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Prevalence and Distribution of Endodontically Treated Teeth Across Different Age Groups: A Retrospective Cross-Sectional Study

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ABSTRACT

Aim: This study examined how age influences both the frequency and distribution of endodontically treated teeth (ETT) through the assessment of panoramic radiographic images.
Materials and Methods: A retrospective cross-sectional analysis was conducted on 1000 digital panoramic radiographs of fully dentate individuals aged 18–60 years. The participants were stratified into four distinct age categories. The presence of ETT was assessed by jaw and tooth type. Two independent observers evaluated all radiographs. Statistical analyses involved the application of the Fisher–Freeman–Halton test and the Monte Carlo simulation technique, together with linear trend analysis ($p<0.05$).
Results: Overall, 51.7% of individuals recorded at least one treated tooth. Age was significantly correlated with the ETT count ($p = 0.007$), demonstrating a significant linear increase across the age groups ($p = 0.021$). Although age-related differences between jaws were not statistically significant, a significant upward trend was detected in the maxilla ($p = 0.017$). Mandibular first molars represented the most commonly treated teeth.
Conclusion: The prevalence of ETT increased significantly with age, with posterior teeth—particularly mandibular first molars—showing the highest treatment frequency. These findings may assist in guiding preventive strategies and supporting age-based considerations in oral healthcare. Future multicenter research including broader age ranges and partially dentate populations is recommended.

Endodontik Tedavi Görmüş Dişlerin Farklı Yaş Gruplarına Göre Prevalansı ve Dağılımı: Retrospektif Kesitsel Bir Çalışma

Makale Bilgisi

Makale Geçmişi

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ÖZET

Amaç: Bu çalışma, panoramik radyografilerin incelenmesi aracılığıyla endodontik tedavi uygulanmış dişlerin (ETT) prevalans ve dağılımındaki yaşa bağlı farklılıkları ortaya koymayı hedeflemektedir.
Gereç ve Yöntemler: Bu retrospektif, kesitsel nitelikteki araştırma, 18–60 yaş aralığında diş eksikliği bulunmayan bireylere ait 1000 dijital panoramik radyografi üzerinde gerçekleştirildi. Katılımcılar dört yaş grubuna ayrıldı. Endodontik tedavili dişlerin varlığı çene ve diş türüne göre değerlendirildi. Tüm radyograflar iki bağımsız gözlemci tarafından incelendi. İstatistiksel analizler Fisher–Freeman–Halton testi, Monte Carlo yöntemi ve lineer trend analizi kullanılarak yapıldı ($p<0.05$).
Bulgular: Bireylerin %51.7'sinde en az bir endodontik tedavili diş mevcuttu. Yaş ile endodontik tedavili diş sayısı arasında istatistiksel olarak anlamlı bir bağlantı saptandı ($p = 0.007$) ve yaş grupları arasında anlamlı lineer bir artış gözlendi ($p = 0.021$). Çeneler arasında yaşa bağlı farklılıklar istatistiksel olarak anlamlı olmasa da, maksillada anlamlı bir artış eğilimi saptandı ($p = 0.017$). Mandibular birinci molarlar en sık tedavi edilen dişler olarak tespit edildi.
Sonuç: Endodontik tedavili diş prevalansı yaşla birlikte anlamlı biçimde artmakta olup posterior dişler—özellikle mandibular birinci molarlar—en yüksek tedavi sıklığını göstermiştir. Bulgular, posterior dişlere yönelik koruyucu stratejilerin güçlendirilmesi ve yaşa dayalı ağız sağlığı planlamasının önemini vurgulamaktadır. Gelecekte daha geniş yaş aralıklarını ve diş eksikliği olan bireyleri içeren çok merkezli çalışmaların planlanması önerilebilir.

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INTRODUCTION

Dental caries is recognized globally as the most common oral health condition.[1] The integrity of the dental pulp may be affected by various risk factors. Dental caries originating from oral microbial activity is recognized as a major pathological process that frequently results in pulpal tissue injury.[2] The distribution of dental caries is shaped by multiple determinants, including demographic variables, oral hygiene behaviors, and socioeconomic status.[3] Dental caries represents a major etiological factor responsible for initiating inflammatory alterations affecting the dental pulp and periradicular tissues, while it remains a leading clinical indication for endodontic treatment.[4] Therefore, it is essential to plan endodontic treatment approaches in accordance with disease prevalence within the population. Increasing the number of studies in endodontic epidemiology will significantly contribute to understanding disease dynamics and advancing scientific knowledge.[2] In this context, evaluating the frequency of root canal–treated teeth within diverse demographic groups is crucial for understanding the population-level burden of endodontic disease and for informing strategic planning in oral healthcare.

