

Evaluation of Principal Reasons of Tooth Extractions in Turkish Population: A Retrospective Study

Türk Toplumunda Diş Çekimlerinin Başlıca Nedenlerinin Değerlendirilmesi: Retrospektif Bir Çalışma

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ABSTRACT Objective: Aim of this study is to investigate causes of tooth extractions, its association with age and gender amongst patients in İzmir. **Material and Methods:** A record of all tooth extractions complied with the treatment plan performed in Ege University Faculty of Dentistry Department of Oral and Maxillofacial Surgery for two years period. The analyses of extractions were performed on panoramic x-ray films before and after dental therapy, checked from patient charts retrospectively. The patients' age, gender, number of extracted teeth, and extraction reason(s) were recorded. **Results:** A total of 2,843 extracted teeth in 1,426 systemic healthy patients were included. Failures in endodontic treatment were the main reasons (31.2%) of tooth extractions, followed by periodontal disease and caries (23.3-22.6%) respectively. Inaccessible root canals were the principal cause for extraction in endodontic treatment failures (32.3%), while inadequate root canal fillings (16.4%) and perforation in root canal or bifurcation (15.5%) had statistically significant values. **Conclusion:** Failures in endodontic treatments are the principal cause for extractions in overall population, while periodontal disease accounts for the majority of tooth loss in patients older than 50 years. This study indicates that excessive carious lesions and difficultness of the restorations are no longer reasons for the decision of extraction.

Key Words: Tooth extraction; retrospective studies; root canal therapy; periodontal diseases; dental caries

ÖZET Amaç: Bu çalışmanın amacı İzmir ili içerisindeki hastalarda diş çekim nedenlerini ve bu nedenler ile yaş ve cinsiyet arasındaki ilişkiyi araştırmaktır. **Gereç ve Yöntemler:** İki yıllık süre içerisinde Ege Üniversitesi Diş Hekimliği Fakültesi Ağız, Diş ve Çene Cerrahisi Anabilim Dalı'nda tedavi planına uygun olarak gerçekleştirilen diş çekimleri çalışma kapsamına alınmıştır. Diş çekimleri önceden tamamlanan hastaların çekilen dişler ile ilgili analizleri, tedavi öncesi ve sonrası alınan panoramik filmler ve hasta kayıtları retrospektif yolla incelenerek yapılmıştır. Hastaların yaş, cinsiyet, çekilen diş sayıları ve nedenleri not edilmiştir. **Bulgular:** 1426 sistemik sağlıklı hastada yapılan 2843 adet diş çekimi ile ilgili veriler çalışmaya dâhil edilmiştir. Bu verilere göre endodontik tedavilerdeki başarısızlıklar başlıca çekim nedenlerini oluştururken (%31,2), onu sırasıyla periodontal hastalık ve ilerlemiş diş çürüğü (%23,3-22,6) izlenmektedir. Başarısız endodontik tedaviler altında ulaşılamayan kanal veya lateral kanal varlığı (%32,3) ilk sırada yer alırken, yetersiz kök kanal dolgularının (%16,4) ve bifurkasyon veya kanalda perforasyon varlığının (%15,5) istatistiksel olarak anlamlı değerlerde olduğu kaydedilmiştir. **Sonuç:** Genel popülasyonda endodontik sebepler birincil diş çekim nedenlerini oluşturmakla birlikte, 50 yaş üzeri bireylerde diş çekimleri çoğunlukla periodontal hastalıklar nedeniyle yaşanmaktadır. Bu çalışma, ilerlemiş çürük lezyonlarının ve onların restore edilebilmelerinde karşılaşılan zorlukların artık diş çekimi kararı verilirken olası bir faktör olmadıklarını göstermektedir.

Anahtar Kelimeler: Diş çekimi; retrospektif çalışmalar; kök kanal tedavisi; periodontal hastalıklar; diş çürükleri

