

Original article

Radiographic Assessment of Permanent First Molars Among patients in Tripoli: A Retrospective cross-sectional Study

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Abstract

The first permanent mandibular molar (FPM) is the first tooth to emerge. It is the most effective oral masticatory unit because of its large occlusal surface and function in proper occlusion. This study aimed to describe the prevalence of PFM loss and status among adult patients in Tripoli, Libya. **Materials and Methods:** A retrospective study was conducted using patient panoramic radiographs from three private dentistry clinics in Tripoli, Libya. Panoramic images (OPG) of 1244 patients aged 13 years and older were evaluated to determine the status of PFM. For categorical variables, descriptive statistics of frequency distribution and percentages were generated, and the difference between the variables was assessed using the chi-square test. A p-value of < 0.05 was considered statistically significant. The results indicated that females had a much higher rate of missing FPMs than males (20.7% vs. 17.9%, respectively). Missing FPMs were more common in the mandibular arch than in the maxillary arch (21.3% vs. 17.6%), with a statistically significant difference. Endodontically treated FPMs accounted for 8.2% of the evaluated teeth, whereas 91.8% had not undergone endodontic treatment. Males had a slightly greater rate of endodontically treated FPMs (8.5%) than females (8.0%). Females had more restored and missing teeth than males, whereas males had higher proportions of remaining roots, crowns, and implants. A statistically significant association was observed between FPM status and dental arch. The mandibular arch showed higher proportions of carious, restored, and missing FPMs, whereas the maxillary arch showed a higher proportion of intact and crowned FPMs. **Conclusion:** Although intact first permanent molars represented the most common finding, a considerable proportion of FPMs had been affected by caries, were missing, fixed, or had undergone endodontic therapy. Missing FPMs were more common in females and in the mandibular arch, and endodontic therapy was mostly associated with age. These findings highlight the importance of early preventive and restorative interventions to preserve first permanent molars and reduce the burden of tooth loss and extensive dental treatment.

Keywords. First Permanent Molars (FPMs); Tooth Loss; Dental Caries; Endodontic Treatment.

Received: 01/08/26

Accepted: 30/09/26

Published: 08/10/26

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Introduction

When a child is six years old, their first permanent molars (FPMs) typically emerge [1]. FPMs are regarded as an essential masticatory unit and the key to occlusion, as a combination of both functional and developmental characteristics [3,4]. As a result, FPMs play a crucial role in the establishment of functionally appropriate occlusion in the teeth and their subsequent impacts on dental and dentofacial development [1]. Lower masticatory efficiency, aesthetic concerns, and displacement of adjacent teeth are possible additional issues. Unfortunately, because of their early emergence, first permanent molars are highly susceptible to dental caries [3].

Dental caries has been identified as one of the principal causes of permanent tooth extraction [5]. Instead of selecting extraction and enduring the consequences of FPM loss and the price of their filling or prosthetic replacements, it is important to progressively preserve or even increase the number of patients with healthy FPMs by increasing awareness and education [6]. The goal is to prevent FPM extraction, with a greater emphasis on preventive measures and early treatment of decay so that early diagnosis and appropriate management of dental caries may reduce the need for extraction [7]. Patients should be recommended for filling or prosthetic replacement and informed about the complications associated with missing FPMs, considering the potential repercussions [8]. Orthopantomography (OPG), also referred to as panoramic radiography, is widely used for diagnosis and assessment of the dentition and surrounding maxillofacial structures and for treatment planning. Additionally, it is the most recommended screening test in dentistry [9]. Additionally, orthodontists are the primary users of OPG due to their essential function as a diagnostic tool, diagnostic record, orthodontic treatment planning, monitoring, and evaluation of treatment progress and results [10, 11].

While obtaining a thorough overview of dental arches, maxillary and mandibular bones, and anatomic structures of relevance, such as inferior alveolar nerves and maxillary sinuses that must be preserved during surgery. Its relatively broad field of view, ease of acquisition, and comparatively low radiation dose make it a valuable diagnostic imaging modality in dental practice [9]. In Tripoli, like other Libyan towns, it's important to collect baseline data regarding the status of the FPMs so that effective preventative and treatment methods may be applied. This study was special in that it aimed to provide baseline data for a previously neglected population group. This data will be used to develop and assess intervention and

instructional oral health services for this community. Follow-up studies will be conducted on an annual basis to monitor the results and, if necessary, adjust and improve the suggested oral health program. To the best of our understanding, the existing literature contains limited information on the status of FPMs among patients in Tripoli, Libya. Therefore, the present study aimed to assess the prevalence and status of panoramic images retrospectively in three different private clinics in Tripoli, Libya, to determine the prevalence of missing, restored, or carious first molars, as well as endodontically treated first molars, and to compare the status of first permanent molars with patient demographics (age, gender, jaw relation).