However, various factors such as dental caries, periodontal pathology, and indications for endodontic treatment can significantly influence the retention of teeth within the oral cavity and affect their long-term prognosis. The comprehensive national oral health assessment carried out by the Brazilian Ministry of Health during 2002-2003 indicated that at least one carious tooth was present in 70% of individuals aged 12 years and 90% of those aged 15–19 years. The report additionally highlighted a pronounced rise in caries-related sequelae in individuals within the 35–44 and 65–74 year age brackets.[5] These findings demonstrate that the burden of dental caries increases substantially with age and suggest that dental treatment needs may differ across age groups.

Changes in caries experience within the population directly influence the need for endodontic treatment and show significant variation according to age. The Turkish Oral and Dental Health Profile Research Report (TADSAP-2018) revealed a marked increase in the burden of dental caries with advancing age. The report indicated that the decayed, missing, and filled teeth (DMFT) index reached 1.57 in 12-year-olds, 2.72 in the 15-year-old group, 8.80 in adults aged 35–44, and reached 22.63 among individuals aged 65–74. Moreover, 86.6% of individuals aged 65–74 years had a DMFT value greater than 10.[6] These national data indicate that treatment needs arising from dental caries may vary substantially across age groups, emphasizing the importance of investigating how the frequency of root canal–treated teeth differs among various age populations.

In the current literature, epidemiological data specific to our country concerning the frequency of root canal-treated teeth across various age groups are limited. Within this framework, it is important to assess the extent to which the increased burden of dental caries associated with aging is reflected in the need for endodontic treatment. Therefore, this study aimed to evaluate the prevalence of root canal-treated teeth among different age groups using panoramic radiographs, to compare their age-related distribution, and to assess their distribution according to tooth type. The null hypothesis of this study was that there would be no significant differences in the prevalence or distribution of root canal-treated teeth among different age groups or tooth types. It was hypothesized that the proportion of root canal-treated teeth would increase across age groups and that molar teeth would show higher frequencies of endodontic treatment than other tooth groups.

MATERIALS AND METHODS

Ethical Approval and Study Design

This research was conducted as a retrospective, cross-sectional epidemiological analysis, and ethical approval was obtained from the Clinical Research Ethics Committee of the Faculty of Dentistry at Marmara University (Approval Date and Number: 30.10.2025; 2025-11-02/2025-91). Following ethical approval, radiographic data retrieval was conducted between November 1 and November 15, 2025.

Study Population and Sampling Strategy

The study cohort comprised digital panoramic radiographs archived in the Department of Endodontics at the Faculty of Dentistry, Marmara University. Participants aged 18-60 years with a full complement of permanent teeth, excluding third molars, and diagnostic radiographs of adequate image quality were included. Those with missing permanent teeth, radiographs demonstrating positioning errors or artifacts, and participants aged over 60 years were excluded from the analysis.

The rationale for selecting individuals with a full dentition of permanent teeth was to minimize potential bias arising from missing teeth and to enable an accurate assessment of the number and distribution of endodontically treated teeth. This selection also provided a standardized basis for comparison among different tooth types. Since the endodontic history of extracted teeth cannot be determined radiographically, the presence of missing teeth could adversely affect the evaluation. Therefore, this strategy represents a methodological approach aimed at enhancing the study's internal methodological rigor. However, this criterion may restrict how well the sample reflects the characteristics of the broader population, a point that will be further elaborated within the discussion section.

The sample size calculation was performed using G*Power 3.1 software, employing a chi-square test assumption and setting the confidence level at 95% (α=0.05) and statistical power at 80% ($1-\beta$=0.80). The calculation was informed by a large-scale systematic synthesis indicating a worldwide prevalence of 8.2% for root canal–treated teeth. This meta-analysis evaluated 74 epidemiological studies including 1.201.255 teeth and 32.162 patients, and reported that 55.7% of individuals worldwide possessed at least one tooth with a history of root canal therapy.[7] According to these assumptions, the projected minimum sample size for the investigation was calculated as 784. To enhance statistical power, 250 radiographs were included from each age group, resulting in a total of 1000 panoramic radiographs analyzed in the study.