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Dental problems including excessive caries lesions, pulpitis, apical periodontitis and apical abscesses, traumatic injuries, tooth and root fractures, periodontal diseases, tooth impaction, massive infections

and failed treatments can lead to extraction of permanent teeth worldwide on literature.¹⁻⁵ In addition tooth loss in many developed countries is still continues to be a major public health problem causing systemic problems such as gastrointestinal disorders in addition.⁶⁻⁹ However, caries and periodontal disease had frequently been shown as the two main reasons for tooth loss, the idea of retaining the teeth at all cost is still dental professionals' priority.¹⁰ Although the majority of studies have reported that caries is the main reason for overall tooth loss in both adult and adolescent patients, it seems that this view is going to be change depending on the technological developments.^{1,11,12} The recent studies in different parts of the world show that tooth extraction is one of the least desirable treatments. On the other hand since the application of implants as an alternative treatment to extraction has become widespread and available for most cases both options are under consideration. There has been no nationwide study in Turkey on reasons for extraction of permanent teeth therefore determining the survival of the teeth and the long term prognosis of the recent treatments is essential for evaluating the sufficiency of preventive dental care programs and treatments.¹³ Additionally, understanding the relative contributions of the two major oral diseases, caries and periodontal disease, to tooth loss rates should aid in the proper allocation of available dental resources aimed at reducing such rates.¹⁴ There is a lack of data on the reasons for tooth extraction in Turkey. Therefore, the aim of this study is focused on investigating the reasons for tooth extraction, revealing the relationship of age and gender with patterns of tooth loss and evaluating the success of dental treatments.

MATERIAL AND METHODS

This was a retrospective study of examining the reasons for tooth extraction in city of İzmir. Major reasons for tooth extractions are orthodontic, periodontal, endodontic and surgical. Therefore four specialists of each restorative, periodontology, endodontics and oral surgery departments, have been chosen to investigate and review the patients' charts and orthopantomographic images who ap-

plied the Ege University Faculty of Dentistry, for re-evaluation and assessment of the extraction. In Turkish health service system, patients may seek all of their medical and dental care and may obtain services from any Medicare certified agency or hospital in accordance with the patients freedom of choice. The specialists were requested to complete a specially designed study form for every patient at issue to reveal the exact reason of extraction within a 24-month period (November 2010-November 2012). The study form was documented the patient's age, gender, all of the dental treatments patients received until fall of 2010 and the reason for the performed extraction(s). The reasons for the extractions were listed as it has reported in previous studies.^{3,15} These reasons were caries, periodontal disease, orthodontic reasons, root fracture, failed root canal treatment (RCT), tooth malposition, prosthetic or esthetic reasons, or patient request of extraction or refusal. If extractions related with many categories such as endo-periodontal lesions those were excluded. All the data acquired from radiographic and clinical patient charts including the extraction reasons, age and gender of the patients and also remaining teeth and treatments applied to extracted teeth were transferred to the software SPSS 17 to perform the statistical analyses. The association between causes and extraction prevalence amongst the patients was analyzed using the chi-square test ($p=0.01$). One-way ANOVA was used to compare the mean ages of patients and failed treatments. The significance level used was $p=0.05$.

RESULTS

A total of 2,843 teeth were extracted in 1,426 patients during the study period (mean extractions per patient= 1.99 ± 0.52 teeth). Of the 2843 extracted teeth, 1532 (53.8%) were extracted in males and 1311 (46.2%) were extracted in females. The distribution of patients and extracted teeth by age range and gender were presented (Table 1). In almost all the age groups more teeth were extracted in males than in females. The patients ranged in age from 18 to 80 years old, the largest proportion being between 36 to 45 years of age (25,8%). On average, older patients lost more teeth than

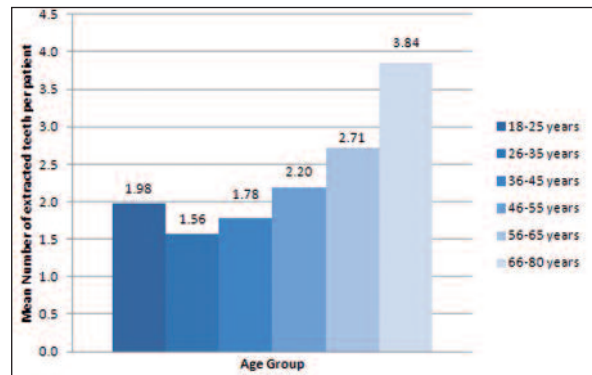
TABLE 1: Distribution of patients and extracted teeth by age range and gender.

