Prevalence of Early Loss of Teeth 0-16 Year-Old Turkish Pediatric Population: A Ten-Year Retrospective Study

Ozgur DOGAN [1], Fatma Duygu DERTLI [2], Suat Serhan ALTINTEPE DOGAN [3], Meliksah URAL [1]

[1] Afyonkarahisar Health Science University, Department of Pediatric Dentistry
[2] Pediatric Dentist, Eskisehir
[3] Afyonkarahisar Health Science University, Department of Periodontology

ABSTRACT

Objective: This retrospective study aims to estimate the extraction frequencies of primary and permanent teeth in Turkish pediatric dental patients according to age and sex. **Materials and Methods:**Data collected from 21.856 patients aged 0-16 between 2012 and 2021 were evaluated. During the evaluation phase, patients were grouped according to their age and sex. Primary teeth, permanent first molars, and premolar teeth extraction were evaluated separately.A total of 19.502 records were evaluated. Microsoft Excel and SPSS data analysis software were used to analyze the data. To analyze the data, we used student t-tests, one-way ANOVA, Games-Howell post hoc, and chi-square tests to analyze the data. We adhere to the standard statistical significance level of 0.05. **Results:**The most commonly extracted permanent teeth are the first molars in the mandibula and the molar and premolars in the maxilla. Boys had higher tooth extraction than girls (p<0.05).Moreover, upper primary first molars were extracted in boys, and lower primary first molars were extracted in girls (p<0.001). **Conclusion:**Although great developments in smart technological devices and innovations in dentistry, tooth caries, and related tooth extractions are still the most frequently used dental procedure. Further studies on smart device-based dental hygiene education may reduce tooth extractions to provide training about these devices.
Keywords: Tooth Extraction, Permanent First Molar, Premolar Tooth Extraction.

0-16 Yaş Türk Pediatrik Popülasyonunda Erken Diş Kaybı Prevelansı: 10 Yıllık Retrospektif Çalışma

ÖZ

Amaç: Bu retrospektif çalışmanın amacı, Türk çocuk hastalarda yaş ve cinsiyete göre süt ve daimi dişlerin çekim sıklıklarını tahmin etmektir. **Gereç ve Yöntem:** 2012-2021 yılları arasında 0-16 yaş arası 21.856 hastadan toplanan veriler değerlendirilmiştir. Değerlendirme aşamasında hastalar yaş ve cinsiyetlerine göre gruplandırıldı. Süt dişleri, daimi birinci büyük azı dişleri ve premolar diş çekimleri ayrı ayrı değerlendirildi. Toplam 19.502 kayıt değerlendirilmiştir.Verileri analiz etmek için Microsoft Excel ve SPSS veri analizi yazılımları kullanılmıştır. Verileri analiz etmek için öğrenci t-testleri, tek yönlü ANOVA, Games-Howell post hoc ve ki-kare testleri kullanılmıştır. Standart istatistiksel anlamlılık düzeyi olan 0.05'e bağlı kalınmıştır. **Bulgular:** En sık çekilen daimî dişler mandibuladaki birinci molar dişler ve maksilladaki molar ve premolar dişlerdir. Erkeklerde diş çekimi kızlara göre daha fazladır (p<0.05). Ayrıca, erkeklerde üst birinci molar dişler, kızlarda ise alt birinci molar dişler daha sık çekilmiştir (p<0.001). **Sonuç:** Teknolojik cihazlardaki büyük gelişmeler ve diş hekimliğindeki yeniliklere rağmen, diş çürükleri ve buna bağlı diş çekimleri hala en sık kullanılan tedavi prosedürüdür, Akıllı cihaz tabanlı oral hijyen eğitimi üzerine yapılacak daha fazla çalışma, eğitim vermek için kullanılırsa diş çekimlerini azaltabilir.
Anahtar Kelimeler: Diş Çekimi, Molar Diş, Premolar Diş Çekimi.

Sorumlu Yazar / Corresponding Author: Melikşah URAL, Afyonkarahisar Health Science University, Department of Pediatric Dentistry, Aftonkarahisar, Türkiye
E-mail: meliksahural@gmail.com

INTRODUCTION

Properly developing dentofacial structures and establishing normal occlusal relationships are both possible by keeping the teeth healthy in both primary and young permanent dentition (Monte-Santo & ark., 2018). Primary teeth lost before the normal exfoliating time are called premature tooth loss (Tatlı & Sarı, 2022). Despite advances in modern dentistry, The extraction of teeth remains frequently performed in dentistry (Alsheneifi & Hughes, 2001). Appropriate childhood healthcare is essential for developing healthy teeth and a correct occlusal relationship. Therefore, maintaining healthy dentition is the responsibility of all dentists, especially pediatric dentists in childhood (Bamashmoos & ark., 2020).

Pathologies that cause tooth extraction have previously been revealed in detail in the literature. Several reasons can lead to dental extractions, including caries, periodontitis, traumatic dental injuries, impacted teeth, unsuccessful dental procedures, and orthodontic treatment (Caldas, Marcenes & Sheiham, 2000; Chestnutt, Binnie & Taylor, 2000; Matthews, Smith & Hanscom 2001; Perera & Ekanayake, 2011; Tatlı & Sarı, 2022). Despite other etiological causes, caries and periodontitis are the two most common major reasons of extractions (Akhter,Hassan,Aida,Zaman & Morita, 2008; Chrysanthakopoulos & Nikolaos, 2011; Tatlı & Sarı, 2022). Studies have indicated that the number of teeth extracted generally increases with age (Lesolang, Motloba & Lalloo, 2009). The number of extracted teeth and whether they have previously been treated indicate socioeconomic status and oral hygiene level (Chrysanthakopoulos & Nikolao, 2011; Miyaura ,Matsuka, Morita, Yamashita & Watanabe, 1999; Tokuç & Çelik, 2022).