Age Group Classification

For analytical purposes, participants were stratified by age into the following categories: 18–25, 26–35, 36–45, and 46–60 years. These age intervals were established based on epidemiological relevance and are consistent with approaches used in previous observational studies examining oral health-related outcomes across adulthood.[8,9] This stratification allowed the assessment of age-related variations in the proportion of root canal-treated teeth and provided adequate sample sizes for statistical comparison. Participants aged above 60 years were not included because obtaining fully dentate individuals in this age range is uncommon in routine clinical populations, and missing teeth could introduce bias, as the endodontic history of extracted teeth cannot be determined radiographically. Although necessary for methodological standardization and internal validity, this criterion may limit the extent to which the findings can be generalized, and it is acknowledged as a study limitation.

Data Collection and Radiographic Assessment

The panoramic radiographs were retrieved from the digital archive system and evaluated by the researchers according to a standardized protocol. All panoramic radiographs were assessed on a 23-inch Acer monitor (1920×1080 pixel resolution) connected to an HP workstation under standardized ambient lighting conditions. Brightness and contrast settings were kept constant throughout the evaluation process. Images were viewed using Romexis software (Planmeca, Helsinki, Finland), which enabled optimal magnification and contrast adjustments when necessary.

Root canal–treated teeth were identified based on the radiographic presence of radiopaque filling material within the root canal system. For each individual, the overall count of root canal–treated teeth was recorded, along with their distribution by jaw (maxilla–mandible) and by tooth type (incisors, canines, premolars, and molars). Additionally, the FDI two-digit notation system was used for tooth-level identification.

Two endodontic specialist trainees independently evaluated all panoramic radiographs. Prior to the main evaluation, the observers jointly reviewed a subset of radiographs to standardize the assessment criteria. The evaluation was performed at the tooth level, and each tooth was recorded according to its FDI (Fédération Dentaire Internationale) two-digit notation system. The presence of endodontic treatment was determined based on the radiographic identification of radiopaque root canal filling material within the canal system. Because the assessment involved a clearly defined binary outcome (presence or absence of root canal treatment), the likelihood of disagreement between observers was minimal. Consequently, complete agreement was obtained, yielding a Cohen's Kappa value of 1.00.

Statistical Analysis

All statistical procedures were executed using IBM SPSS Statistics software (Version 27.0, IBM Corp., Armonk, NY, USA). Descriptive outcomes were summarized as frequencies and percentages. Associations between categorical variables were examined through the Fisher–Freeman–Halton exact test, and when more than 20% of expected cell values were below five, the Monte Carlo simulation approach was employed. The linear-by-linear association test was applied to evaluate ordinal trends within groups. A significance threshold of $p < 0.05$ was adopted for all analyses.

RESULTS

Panoramic radiographs from 1000 participants enrolled in the study were examined. Among the participants, 51.7% had at least one endodontically treated tooth. A statistically significant relationship was identified between the age groups and the number of root canal-treated teeth (Monte Carlo Fisher–Freeman–Halton exact test, p=0.007) (Table 1). Linear-by-linear trend analysis demonstrated that there was a statistically significant upward trend in the number of root canal–treated teeth with advancing age (p=0.021).

When evaluated by jaw, the comparison of age groups showed no statistically significant variation in maxillary root canal–treated tooth counts (p=0.148) (Table 2). However, linear-by-linear trend test demonstrated a statistically significant rise in the rate of endodontic treatment in the maxilla with advancing age (p=0.017).

In the mandible, no significant difference was detected among age groups (p = 0.100), and no linear trend was observed (p=0.155) (Table 3).

Regarding tooth type, no statistically meaningful variation was observed across age

groups for incisors, canines, or molars with respect to the count of endodontically treated teeth (Table 4). Linear trend analysis also did not reveal significant results for these tooth groups (p=0.487, p=0.173, and p=0.379, respectively).

