3	-	-	3 (0.2)
Total n (%)	235 (16.1)	1097 (75.1)	6 (0.4)	16 (1.1)	107 (7.3)	1461 (100)

MIH: Molar-incisor hypomineralisation.

TABLE 4: Percentage of reasons for tooth extraction by dentition in children.

	Dentition types							
Reasons	**Primary (n)**	**Primary (%)**	**Mixed (n)**	**Mixed (%)**	**Permanent (n)**	**Permanent (%)**	**Total (n)**	**Total (%)**
Caries	158	16.6	298	31.2	27	2.9	483	50.7
Failed restoration	9	0.9	65	6.8	12	1.3	86	9
Physiological mobility	19	2	224	23.5	5	0.5	248	26
Orthodontics	1	0.1	29	3	14	1.5	44	4.6
MIH	-	-	18	1.9	9	0.9	27	2.8
Periodontal problems	27	2.8	25	2.6	4	0.4	56	5.8
Trauma	4	0.4	2	0.2	-	-	6	0.6
Others	1	0.1	1	0.1	1	0.1	3	0.3
Total							953	100

MIH: Molar-incisor hypomineralisation.

The most common indication for tooth extraction was in mixed dentition due to caries (31.2%), followed by physiological mobility (23.5%). Caries was also the most common cause of tooth extraction in the primary dentition (16.6%), followed by periodontal problems, with a frequency of 2.8% in primary dentition. The most common reason for tooth extraction in permanent dentition was caries (2.9%), followed by orthodontics (1.5%) (Table 4).

A total of 291 (30.5%) children out of 953 had early primary tooth loss. The measurements from the panoramics showed that 234 of these 291 (80.4%) children had tipping in their adjacent teeth.

DISCUSSION

Tooth loss in a population can provide information about oral and dental health knowledge and attitudes, the level of dental care in the community, and the availability of dental services. Despite all the scientific and technological developments in dentistry, tooth extractions continue to be performed frequently, especially in pediatric patients. It is well known that early tooth loss has a negative impact on the quality of life of schoolchildren.[14] Despite the fact that the replacement of primary teeth with permanent teeth is a physiological process, early loss is frequent, and is caused by pathological factors such as caries, trauma or periodontal problems.

Notwithstanding the relative abundance of studies looking into the frequency and causes of primary tooth extractions in pediatric patients in Turkish subpopulations, surprisingly little information is available on permanent tooth loss.[8,9] Therefore, in the present study we investigated the frequency and causes of both primary and permanent tooth extractions. In addition, the frequency of previous early tooth loss in these patients and the presence of tipping in the adjacent tooth due to this loss were evaluated.

The results of the present study found that the rates between the genders were similar, which is in accordance with the results of previous studies.[15-17] Differences in early loss were detected in different age groups and the highest occurrence was recorded in children of around 8 and 9 years old, in accordance with the findings reported in previous studies.[8,15-17]

At least one tooth was diagnosed as requiring extraction in 31% of the patients who attended the clinic, which is consistent with studies conducted by researchers in developing countries.[17,18] In primary and mixed dentition, the indications for tooth extraction due to caries are 16.6% and 31.2%, respectively. Although varying results have been reported, studies have indicated that the main reason for tooth extraction is caries in both primary and mixed dentitions.[19-21] The reason why caries is found in different rates is probably related to cultural or nutritional differences and oral hygiene habits. Samuel et al. reported physiological mobility to be the second most common cause of tooth extraction in mixed dentition after caries, as in the present study.[22] In permanent denti-

tion, the most common reason was also caries (2.9%), followed by orthodontic reasons (1.5%). Although the number of studies evaluating the causes of primary tooth extraction in children is high, there are few studies investigating permanent tooth extraction. In a study conducted by Tokuç and Çelik, 6.8% of children had been diagnosed as requiring the extraction of at least one permanent molar tooth due to caries, a rate considerably higher than in the results of our study.[23]

Extraction may be the only option for severely affected MIH molars, which have a poor long-term prognosis.[24] Albadri et al. reported that after caries the 2nd most frequent cause of permanent first molar tooth extraction was MIH, with a rate of 11%; this is similar to our study.[25] Balanced or compensating extractions of first molars are considered part of the treatment planning process at this stage, in order to preserve occlusal relationships and arch symmetry within the developing dentition.[26] Prior to balanced or compensating extraction of first molars, the underlying malocclusion should be evaluated for any hypodontia, the presence or absence of crowding, the presence of a 3rd ed permanent molar, and the child's dental developmental stage.[24] It has been recommended these extractions be performed at the optimum developmental stage, that is, between the ages of 8 and 10.[27]

The most common tooth type that was diagnosed for extraction was the primary molar (75.1%). These findings run parallel to the studies conducted by Reddy et al. and Al-Assadi et al.[19,20] Possible explanations could be the morphological variation of the posterior teeth, a lower accessibility to brushing compared to the anterior teeth, and brushing dextricity.[28] This leads to plaque accumulation and eventually to dental caries, which necessitates the extraction of the molars, and thus the early teeth loss.