Age range years	Males		Females		Total	
	Teeth	Patients	Teeth	Patients	Teeth	Patients
18-25	380	185	298	158	678 (23.8)	343 (24.1)
26-35	258	168	233	146	491 (17.3)	314 (22.0)
36-45	342	199	316	170	658 (23.2)	369 (25.8)
46-55	286	129	252	116	538 (18.9)	245 (17.2)
56-65	150	60	132	44	282 (9.9)	104 (7.3)
66-80	116	28	80	23	196 (6.9)	51 (3.6)
Total	1532 (53.8)	769 (53.9)	1311 (46.2)	657 (46.1)	2,843 (100)	1426 (100)

Figures in parentheses indicate percentages.

younger patients, as measured by the mean number of teeth lost per patient in each group (Figure 1). The highest tooth extraction rate per patient was seen in the 56- to 65-year age group (2.71 ± 1.45 teeth) and the 66- to 80-year age group (3.84 ± 1.53 teeth; $p=0.005$). The pattern of extraction in the maxillary and mandibular arches of dentition was analyzed. Of the 2843 teeth extracted, 1476 (51.9%) were extracted from the maxillary arch and 1367 (48.1%) were extracted from the mandibular arch.

Overall, failures in endodontic treatment and impossibility of retreatment were the main reasons (31.2%) of tooth extraction, followed by periodontal disease and caries (23.3% and 22.6%) respectively. Orthodontic reasons (8.5%) and extraction of the malpositioned third molars (8.0%) were few in number but had significant amounts. Other reasons included patient request: 2.9%; Prosthodontic

**FIGURE 1:** Mean number of teeth extracted per patient by age group.

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reasons: 1.8% and odontogenic cysts: 1.7%. The reasons for extraction in different age ranges were listed (Table 2). Failures in endodontic treatment was the principal cause for tooth extraction in two

TABLE 2: Reasons for tooth extraction by age range.

Age range years	Caries	Periodontal	Endodontic	Unerupted	Cystic lesion	Orthodontic reasons	Prosthodontic reasons	Patient request
18-25 (n=678)	46 (6.8)	20 (2.9)	201 (29.7)	181 (26.7)	4 (0.6)	226* (33.3)	0	0
26-35 (n=491)	82 (16.7)	69 (14.1)	262* (53.4)	38 (7.7)	24 (4.9)	16 (3.2)	0	0
36-45 (n=658)	245 (37.2)	113 (17.2)	261* (39.7)	5 (0.8)	18 (2.7)	0	4 (0.6)	12 (1.8)
46-55 (n=538)	191* (35.5)	156 (29)	131 (24.3)	2 (0.4)	3 (0.6)	0	12 (2.2)	43 (8)
56-65 (n=282)	60 (21.3)	151* (53.5)	30 (10.6)	1 (0.4)	0	0	22 (7.8)	18 (6.4)
66-80 (n=196)	19 (9.7)	153* (78.1)	3 (1.5)	0	0	0	13 (6.6)	8 (4.1)
Total (n=2843)	643 (22.6)	662 (23.3)	888 (31.2)	227 (8.0)	49 (1.7)	242 (8.5)	51 (1.8)	81 (2.9)

* The most common reason for extraction within the age group (X^2 test; $p<0.01$). Figures in parentheses indicate percentages.

TABLE 3: Reason for tooth extraction by gender.

Reason	Males		Females		Total		p value
	n	%	n	%	n	%	
Caries	354	23.1	289	22.1	643	22.6	0.001*
Periodontal	347	22.6	316	24.1	663	23.3	0.051
Endodontic	473	30.8	414	31.6	887	31.2	0.078
Unerupted	125	8.2	102	7.8	227	8.0	0.001*
Cystic	26	1.7	23	1.8	49	1.7	0.000*
Orthodontic	131	8.5	111	8.5	242	8.5	0.000*
Prosthetic	30	1.9	21	1.6	51	1.8	0.000*
Patient request	49	3.2	32	2.5	81	2.9	0.090
Total	1532	100	1311	100	2843	100	

* Statistically insignificant difference found in X²(chi-square) test.

age groups; 26-35: 53.4%; and 36-45: 39.7%. In addition, caries was the most important reason for extraction in age group of 46-55: 35.5%. Furthermore periodontal disease was the most common reason for extraction in all age groups over 55 years of age, 56-65: 53.5%; 66-80: 78.1%.

Significant gender differences were also seen in the reasons for tooth extraction (Table 3). Failures in endodontic treatment was found to be the main cause of tooth extraction in the study population. Caries and periodontal disease together accounted for more than 45% of the extractions. Of the 2843 teeth extracted, 887 teeth (31.2%) were extracted due to failures in RCT, 663 teeth (23.3%) periodontal disease, 643 teeth (22.6%) for caries, 227 teeth (8.0%) for malposition, 242 teeth

(8.5%) for orthodontic purposes, 81 teeth (2.9%) due to patient request, 51 teeth (1.8%) for prosthetic purposes, and 49 teeth (1.7%) due to cystic lesions. In males, the leading cause for tooth extraction was found to be failures in endodontic treatment (30.8%) followed by caries (23.1%). Similarly, in females, failures in endodontic treatment (31.6%) was found to be the primary cause for tooth loss while periodontal disease accounted for 24.1% of the extractions. The observed difference between the two groups was found to be statistically significant. Additionally, more teeth per patient were lost due to periodontal disease (4.3±1.10 teeth) and caries (3.7±1.04 teeth) than all other causes (p=0.015, p=0.02) (Figure 2, Table 4).