Tooth-level analysis demonstrated that endodontic treatment occurred predominantly in the mandibular first molars (teeth 36 and 46). In contrast, the prevalence of endodontic treatment in maxillary and mandibular incisors was notably low, and no endodontically treated teeth were identified in tooth 33. No statistically significant association was detected across age groups regarding the distribution of root canal–treated teeth by tooth type (p>0.05) (Table 5).

Table 1. Distribution of endodontically treated teeth according to age groups

		Age Groups				**Total**	**p-value**
		18-25	**26-35**	**36-45**	**46-60**		
Endodontically treated teeth(n)	0	151(60.4%)	112(44.8%)	107(42.8%)	113(45.2%)	483(48.3%)	0.007*
	1	48(19.2%)	57(22.8%)	54(21.6%)	60(24%)	219(21.9%)	
	2	24(9.6%)	34(13.6%)	42(16.8%)	32(12.8%)	132(13.2%)	
	3	13(5.2%)	24(9.6%)	24(9.6%)	14(5.6%)	75(7.5%)	
	4	2(0.8%)	7(2.8%)	14(5.6%)	16(6.4%)	39(3.9%)	
	5	4(1.6%)	6(2.4%)	3(1.2%)	6(2.4%)	19(1.9%)	
	6	3(1.2%)	4(1.6%)	4(1.6%)	5(2%)	16(1.6%)	
	7	1(0.4%)	0	0	1(0.4%)	2(0.2%)	
	8	2(0.8%)	2(0.8%)	0	1(0.4%)	5(0.5%)	
	9	1(0.4%)	3(1.2%)	2(0.8%)	2(0.8%)	8(0.8%)	
	10	0	1(0.4%)	0	0	1(0.1%)	
	13	1(0.4%)	0	0	0	1(0.1%)	
Total		250(100%)	250(100%)	250(100%)	250(100%)	1000(100%)	

*p-value calculated using the Monte Carlo Fisher–Freeman–Halton exact test due to >20% of expected cell counts being <5.

Table 2. Distribution of endodontically treated teeth in the maxilla according to age groups

		Age Groups				Total	p-value
		18-25	26-35	36-45	46-60		
Maxillary endodontically treated teeth (n)	0	177(70.8%)	153(61.2%)	146(58.4%)	144(57.6%)	620(62%)	0.148*
	1	41(16.4%)	60(24%)	56(22.4%)	59(23.6%)	216(21.6%)	
	2	18(7.2%)	20(8%)	28(11.2%)	24(9.6%)	90(9%)	
	3	7(2.8%)	6(2.4%)	12(4.8%)	16(6.4%)	41(4.1%)	
	4	4(1.6%)	5(2%)	5(2%)	4(1.6%)	18(1.8%)	
	5	1(0.4%)	4(1.6%)	2(0.8%)	1(0.4%)	8(0.8%)	
	6	2(0.8%)	1(0.4%)	1(0.4%)	0	4(0.4%)	
	7	0	1(0.4%)	0	2(0.8%)	3(0.3%)	
Total		250(100%)	250(100%)	250(100%)	250(100%)	1000(100%)	

*p-value calculated using the Monte Carlo Fisher–Freeman–Halton exact test due to >20% of expected cell counts being <5.

Table 3. Distribution of endodontically treated teeth in the mandible according to age groups

		Age Groups				Total	p-value
		18-25	26-35	36-45	46-60		
Mandibular endodontically treated teeth (n)	0	191(76.4%)	155(62%)	159(63.6%)	173(69.2%)	678(67.8%)	0.100*
	1	36(14.4%)	55(22%)	56(22.4%)	41(16.4%)	188(18.8%)	
	2	16(6.4%)	24(9.6%)	25(10%)	21(8.4%)	86(8.6%)	
	3	4(1.6%)	10(4%)	7(2.8%)	10(4%)	31(3.1%)	
	4	1(0.4%)	4(1.6%)	3(1.2%)	4(1.6%)	12(1.2%)	
	5	1(0.4%)	2(0.8%)	0	1(0.4%)	4(0.4%)	
	7	1(0.4%)	0	0	0	1(0.1%)	
Total		250(100%)	250(100%)	250(100%)	250(100%)	1000(100%)	

*p-value calculated using the Monte Carlo Fisher–Freeman–Halton exact test due to >20% of expected cell counts being <5.