The primary goals of modern dentistry is to prevent premature tooth loss. Determining the teeth that are more commonly lost is essential in preventing tooth loss. Recent studies state that the frequency of tooth extraction has decreased. In contrast, others indicate that it has increased in recent years (Perera & Ekanayake,2011, Müller, Naharro & Carlsson, 2007). The common attribute of all studies is that further studies should incorporate larger populations. The present study, which analyzes the prevalence of tooth extraction, has the largest pediatric population in Turkey.

MATERIALS AND METHODS
Study type

We analyzed data from 21.856 patients, ranging in age from 0 to 16 years, who had experienced tooth extraction at Afyonkarahisar Health Sciences University Faculty of Dentistry between 2012 and 2021. The Department of Pediatric Dentistry has provided dentistry services since 2012 using the same ENLIL database (Efe Eroğlu Information Technologies Industry and Trade Limited Company,

Odunpazarı, Eskişehir). The data of the dental treatment access codes and their corresponding dental treatment terminology in the database were compared. Periapical radiographs of the patients who underwent tooth extraction were examined with code 401051, and orthopantomographic X-ray images were examined with code 401080. The system code in this database was defined as 405010-1 for primary tooth extraction, 405010-2 for permanent tooth extraction, and 405021 for permanent tooth extraction with complications. These data entered into the ENLIL database were filtered and divided into groups after they were imported into the Excel (Excel, Office 365, Microsoft) numerical data processing software. The decision on the consistency of the clinical procedure and the codes entered into the system, the elimination of mistakes, and the accuracy of the data entered into the system were checked and approved by four researchers separately. After analyzing the data, it was found that 19.502 patients out of 21.856 were eligible to be included in the study. 2354 (10.77%) person were excluded from the analysis, including those who entered the system with the wrong transaction code, who had tooth extraction inconsistent with their age, and who did not have radiography. The pediatric dentistry clinic is only available for individuals under 16. Therefore, the study did not include individuals who were 16 years old or older. The teeth and ages were divided into specific groups to provide accurate statistical evaluation results and ease of analysis.

Less frequently extracted teeth in the pediatric population were excluded from the study to avoid disturbing the homogeneity of the statistical evaluation and to interpret the results more accurately.

Statistical analysis

SPSS (v.21, IBM Corporation, Armonk, NY, USA) software was used to dissect the data. Standard deviation and median (minimum-maximum) were used as descriptors for quantitative variables, and the number of patients (percentage) was used for qualitative variables. If there was a difference between a qualitative variable and two categories in a quantitative variable, a student t-test was utilized since standard distribution assumptions were provided. Thus, one-way ANOVA was used to determine whether there was a difference between the categories of the qualitative variable and more than two categories in a quantitative variable. The chi-square test was used to examine the relationship between two qualitative variables. Paired groups that created a significant difference were examined with the Games Howell post hoc test. The statistical significance level was set at 0.05.

Ethical considerations

The Afyonkarahisar Health Sciences University, Faculty of Medicine Ethics Committee, 2022/6, approved this study. All participants signed an informed consent form, and all procedures performed

in studies involving human participants were in accordance with the Helsinki Declaration.

Patients were categorized into one of the abovementioned groups, as appropriate, and then formed into groups (Table 1). The individuals with extracted teeth were grouped by sex, determining the tooth group extracted. Furthermore, the group of primary teeth extracted most frequently were categorized based on the age of the patients (Table 2). Tables 2, 3, and 4 groups and evaluate the distribution of primary and permanent teeth based on age and sex.

RESULTS

The average age of the patients who had a tooth extraction was 8.13 (mean) (Table 1) (Figure 1). The most frequently extracted tooth group among primary dentition was the lower primary molars, followed by upper primary molars and upper primary incisors (Table 1) (Figure 2). The mandibular molars were the most frequently extracted permanent teeth (Table 1), followed by maxillary molars and maxillary premolars (Table 2) (Figure 3). The maxillary and mandibular permanent first molars were compared. A significant age difference between maxillary and mandibular permanent molar extraction has been

determined ($p<0.001$) (Table 2). After comparing the data by sex, it was found that boys had a higher frequency of permanent first molar extraction on the maxilla. The girls had a higher rate of lower permanent first molar ($p>0.05$) (Figure 4). Only the maxillary and mandibular permanent first molars showed a significant difference in age between the tooth groups ($p<0.001$) (Table 2) (Figure 5). Additionally, there were notable age and sex variations between the different permanent tooth groups ($p<0.001$). The majority of the permanent upper molars consisted of boys, while the upper premolars, lower premolars, and the majority of the lower molars consisted of girls (Table 4).

Comparisons were made for primary tooth groups, and significant differences were found between them in terms of age and sex ($p<0.001$ and $p<0.001$, respectively). The mandibular primary incisors were extracted most frequently at six years of age, and the primary molar group was as at 8.5. The lower primary incisors and upper and lower primary canine tooth extraction procedures were mostly performed on girls ($p>0.05$) (Table 2).

Table 1. Descriptive values.