In the present study, the mean dmft value was 8.8 in primary and dft was 8.0 in mixed dentitions, whereas DMFT were 6.0 and 6.7 in mixed and permanent dentition respectively. According to data from the World Health Organization, if a 12-year-old child's DMFT value is between 4.5 and 6.5 they are considered at high risk of caries, whereas if this value are higher than 6.5 the child has a very high caries risk.[29] From the results of our study it can be concluded that the children included in the study had a high/very high risk of caries. This explains the greater need for extraction. Similarly, in the study of Feu et al., it was stated that high dmft scores were associated with early loss of primary teeth.[30]

In addition, 30% of the children included in the study had at least one early primary tooth loss. Even though we did not conduct an oral hygiene evaluation, this finding can be explained by the poor oral hygiene of the children, given the high dmft/DMFT scores in our study and the fact that the most common reason for extraction is dental caries in all dentitions. Another explanation for this high ratio may be related to the fact that many dentists favor extracting primary teeth rather than trying to restore them.[31] It might also be due to the fact that parents do not care about primary teeth because they believe the primary teeth will eventually be replaced.

Premature extraction of primary teeth results in an increased incidence of space loss through migration of adjacent tooth.[16] Many factors influence the pattern of space loss, including age, the developmental stage, which teeth have been lost, the presence of crowding or spacing, and occlusal relationships. Furthermore, mesial movement of the permanent first molar, impaction of the premolars and accelerated eruption of the permanent 2nd molar can be observed following a premature loss of primary molars. Space maintainers can frequently prevent space loss and either prevent or reduce the severity of later malocclusions.[32] In the present study, the incidence of tipping in the adjacent teeth of these children was found to be high (80.4%). These children did not have or use space maintainers after primary teeth extraction. This result is comparable to the study of Ibiyemi et al., who stated that 85% of the children did not use space maintainers after tooth extraction.[33] However, the method we used in our study constitutes a limitation as it does not adequately explain the space loss. It would be more accurate to conduct detailed model analyses for a better evaluation of space loss. Furthermore, the time elapsed since tooth extraction could not be learned due to the parents' lack of knowledge. It would be useful to evaluate the rela-

tionship between the time elapsed and tipping levels in detail in further studies.

According to the 2018 national oral health survey, 70% of 5-year-old and 25% of 12-year-old children had never been to the dentist. Moreover, the most common reason for utilizing the services was the occurrence of a dental problem (with a rate of 84% in 5-year-olds and 90% in 12-year-olds).[34] This data reveals that oral health culture is still developing and there is no system in place for routine dentist visits in Türkiye.[35] Considering the high rate of tooth extraction indicated due to caries (50.7%), it is clear that the parents and teachers need to be educated about oral hygiene, and that parents should be informed about the benefits of regularly visiting a dentist. Moreover, in order to reduce the prevalence of dental caries and improve oral health among children, appropriate oral health promotion and care programs should be implemented for use in day care centers and schools.

Despite the fact that the sample size was not small, the main limitation of the study is that the study was conducted at a single dental hospital, while there are more than ten dental hospitals in Ankara. Nevertheless, this hospital is Ankara's largest dental hospital. As a result, generalizations must be made with caution, as this study sample may not accurately reflect the prevalence of premature tooth loss in Turkish children. More research observing large groups of children from various regions is needed to reach a reliable conclusion.

CONCLUSION

This study emphasizes the importance of appropriate protective strategies. We found that the number of primary and permanent teeth that need to be extracted was high. Unnecessary teeth extraction in children should be prevented by emphasizing the importance of preventing dental caries and performing dental treatments at an early age, together with oral hygiene awareness and education programs in the community.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

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: *Esra Ceren Tatlı;* ***Design:*** *Esra Ceren Tatlı;* ***Control/Supervision:*** *Esra Ceren Tatlı;* ***Data Collection and/or Processing:*** *Esra Ceren Tatlı, Ayça Hande Sarı;* ***Analysis and/or Interpretation:*** *Esra Ceren Tatlı;* ***Literature Review:*** *Esra Ceren Tatlı;* ***Writing the Article:*** *Esra Ceren Tatlı;* ***Critical Review:*** *Esra Ceren Tatlı;* ***References and Fundings:*** *Esra Ceren Tatlı, Ayça Hande Sarı;* ***Materials:*** *Ayça Hande Sarı.*

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