Table 4. Comparison of the number of endodontically treated incisors, canines, and molars across different age groups

		Age Groups				Total	p-value
		18-25	26-35	36-45	46-60		
Endodontically treated incisors (n)	0	234(93.6%)	233(93.2%)	238(95.2%)	233(93.2%)	938(93.8%)	0.838*
	1	9(3.6%)	10(4%)	7(2.8%)	10(4.0%)	36(3.6%)	
	2	5(2%)	3(1.2%)	4(1.6%)	5(2.0%)	17(1.7%)	
	3	2(0.8%)	3(1.2%)	1(0.4%)	0	6(0.6%)	
	4	0	1(0.4%)	0	2(0.8%)	3(0.3%)	
Endodontically treated canines (n)	0	247(98.8%)	250(100%)	248(99.2%)	243(97.2%)	988(98.8%)	0.051*
	1	2(0.8%)	0	1(0.4%)	6(2.4%)	9(0.9%)	
	2	1(0.4%)	0	1(0.4%)	1(0.4%)	3(0.3%)	
Endodontically treated molars(n)	0	171(68.4%)	140(56%)	147(58.8%)	154(61.6%)	612(61.2%)	0.056**
	1	52(20.8%)	60(24%)	66(26.4%)	58(23.2%)	236(23.6%)	
	2	12(4.8%)	34(13.6%)	21(8.4%)	24(9.6%)	91(9.1%)	
	3	11(4.4%)	9(3.6%)	14(5.6%)	7(2.8%)	41(4.1%)	
	4	2(0.8%)	4(1.6%)	1(0.4%)	3(1.2%)	10(1%)	
	5	1(0.4%)	3(1.2%)	1(0.4%)	4(1.6%)	9(0.9%)	
	7	1(0.4%)	0	0	0	1(0.1%)	

*p-value calculated using the Fisher–Freeman–Halton exact test due to >20% of expected cell counts being <5.

** P-value calculated using the Monte Carlo Fisher–Freeman–Halton exact test due to >20% of expected cell counts being <5.

Table 5. Distribution of endodontically treated teeth by tooth number according to age groups

		Age Groups				Total	p-value
		18-25	26-35	36-45	46-60		
Root canal treated tooth numbers	11	5(2.2%)	10(3%)	4(1.2%)	10(3%)	29(2.4%)	0.126
	12	1(0.4%)	5(1.5%)	2(0.6%)	5(1.5%)	13(1.1%)	
	13	1(0.4%)	0	1(0.3%)	3(0.9%)	5(0.4%)	
	14	10(4.5%)	12(3.6%)	17(5.3%)	14(4.2%)	53(4.4%)	
	15	15(6.7%)	28(8.5%)	34(10.5%)	25(7.6%)	102(8.5%)	
	16	23(10.3%)	29(.8%)	22(6.8%)	24(7.3%)	98(8.1%)	
	17	1(0.4%)	5(1.5%)	7(2.2%)	9(2.7%)	22(1.8%)	
	21	10(4.5%)	9(2.7%)	5(1.5%)	6(1.8%)	30(2.5%)	
	22	7(3.1%)	3(0.9%)	1(0.3%)	4(1.2%)	15(1.2%)	
	23	2(0.9%)	0	2(0.6%)	4(1.2%)	8(0.7%)	
	24	10(4.5%)	13(3.9%)	16(5.0%)	12(3.6%)	51(4.2%)	
	25	13(5.8%)	23(7.0%)	32(9.9%)	35(10.6%)	103(8.5%)	
	26	28(12.5%)	30(9.1%)	33(10.2%)	27(8.2%)	118(9.8%)	
	27	4(1.8%)	4(1.2%)	9(2.8%)	16(4.8%)	33(2.7%)	
	31	0	2(0.6%)	3(0.9%)	1(0.3%)	6(0.5%)	
	32	1(0.4%)	0	0	1(0.3%)	2(0.2%)	
	34	2(0.9%)	2(0.6%)	2(0.6%)	4(1.2%)	10(0.8%)	
	35	5(2.2%)	18(5.5%)	14(4.3%)	15(4.5%)	52(4.3%)	
	36	34(15.2%)	49(14.8%)	33(10.2%)	29(8.8%)	145(12%)	
	37	8(3.6%)	8(2.4%)	12(3.7%)	11(3.3%)	39(3.2%)	
	41	1(0.4%)	0	3(0.9%)	1(0.3%)	5(0.4%)	
	42	0	0	0	1(0.3%)	1(0.1%)	
	43	1(0.4%)	0	0	1(0.3%)	2(0.2%)	
	44	3(1.3%)	2(0.6%)	4(1.2%)	3(0.9%)	12(1%)	
	45	10(4.5%)	16(4.8%)	22(6.8%)	20(6.1%)	68(5.6%)	
	46	24(10.7%)	50(15.2%)	34(10.5%)	36(10.9%)	144(11.9%)	
	47	5(2.2%)	12(3.6%)	11(3.4%)	13(3.9%)	41(3.4%)	
Total		224(100%)	330(100%)	323(100%)	330(100%)	1207(100%)	