Variables		(%)
Age (years)	**Mean ± SD**	8.13 ± 2.20
	Median (Min-Max)	8.00 (0.00-16.00)
Primary tooth, n (%)	Maxillary Primary Incisor	2770 (15.2)
	Mandibular Primary Incisor	1421 (7.8)
	Maxillary And Mandibular Primary Canines	1414 (7.8)
	Maxillary Primary Molars	5738 (31.6)
	Mandibular Primary Molars	6827 (37.6)
Permanent tooth, n (%)	Maxillary Premolars	240 (23.8)
	Mandibular Premolars	82 (8.1)
	Maxillary Molars	264 (26.2)
	Mandibular Molars	421 (41.9)
Tooth Groups, n (%)	Primary Tooth	18170 (94.7)
	Permanent Tooth	1007 (5.3)
Permanent First Molar, n (%)	Maxillary Permanent First Molar	264 (38.5)
	Mandibular Permanent First Molar	421 (61,5)
Sex, n (%)	Male	10202 (53.2)
	Female	8975 (46.8)

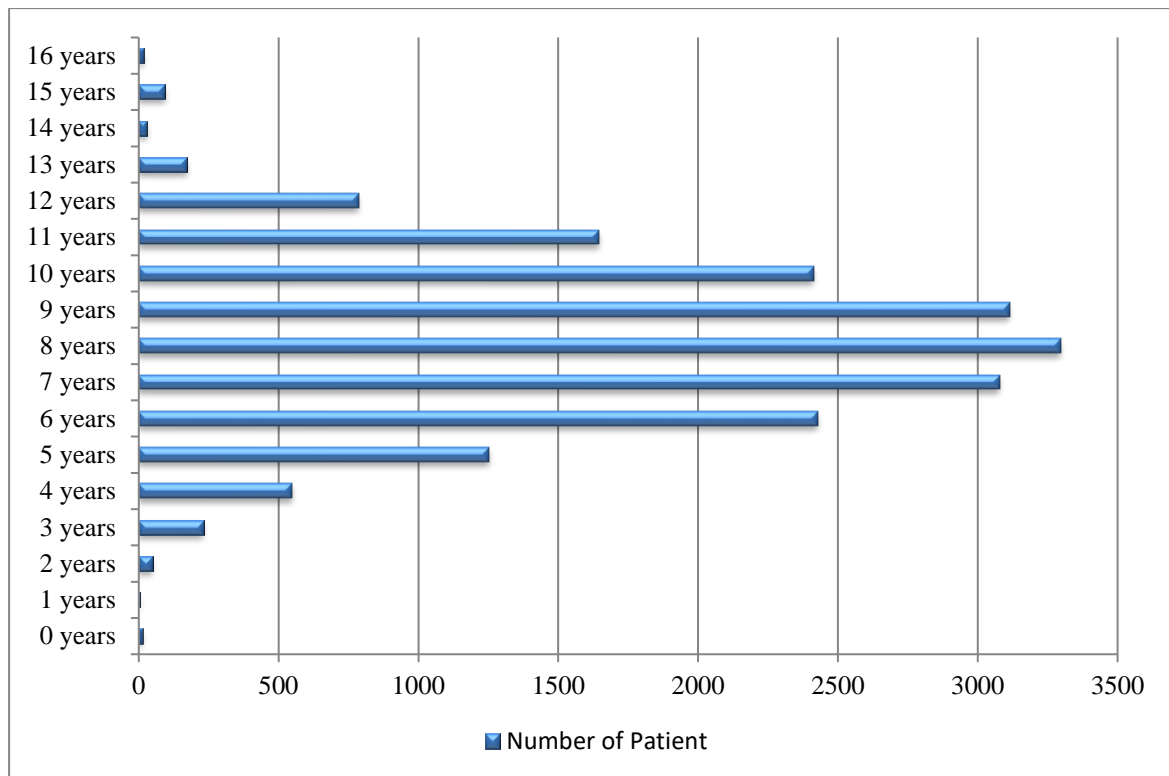**SD:** Standard Deviation, **Min:** Minimum, **Max:** Maximum.

Figure 1. **Distribution of the number of patients admitted by age.**

Table 2. The relation of the extraction of primary teeth with age and sex.

Variables		Maxillary Primary Incisor	Mandibular Primary Incisor	Maxillary and Mandibular Primary Canines	Maxillary Primary Molars	Mandibular Primary Molars	p
Age (years)	**Mean±SD**	6.20 ± 1.77	6.60 ± 1.27	9.93 ± 1.54	8.46 ± 2.01	8.17 ± 1.82	<0.001[a]
	Median (Min-Max)	6.00 (1.00-12.00)	7.00 (0.00-11.00)	10.00 (2.00-12.00)	9.00 (2.00-12.00)	8.00 (3.00-12.00)	
Sex, n (%)	Male	1602(57.8)	694 (48.8)	660 (46.7)	3094 (53.9)	3732 (54.7)	<0.001[b]
	Female	1168(42.2)	727 (51.2)	754 (53.3)	2644 (46.1)	3095 (45.3)	

Table 3. Comparison of maxillary and mandibular permanent first molars.