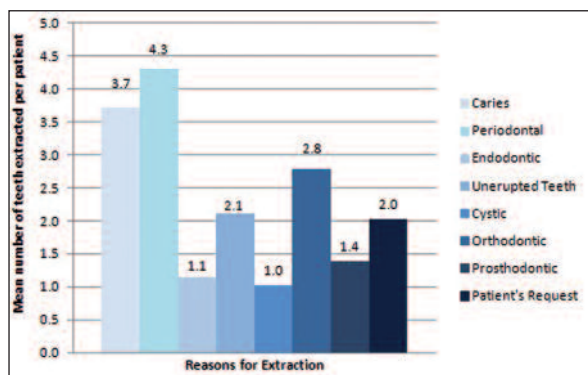


FIGURE 2: Mean number of teeth extracted per patient by age reason for tooth loss.

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TABLE 4: Mean number of teeth extracted per patient by reason for tooth loss One-way ANOVA test.

Reason	Patients	Teeth	Average	p value
Caries	173	643	3.7	0.015*
Periodontal	154	662	4.3	0.002*
Endodontic	779	888	1.1	0.075
Unerupted	108	227	2.1	0.043*
Cystic	48	49	1.0	0.079
Orthodontic	87	242	2.8	0.005*
Prosthetic	37	51	1.4	0.055
Patient request	40	81	2.0	0.045*
Total (n)	1426	2843	2.0	

* Statistically significant difference found in teeth losses per patient due to the reasons.

TABLE 5: Reasons for extraction by tooth type.

Tooth type	Caries	Periodontal disease	Endodontic	Impact tooth	Cystic lesion	Orthodontic reasons	Prosthetic reasons	Patient request	Total
Maxillary									
Anterior	103* (30)	65 (19.5)	59 (17.7)	30 (8.9)	6 (1.8)	61 (18.3)	6 (1.8)	4 (1.2)	334 (11.8)
Premolar	125 (25.8)	73 (15.1)	195* (40.3)	6 (1.2)	6 (1.2)	58 (12.0)	8 (1.7)	13 (2.7)	484 (17.0)
Molar	137 (20.8)	172 (26.1)	229* (34.8)	81 (12.3)	9 (1.4)	4 (0.6)	7 (1.1)	19 (2.9)	658 (23.1)
Mandibular									
Anterior	41 (10.6)	134* (34.8)	119 (30.9)	1 (0.3)	7 (1.8)	55 (14.3)	15 (3.9)	13 (3.4)	385 (13.5)
Premolar	76 (23.3)	69 (21.1)	82* (25.2)	15 (4.6)	10 (3.1)	57 (17.5)	7 (2.1)	10 (3.1)	326 (11.5)
Molar	161 (24.5)	149 (22.7)	204* (31.1)	94 (14.3)	11 (1.7)	7 (1.1)	8 (1.2)	22 (3.4)	656 (23.1)
Total	643 (22.6)	662 (23.3)	888 (31.2)	227 (8.0)	49 (1.7)	242 (8.5)	51 (1.8)	81 (2.9)	2,843 (100)

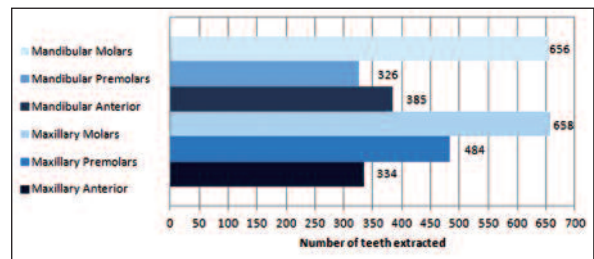
* The most common reason for extraction of that tooth type (X^2 test.; $p=0.01$). Figures in parentheses indicate percentages.