*p-value calculated using the Monte Carlo Fisher–Freeman–Halton exact test due to >20% of expected cell counts being <5.

DISCUSSION

In this retrospective epidemiological study, the analysis of 1000 panoramic radiographs demonstrated that the proportion of root canal-treated teeth showed a statistically significant upward trend with age, and that treatment was most commonly performed on the mandibular first molars. These findings support the study hypothesis indicating that the burden of endodontic treatment rises progressively with advancing age and that posterior teeth present a higher endodontic risk profile. Furthermore, the absence of statistically meaningful differences in endodontic treatment rates between jaws and among tooth types suggests that endodontic treatment demand should be considered a general population-level burden rather than one limited to specific anatomical regions. These findings emphasize the necessity of monitoring endodontic treatment needs across different age groups and highlight the value of epidemiological data in guiding oral healthcare planning, resource allocation, and public health policy.

A recently published systematic review and meta-analysis investigating worldwide rates of root canal-treated teeth indicated that 55.7% of adults possessed at least one tooth that had undergone root canal therapy, and that an average of 8.2% of all teeth were endodontically treated. However, the prevalence across different countries and populations demonstrated a remarkably wide range, varying from 0.7% to 87%. This substantial variation has been attributed to differences in endodontic disease burden, accessibility and availability of dental care services, socioeconomic conditions, and disparities in clinical practice patterns.[7] In the present study, 51.7% of the 1000 evaluated participants had at least one root canal-treated tooth, a finding that is consistent with values reported in the global literature and supports the widespread need for endodontic treatment within the population. However, a study conducted in Ukraine based on the evaluation of digital panoramic radiographs reported a considerably higher prevalence of 82.5%.[10] This substantial difference may be attributed to population-specific socioeconomic factors such as caries prevalence, oral hygiene behaviors, the availability and utilization of preventive dental care, and the level of access to dental services. From this perspective, the prevalence of endodontic treatment can be regarded not only as an indicator of clinical conditions but also as a reflection of community-based health policies and dental service delivery models.

In the present study, the number of endodontically treated teeth increased significantly with advancing age ($p=0.007$). This finding aligns with previous studies demonstrating that the need for endodontic treatment increases with aging. For example, a study conducted in a Ukrainian population reported that the proportion of endodontically treated teeth increased from 5.2% in individuals aged 18–19 years to 24.9% in those over 65 years of age.[10] Similarly, a large-scale health records analysis from Finland involving 183.932 adult patients demonstrated that the volume of endodontic treatment was strongly age-dependent, reaching its highest level among individuals aged 50–64 years.[11] Furthermore, a longitudinal cohort study conducted in Denmark demonstrated that the prevalence of apical periodontitis and root canal–treated teeth increased with age in both the 1997–2008 and 2009–2019 cohorts. However, the more recent cohort exhibited lower rates of root canal treatment and tooth extraction, which the authors interpreted as a “cohort effect” associated with improvements in overall oral health.[12] When considered collectively, these findings suggest that factors such as the increased burden of systemic diseases, the heightened risk of caries associated with medication use, the retention of a greater number of natural teeth into older age, and increased exposure to restorative interventions contribute to the rising need for endodontic

treatment with advancing age.[12,13] However, the exclusion of individuals over 60 years of age in the present study represents a limitation, as it restricts the ability to fully characterize the true endodontic treatment needs of older age groups.