Variables		Maxillary Permanent First Molar	Mandibular Permanent First Molar	p
Age (years)	Mean ± SD	9.76 ± 1.50	9.30 ± 1.58	<0.001[a]
	Median (Min-Max)	10.00 (6.00-14.00)	9.00 (6.00-13.00)	
Sex n (%)	Male	137 (51.9)	195 (46.3)	0.155[b]
	Female	127 (48.1)	226 (53.7)	

SD: Standard Deviation, Min: Minimum, Max: Maximum, a: Student's t-test, b: Chi-square test
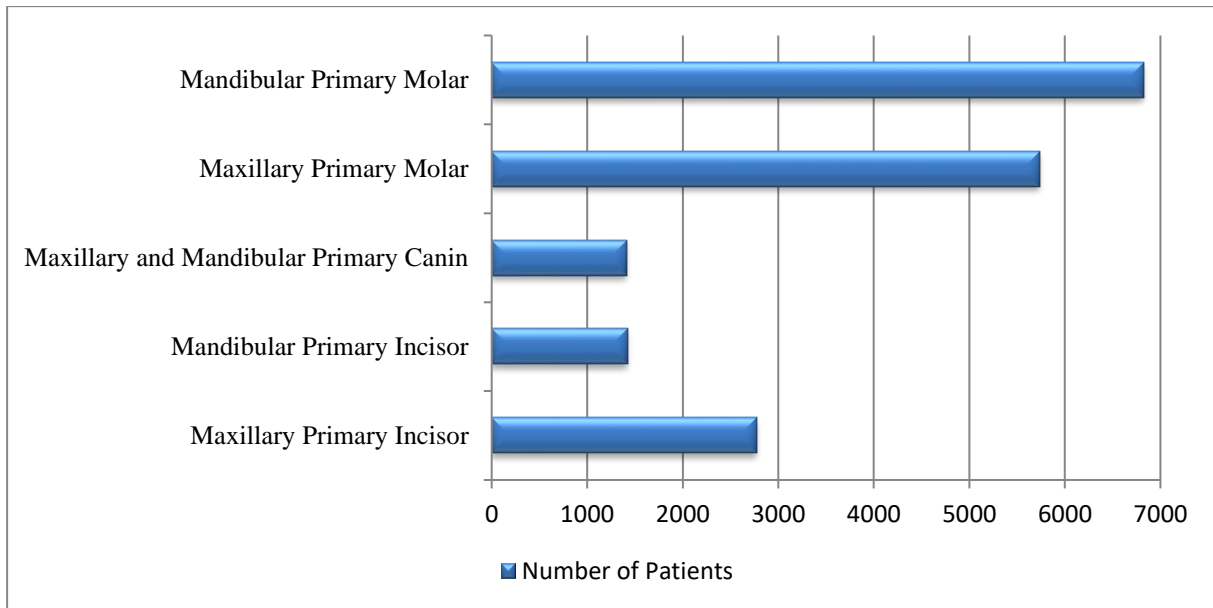
Figure 2. Distribution of the number of patients admitted by primary tooth types.
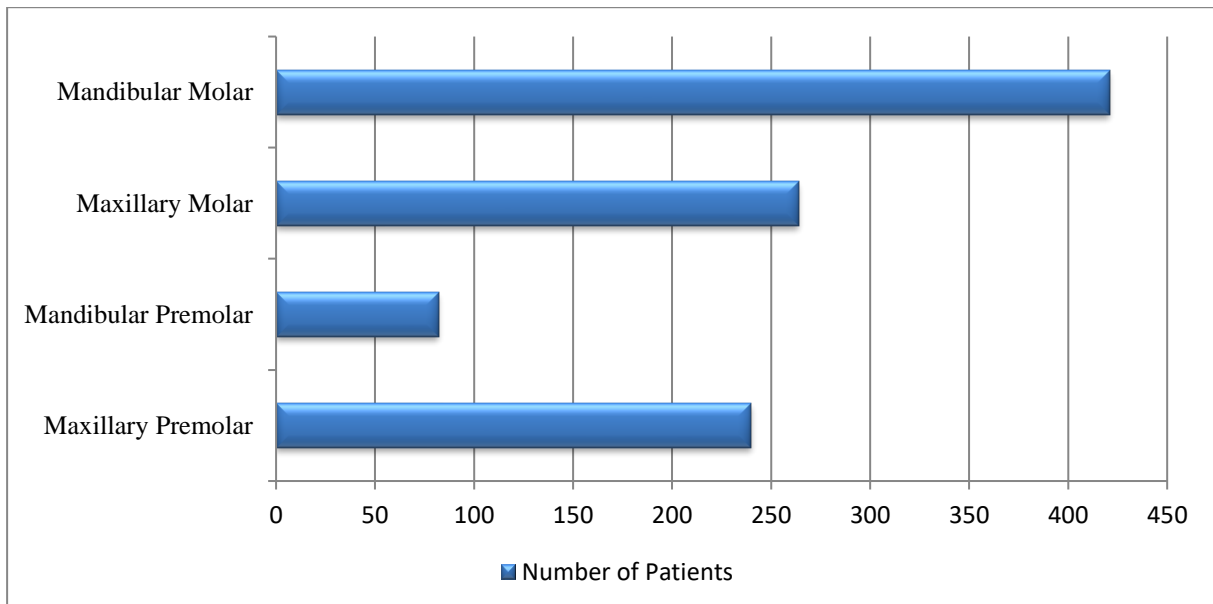

Figure 3. Distribution of the number of patients admitted by permanent tooth type.

Table 4. Comparison to permanent tooth.