In this study the cause of extraction of individual teeth from both maxillary and mandibular arches were given (Table 5, Figure 3). Number of extracted maxillary and mandibular molars were similar (658/656, $p=0.061$) respectively, compared to the premolars (484/326, $p=0.045$) and teeth in frontal region (334/385, $p=0.055$). The tooth most frequently extracted due to failures in endodontic treatment was the maxillary molar (229 teeth), followed by the mandibular molar (204 teeth), and the mandibular premolar (82 teeth). A larger proportion of anterior teeth were extracted due to periodontal disease and failures in endodontic treatment in the mandible (65.7% of the anterior teeth) than in the maxilla (37.2%).

DISCUSSION

Previous studies have shown that the dental caries and periodontal diseases are the most important factors in tooth extraction etiology.^{11,16,17} The results of this survey indicated that in Izmir, Turkey, failed endodontic treatment and its consequences were the leading reason for tooth extraction followed by aggressive periodontal diseases and untreatable excessive caries legions.

The findings in our study that endodontic reasons were the most common reason for tooth loss overall is in conflict with the majority of some studies reported that periodontal disease was the main reason, while others found that caries was re-

**FIGURE 3:** Distribution of extracted teeth by tooth type.

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sponsible for the majority of extractions.¹⁷⁻²¹ The reason for this could be the changes in the concepts in preventive and restorative dentistry. At least 47.2% of the 779 apical periodontitis cases with excessive caries legions were tried to be treated which prevents the extractions due to caries become the primer reason.²² This could be explained by the survival rates of applied endodontic treatments in Turkish population and the prognosis of intact and impermeable coronal restoration after root canal filling.^{5,23,24} However this survey revealed the fact inadequate and oversized restorations could not prevent extractions as it expected.²⁵⁻²⁷ Other reasons, including extractions had performed upon the patient's request, for prosthodontic and surgical reasons (such as malpositioned teeth) were responsible for a smaller proportion of extractions.

It was also observed that significantly different patterns of tooth loss were seen among the pa-

tients in four groups. While being responsible for only 8.5% of extractions in total, orthodontic reasons accounted for 37.7% of extractions in those younger than 26 years old. This is due to the high number of teeth need extraction for orthodontic treatment, malposed teeth and partially erupted teeth in this age group.²⁸ The highest percentage of tooth needing extraction due to endodontic failures were belong to 26-35 and 36-45 years age groups (262/261 teeth), and this in agreement with the study by Fuss et al which noted a low frequency of periodontal reasons and a predominance of reasons related to the impossibility of restoring the tooth after the endodontic therapy and to RCT failures (21.1%).²⁹ Caries was the main cause of tooth extraction in 46-55 age group (35.5%) and third amongst all groups (22.7%) in our study.

Despite the high rate of periodontal causes noted in several studies and the causes related to the impossibility of restoration of the teeth, the results of this study are not similar from those found in the literature. In this study we observed that teeth extracted for periodontal disease had a significant increase with age, which is consistent with other studies.^{2,30} The level of periodontal disease, we obtained the highest percentage in patients aged between 56-65 and 66-80 years (24.6%), similar to observations that occurred in Scotland Nigeria, Singapore, Germany and Croatia.^{4,31-33} In both groups the increase in extractions due to periodontal diseases, were statistically significant compared to the other possible causes.

In this investigation males and females had an equal percentage of tooth loss (1.99 per patient), with a larger number of men in the sample (1532 patients). The unequal male and female distribution of participants may also explain this results, considering that women seek health services more frequently than men.³⁴

Regardless of the tooth types, it has found that premolars and anterior teeth were extracted for orthodontic and prosthodontic reasons while molars were more commonly extracted due to caries, periodontal disease and endodontic failures. There are possible explanations that have been proposed for this pattern: first molars which erupted in mix dentition most likely to decay than the others, succes rates of RCT are relatively lower compared to the single root teeth and periodontal care of posterior dentition becomes much more challenging in certain age groups.^{35,36} The orthodontic and prosthodontic extractions lower rate of molar tooth could explain for anchorage capacity is more than anterior and premolar teeth.

This difference may be attributed to nutrition, socio-economic factors as well as level of dental awareness among the urban and rural population of Turkey which could explain the dilemma of high demand for dental treatments and loss of teeth due to caries and periodontal diseases. These differences also highlight the difficulties of comparing tooth loss studies due to the differing methodologies and populations studied.

CONCLUSION

It was concluded that tooth extractions were distributed in different age-groups and considering the fact that elderly patients seem to have more tooth losses compared to the younger ones. Furthermore, extractions due to failed endodontic treatments were the main reasons for tooth loss amongst all, while caries and periodontal diseases were found leading reasons considered individually. Finally, it was though that despite the technological and practical development in dentistry tooth extraction is still a treatment in progress in Turkey.

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