In the present study, the number of endodontically treated teeth demonstrated an increasing trend with age in the maxilla (p=0.017), whereas no significant age-related change was observed in the mandible. Although this study evaluated the age-dependent distribution between the jaws, previous research has reported that the maxilla may generally exhibit higher rates of endodontically treated teeth in different populations (14.2% vs. 9.9%).[10] When these findings are considered together, they suggest that the posterior maxillary region may represent a higher-risk anatomical area in terms of endodontic involvement. This may be related to the more complex root morphology of maxillary molars, increased exposure to caries, and a greater restorative burden in this region. Therefore, strengthening preventive strategies aimed at preserving posterior maxillary teeth is of clinical importance for reducing the endodontic treatment burden.

In the tooth-level evaluation, endodontic treatment was most frequently observed in the mandibular first molars (teeth 36 and 46). This finding supports existing evidence indicating that first molars have the highest rates of root canal treatment, which may be explained by their early eruption into the oral cavity, resulting in the longest cumulative exposure to caries risk.[10] In contrast, the notably lower prevalence of endodontic treatment in maxillary and mandibular incisors may be explained by the reduced risk of caries exposure and a lower likelihood of pulpal complications in these teeth compared with posterior teeth. These findings emphasize the clinical importance of reinforcing preventive strategies targeted at preserving posterior teeth, as such measures may play a critical role in reducing the overall endodontic treatment burden.

This study acknowledges several limitations. Primarily, the cross-sectional nature of the research does not allow for inference of causality between the examined variables. Second, because the sample did not include individuals over 60 years of age, the true endodontic treatment needs of older populations may not be fully represented. Third, only panoramic radiographs were used to identify root canal–treated teeth. Although panoramic imaging provides an adequate and practical screening tool for determining endodontic treatment prevalence at the population level, it does not allow for detailed three-dimensional assessment of root canal fillings, and therefore small filling deficiencies or anatomical variations may not be detected. Furthermore, panoramic radiography provides a two-dimensional representation of complex dental structures, and anatomical superimposition or image distortion may affect the visualization of certain endodontic features. Although cone-beam computed tomography (CBCT) offers superior three-dimensional diagnostic capability, its routine use in large epidemiological studies is often limited due to higher radiation exposure, cost considerations, and limited availability in retrospective datasets. Importantly, the present study focused on the identification of the presence or absence of root canal filling material, which represents a clearly recognizable radiographic feature. Therefore, panoramic radiography remains a widely accepted and practical imaging modality for population-based prevalence studies evaluating root canal-treated teeth. The inclusion of only fully dentate individuals was a methodological choice intended to reduce bias related to missing teeth and to enable more accurate comparisons among tooth types, thereby strengthening internal validity. However, restricting the sample to fully dentate participants may limit the extent to which the true distribution of endodontic treatment history is reflected in the broader population, particularly among individuals with tooth loss.

In populations with higher rates of tooth loss, particularly in older age groups, previously root canal–treated teeth may have already been extracted. Consequently, the true lifetime burden of endodontic treatment in the population may be underestimated in such samples. In addition, the single-center design may limit the generalizability of the findings.

Therefore, future studies with multicenter sampling, wider age ranges, and the inclusion of partially dentate individuals are recommended to enhance the representativeness and external validity of the results. In addition, the application of multivariable statistical models, such as logistic or Poisson regression, may provide further insight into the independent effects of demographic and clinical variables on the prevalence of endodontically treated teeth.

CONCLUSION

This retrospective cross-sectional study demonstrated that the prevalence of endodontically treated teeth increased significantly with age. Mandibular first molars were the most frequently treated teeth, highlighting the greater endodontic burden in posterior regions. Although a statistically significant age-related increase was observed in the maxilla, no significant differences were detected between jaws or tooth types across age groups. These findings emphasize the importance of preventive strategies targeting posterior teeth and considering age-related endodontic treatment demand in oral healthcare planning.

Ethical Approval

Ethical approval for this study was received from the Clinical Research Ethics Committee of Marmara University Faculty of Dentistry (Approval Date and Number: 30.10.2025; 2025-11-02/2025-91.

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Conflict of Interest

The authors deny any conflicts of interest related to this study.

Author Contributions

Design: MG, YG, HSO, Data collection or access: GY, EA, Analysis and comments: MG, YG, HSO, Literature search: MG, YG, Writing: MG.

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