Variables		Maxillary Premolar	Mandibular Premolar	Maxillary Molar	Mandibular Molar	p
Age (years)	**Mean±SD**	14.13 ± 1.05	12.62 ± 0.54	9.76 ± 1.50	9.30 ± 1.58	<0.001[a]
	Median (Min-Max)	14.00 (13.00 -16.00)	13.00 (11.00-13.00)	10.00 (6.00-14.00)	9.00 (6.00-14.00)	
Sex, n (%)	Male	71 (29.6)	17 (20.7)	137 (51.9)	195 (46.3)	<0.001[b]
	Female	169 (70.4)	65 (79.3)	127 (48.1)	226 (53.7)	

SD: Max standard deviation, Min: minimum, Max: maximum, a: one-way ANOVA test, b: chi-square test
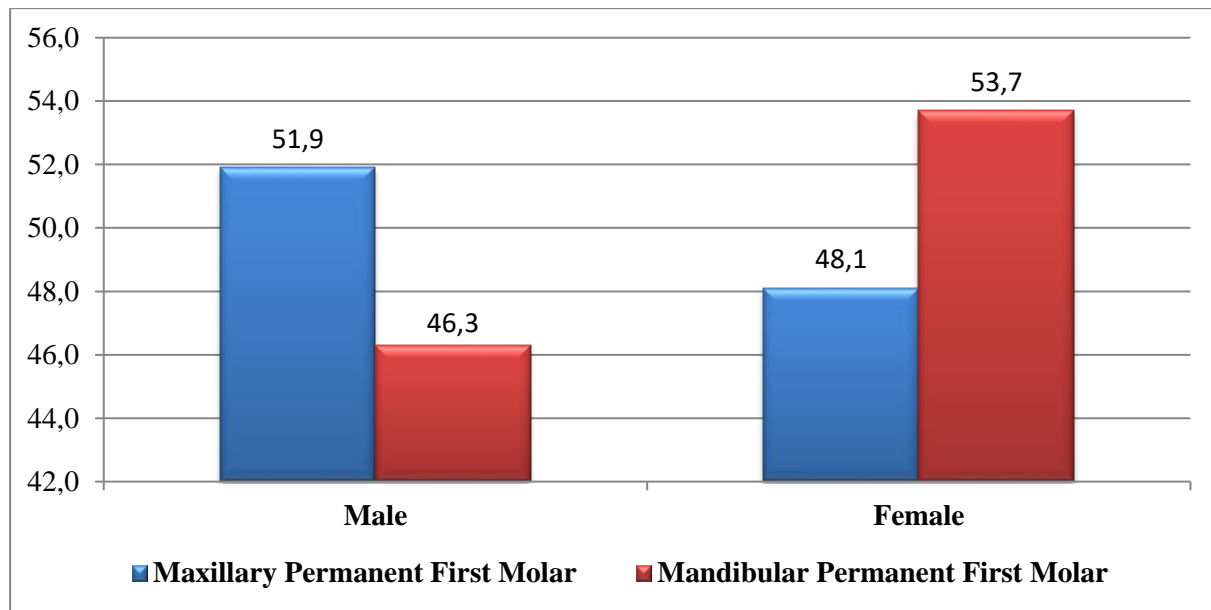
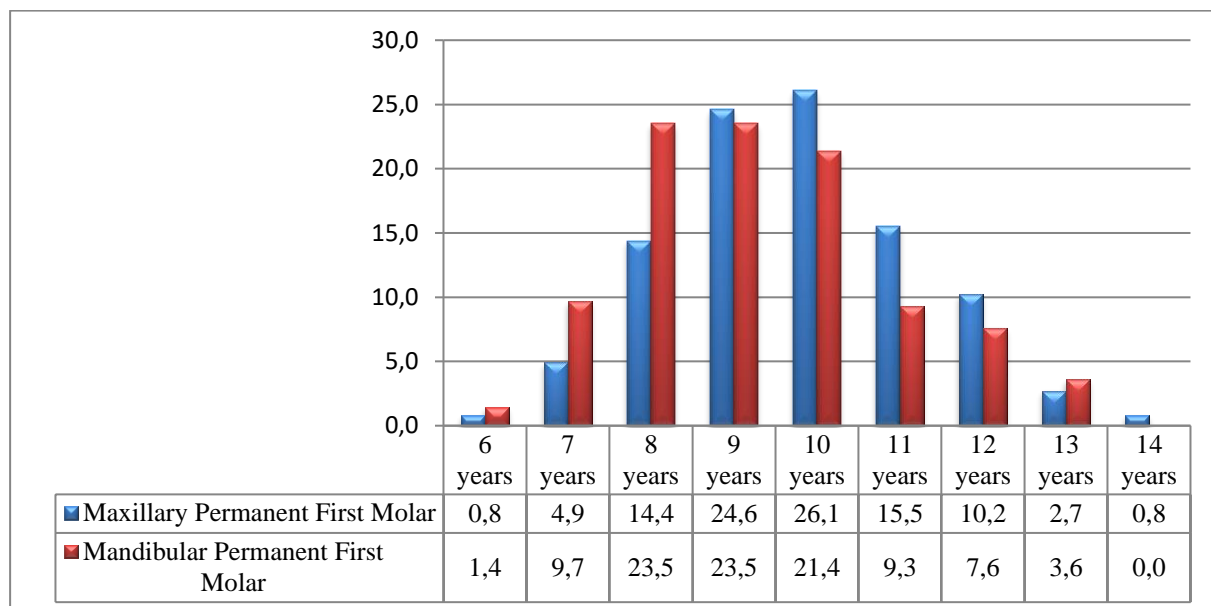**Figure 4. Distribution of permanent first molar tooth types by sex.**

	6 years	7 years	8 years	9 years	10 years	11 years	12 years	13 years	14 years
Maxillary Permanent First Molar	0,8	4,9	14,4	24,6	26,1	15,5	10,2	2,7	0,8
Mandibular Permanent First Molar	1,4	9,7	23,5	23,5	21,4	9,3	7,6	3,6	0,0

Figure 5. Distribution of permanent first molar types by age group.

DISCUSSION

There is limited research on tooth extraction frequency among the general population in Turkey and pediatric patients (Demiriz & Hazar Bodrumlu, 2018; Tatlı & Sarı, 2022). The prevalence of tooth extraction with the most extensive sample group among the studies conducted in the Turkish pediatric population was evaluated. The data from 19.502 people were examined within the scope of the study. Previous studies suggested that accessible dental health services can significantly affect individuals views and attitudes toward oral health (Angelillo, Nabilo & Pavila, 1996; Burdurlu, Dagasan, Cabbar, Karakurt & Atalay, 2020). Tooth caries still maintain the characteristic of being the primary etiological cause of tooth extraction in developing countries (Al-Shammari, Al-Ansari, Al-Melh, & Al-Khabbaz,

2006). More effective education and awareness-raising strategies can be developed to prevent tooth loss by examining and evaluating tooth extraction causes and prevalence according to age groups(Alsheneifi & Hughes, 2001).

Parents worldwide do not take their children to visit the dentist unless they complain of pain(Ahamed et al., 2012). Another reason is that parents avoid treatment, thinking that permanent teeth can replace primary teeth in the future (Burdurlu et al., 2020). The process of tooth extraction can significantly diminish the quality of life for individuals, regardless of whether they are children or adults (Al-Omiri, Karasneh, Lynch, Lamey & Clifford, 2009; Brennan et al., 2008). Uncontrolled dental caries and related tooth extractions in childhood lead to a loss of teeth over the years, leading to earlier onset of physical

disability and a higher early death rate in old age (Holm-Pedersen, Schultz-Larsen, Christiansen, & Avlund, 2008). As a result of the study, the most frequently extracted primary tooth group primary mandibular molars, followed by primary maxillary molars, primary incisors. The results were consistent with the previous studies of Bani et al.,(Bani et al., 2015) Demiriz & Bodrumlu (Demiriz & Hazar Bodrumlu, 2018). Burdurlu et al.,(Burdurlu et al., 2020), and Tatlı & Sarı(Tatlı & Sarı, 2022). These results were also previously reported by Tatlı & Sarı,(Tatlı & Sarı, 2022) Burdurlu et al.,(Burdurlu et al., 2020) and Bani et al.(Bani et al., 2015). In this study, it was found that boys had a higher rate of tooth extraction compared to girls. This observation can be attributed to the analysis of a large sample group (Tatlı & Sarı, 2022), which determined that boys lost their primary teeth significantly more than girls.

Pathologies such as the placement of the first molars at the end of the dental arch, their contact with the second primary molars, deep pits and fissures on the occlusal surface, and hypomineralization of the maxilla as well as incisors led to more caries, restorations, endodontic treatment, and tooth extraction in these teeth. The mandibular first molars were the most extracted permanent teeth, as shown in previous studies (Esin Günal, 2020; Halicioglu Toptas, Akkas, & Celikoglu, 2014; Tatlı & Sarı, 2022; Tokuç & Çelik, 2022). Maxillary molars and maxillary premolars, followed this. The results show that mandibular molars are lost significantly earlier than maxillary molars. The extraction age in mandibular molars is predominantly 9. The maxillary molars are mainly extracted at the age of 10.

In adolescents and young adults, premolar extractions, mainly upper ones, are performed as a part of orthodontic treatment (Halicioglu Toptas, Akkas, & Celikoglu, 2014). Anterior tooth crowding and lip protrusion are corrected by maxillary permanent first premolar extraction and, less frequently, second premolar extraction. In addition, the treatment protocol includes provision of occlusal rehabilitation in hyper-divergent face types and reduction of the vertical facial dimension (Kouvelis et al., 2018). In this study, evaluating the prevalence of extracted teeth and orthopantomographic examinations, the researchers confirmed that most of the maxillary and mandibular premolars were extracted because of the caries, unsuccessful treatments, compensation-balance procedures. Based on this information, premolars are extracted for orthodontic purposes. The upper premolars were extracted significantly more than the lower premolars. Maxillary premolar teeth are extracted at a significantly higher rate in girls than boys. There is a need for further studies on the Turkish population in this regard (Kouvelis et al., 2018).

The most important limitation is the inability to analyze the causes of extraction. The records of patients who visited the clinic were analyzed, focusing on a large sample of patients over the age of 10. The ENLIL data system has no data entry window where the reason for extraction is entered. However, in the data filtering, thickness checking, and analysis processes carried out by all four experimenters simultaneously, caries were the most common reason for extraction. Many parents do not have enough information about the early loss of primary teeth and the pathologies it can cause. Parents and caregivers are responsible for children's oral hygiene habits. Although it seems possible to avoid early tooth loss and its complications in pediatric and adolescent patients by educating parents, this issue is still controversial in the literature (Selwitz, Ismail & Pitts 2007). Studies have determined that school-based oral education programs generally give more effective results than community-based oral education programs (Larsen, Larsen, Handwerker, Kim, & Rosenthal, 2009).

It has been noted that the most frequently extracted teeth among adolescents are the mandibular molars, which are permanent molars. The results obtained in the current study confirm this. The cause for the extraction of permanent mandibular molars is similar to primary molars. In addition, it is one of the earliest permanent teeth to erupt in the mouth for most people. Individuals with active caries are more prone to experiencing early tooth caries during the eruption.

Limitations of study

There are significant limitations to this retrospective study, which analyzed patient records spanning a decade. In the 10-year retrospective design of this study, there is a high probability of mistakes in patient information. Researchers have invested significant effort in minimizing the occurrence of mistakes. One of the significant limitations is that the ENLIL database lacks information on the reasons for tooth extractions. In case of conflicting information regarding the age and the extracted tooth, the researchers reviewed the orthopantomography film of the patient again. Approximately 3000 patients were excluded from the study in this way. Based on our analysis, we have identified the most frequent mistakes that occur during data entry.

• Labeling of permanent tooth numbers despite primary tooth extraction.

• Entering permanent tooth extraction numbers into the system as primary tooth numbers.

• Tooth extraction without taking any radiographs from the patients to be extracted.

• Residual root extraction can make it seem like the primary tooth was extracted again.

• Supernumerary tooth extraction entered into the system as the number of the adjacent tooth. (No supernumerary tooth extraction entry information exists in the ENLIL database.)

• Spontaneously exfoliated teeth entered on the system as a later extraction by a dentist.

• Entering teeth lost due to trauma into the system as extractions by a dentist.

The number of final patients decreased to 19,502 with the elimination of mistakes by examining such reasons in detail.

This study, carried out by examining the data extensively, is one of the rare studies conducted in Turkey on this subject and in this context. The obtained data was collected exclusively from one city. Afyonkarahisar is a city located west of central Anatolia in Turkey. Its sociodemographic structure reflects the diversity found throughout Turkey (Müjgan, 2007). Studies with larger sample sizes and multi-centers are necessary to confirm the outcomes. The current study determined that tooth extraction was performed on babies under one year old. However, the majority of these patients lack radiographs. It was determined that these babies' primary incisors and natal/neonatal lower incisors were extracted. These babies were not excluded from the study, assuming that they had their primary teeth extracted.

According to the findings of the study, it was observed that boys had a higher incidence of extraction. Although this issue has been mentioned in the literature, it remains controversial. Boys may resist following parental instructions; they are more active and may express a stronger desire to conduct their tooth brushing (Peretz & Efrat, 2008). The lower instances of these factors in girls can often lead to the prevention of extraction procedures. Studies on patient compliance in dental clinics have shown that boys tend to have higher treatment compliance rates than girls (Peretz & Efrat, 2008).

CONCLUSION

Awareness should be raised through oral hygiene education for preschool and school children. Parents and children should be advised that dental caries is preventable, and that caries treatment is essential in the early period. Thus, tooth extraction and related complications can be prevented. All dentists should explain in detail to their patients and parents the importance of healthy dentition and how to maintain it.

Acknowledgement

Conflict of Interest

The author declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Author Contributions

Plan, design: ÖD, FDD; **Material, methods and data collection:** SSAD, FDD; **Data analysis and comments:** ÖD; **Writing and corrections:** ÖD, MU

Funding

Ethical considerations

The Afyonkarahisar Health Sciences University, Faculty of Medicine Ethics Committee, 2022/6, approved this study. All participants signed an informed consent form, and all procedures performed in studies involving human participants were in accordance with the Helsinki Declaration.

REFERENCES

Ahamed, S. S., Reddy, V., Krishnakumar, R., Mohan, M., Sugumaran, D., & Rao, A. (2012). Prevalence of early loss of primary teeth in 5-10-year-old school children in Chidambaram Town. *Contemporary Clinical Dentistry*, *3*(1), 27. https://doi.org/10.4103/0976-237X.94542

Akhter, R., Hassan, N. M. M., Aida, J., Zaman, K. U., & Morita, M. (2008). risk indicators for tooth loss due to caries and periodontal disease in recipients of free dental treatment in an adult population in Bangladesh. *Oral Health & Preventive Dentistry*, *6*(3), 199–207.

Al-Omiri, M. K., Karasneh, J. A., Lynch, E., Lamey, P.-J., & Clifford, T. J. (2009). Impacts of missing upper anterior teeth on daily living. *International Dental Journal*, *59*(3), 127–132.

Al-Shammari, K. F., Al-Ansari, J. M., Al-Melh, M. A., & Al-Khabbaz, (2006). Reasons for tooth extraction in Kuwait. *Medical Principles and Practice*, *15*(6), 417–422. https://doi.org/10.1159/000095486

Alsheneifi, T., & Hughes, C. V. (2001). Reasons for dental extractions in children. *Pediatric Dentistry*, *23*(2), 109–112.

Angelillo, I. F., Nobile, C. G. A., & Pavia, M. (1996). Survey of reasons for extraction of permanent teeth in Italy. *Community Dentistry and Oral Epidemiology*, *24*(5), 336–340. https://doi.org/10.1111/j.1600-0528.1996.tb00872.x

Bamashmoos, K. A. O., Alhasani, A. H., Al-Akwa, A. A. Y., Zabara, A. Q. M. Q., Al-Shamahy, H. A. wahab, Al-deen, H. M. S., & Al-labani, M. A. et al. (2020). Prevalence of premature loss of prımary teeth at the age of 6-10 y ears in Sana'a City, Yemen. *Universal Journal of Pharmaceutical Research*. https://doi.org/10.22270/ujpr.v5i4.439

Bani, M., Akal, N., Bodur, H., Odabaş, M. E., Tüzüner, T., Delilbaşı, A. E., & Özdoğan, Y. T. et al. (2015). The reasons for extractions of primary teeth in Turkish Children. *European Journal of Paediatric Dentistry*, *16*(3), 187–190.

Brennan, D. S., Spencer, A. J., & Roberts-Thomson, K. F. (2008). Tooth loss, chewing ability and quality of life. *Quality of Life Research*, *17*(2), 227–235. https://doi.org/10.1007/s11136-007-9293-2

Burdurlu, Ç., Dagasan, V., Cabbar, F., Karakurt, C., & Atalay, B. (2020). Retrospective analysis of primary teeth extractions. *Yeditepe Dental Journal*, *16*(1), 49–53. https://doi.org/10.5505/yeditepe.2020.14227

Caldas, A. F., Marcenes, W., & Sheiham, A. (2000). Reasons for tooth extraction in a Brazilian population. *International Dental Journal*, *50*(5), 267–273. https://doi.org/10.1111/j.1875-595X.2000.tb00564.x

Chrysanthakopoulos, Nikolaos A. (2011). reasons for extraction of permanent teeth in greece: a five-year follow-up study. *International Dental Journal*, *61*(1), 19–24. https://doi.org/10.1111/j.1875-595X. 2011 00 004.x

Demiriz L., & Hazar Bodrumlu, E. (2018). reasons for the extraction of primary teeth in primary school-age children in Zonguldak, Turkey: a retrospective study. *Meandros Medical and Dental Journal*, *19*(1), 32–38. https://doi.org/10.4274/meandros.21939

Esin Günal, P. B. (2020). Çocuk hastalarda erken diş kaybının yaşa ve diş grubuna göre incelenmesi. *Ankara Üniversitesi Diş Hekimliği Fakültesi Dergisi*, *1–3*(47), 27–35.

Halicioglu, K., Toptas, O., Akkas, I., & Celikoglu, M. (2014). Permanent first molar extraction in adolescents and young adults and its effect on the development of third molar. *Clinical Oral Investigations*, *18*(5), 1489–1494. https://doi.org/10.1007/s00784-013-1121-1

Holm-Pedersen, P., Schultz-Larsen, K., Christiansen, N., & Avlund, K. (2008). Tooth loss and subsequent disability and mortality in old age. *Journal of the American Geriatrics Society*, *56*(3), 429–435. https://doi.org/10.1111/j.1532-5415.2007.01602.x

Kouvelis G, Dritsas K, Doulis I, Kloukos D, Gkantidis N. Effect of orthodontic treatment with 4 premolar extractions compared with nonextraction treatment on the vertical dimension of the face: A systematic review. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2018;154(2):175-187.

Larsen , C. D., Larsen, M. D., Handwerker, L. B., Kim, M. S., & Rosenthal, M. (2009). A comparison of urban school- and community-based dental clinics. *Journal of School Health*, *79*(3), 116–122. https://doi.org/10.1111/j.1746-1561.2008.00395.x

Lesolang , R. R., Motloba, D. P., & Lalloo, R. (2009). Patterns And Reasons Fo Clinic: 1998-2002. *SADJ : Journal of the South African Dental Association = Tydskrif van Die Suid* r Tooth Extraction At The Winterveldt,-*Afrikaanse Tandheelkundige Vereniging*, *64*(5), 214–215, 218.

Matthews, D. C., Smith, C. G., & Hanscom, S. L. (2001). Tooth loss in periodontal patients. *Journal (Canadian Dental Association)*, *67*(4), 207–210.

Miyaura , K., Matsuka, Y., Morita, M., Yamashita, A., & Watanabe, T. (1999). comparison of biting forces in different age and sex groups: a study of biting efficiency with mobile and non-mobile teeth. *Journal of Oral Rehabilitation*, *26*(3), 223–227. https://doi.org/10.1046/j.1365-2842.1999.00364.x

Monte Santo , A. S., Viana, S. V. C., Moreira, K. M. S., Imparato, J. C. P., Mendes, F. M., & Bonini, G. A. V. C., et al. (2018). Prevalence of early loss of primary molar and its impact in schoolchildren's quality of life. *International Journal Of Paediatric Dentistry*, *28*(6), 595–601. https://doi.org/10.1111/ipd.12416

Müjgan , G. (2007). *Kentleşme sürecinde akrabalık ve komşuluk kültürü*. Afyon Kocatepe Üniversitesi, Afyonkarahisar

Müller, F., Naharro, M., & Carlsson, G. E. (2007). What are the prevalence and incidence of tooth loss in the adult and elderly population in Europe? *Clinical Oral Implants Research*, *18*, 2–14. https://doi.org/10.1111/j.1600-0501.2007.01459.x

Perera, R., & Ekanayake, L. (2011). Tooth loss in Sri Lankan adults. *International Dental Journal*, *61*(1), 7–11. https://doi.org/10.1111/j.1875-595X.2011.00002.x

Peretz, B., & Efrat, J. (2008). Dental anxiety among young adolescent patients in Israel. *International Journal of Paediatric Dentistry*, *10*(2), 126–132. https://doi.org/10.1046/j.1365-263x.2000.00181.x

Selwitz, R. H., Ismail, A. I., & Pitts, N. B. (2007). Dental caries. *The Lancet*, *369*(9555), 51–59. https://doi.org/10.1016/S0140-6736(07)60031-2

Tatlı, E. C., & Sarı, A. H. (2022). Evaluation of the frequency of primary and permanent teeth extraction in children at a dental hospital: a cross-sectional study. *Turkiye Klinikleri Journal of Dental Sciences*, *28*(4), 839–845. https://doi.org/10.5336/dentalsci.2022-90792

Tokuç, M., & Çelik, M. (2022). Çocuklarda Diş çürüğü nedeniyle birinci büyük azı dişi çekimlerinin incelenmesi. *Acta Odontologica Turcica*, 16–20. https://doi.org/10.17214/gaziaot.90551