Methods

Study design

This study was a descriptive cross-sectional study performed to assess the prevalence of permanent tooth status among patients aged 13 years and older in Tripoli, Libya. The study was based on the evaluation of digital panoramic radiographs obtained from dental clinics in Tripoli.

Inclusion and Exclusion Criteria

Patients aged 13 years and older without any orthodontic appliances were among the selection criteria. Orthopantomograms (OPGs) with considerable overlap were excluded, as were any other factors that resulted in an incorrect diagnosis. The assessment included all panoramic views; other factors that resulted in an incorrect diagnosis were eliminated. All panoramic files that lacked complete information (date, gender, and age) were excluded.

Data Collection and Radiographic Assessment

A total of 4976 first permanent molars were assessed among 1244 digital panoramic radiographs that were randomly selected from the panoramic radiograph files of dental patients aged 13 years and older who attended three major dental clinics in Tripoli, Libya's capital. The selected clinics were in both the central and peripheral areas of the city to ensure broader geographic representation. The radiographs had been obtained between January 2020 and December 2025. Each permanent molar (FPM) was evaluated and classified according to its radiographic status using an eight-category scoring system from 0 to 7: 0, sound; 1, caries; 2, filling; 3, endodontic therapy; 4, missing; 5, remaining root; 6, crowned; and 7, replaced by a dental implant. The state of each FPM was subsequently analysed in relation to the patient's age and sex, as well as the location of the tooth within the dental arches.

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 27. Descriptive statistics were used to summarise the study data. Categorical variables were presented as frequencies and percentages, whereas continuous variables were summarised using means and standard deviations. Associations between categorical variables were assessed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1 shows the socio-demographic characteristics of the study participants (n = 1,244). Females represented 54.6% of the study population (n = 679), whereas males accounted for 45.4% (n = 565). The mean age of participants was 34 ± 14 years, with an age range of 13 to 82 years. Regarding age distribution, the largest proportion of participants was aged ≤30 years (45.4%), followed by those aged 30–50 years (41.6%). Participants aged > 50 years represented the smallest proportion of the study population (13.0%).

Table 1. Socio-demographic characteristics of the study participants

Variable		Frequency	Percentage %
Sex	Male	565	45.4%
	Female	679	54.6%
Age group (Years)	≤30	565	45.4%
	30 -50	517	41.6%
	> 50	162	13.0%

Table 2 presents the distribution of dental status among the examined first permanent molars FPMs (n = 4,976). The highest proportion of FPMs was intact, accounting for 2115 (42.5%). Missing FPMs were the second most frequent category, representing 967 (19.4%), followed by restored FPMs, with 708 (14.2%). Endodontically treated FPMs constituted 409 (8.2%), whereas carious FPMs accounted for 371 (7.5%). Crowned teeth represented 195 (3.9%), and remaining roots

comprised 140 cases (2.8%). Dental implants were the least frequent category, representing 71 (1.4%) of the total sample of FPMs, as shown in (Figure 1).

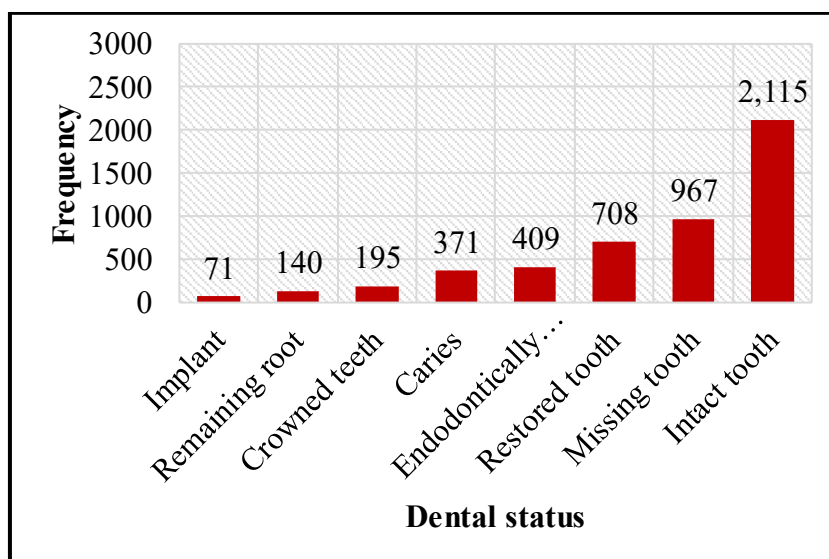


Figure 1. Distribution of dental status among the examined first permanent molars (FPMs) (n = 4,976)

The overall prevalence of missing FPMs was 19.4%, whereas 80.6% of the examined FPMs were present. As shown in (Figure 2), the prevalence of missing FPMs was significantly higher among females than among males (20.7% vs. 17.9%, respectively), and this difference was statistically significant ($p = 0.014$). A highly significant association was also observed between age group and the prevalence of missing FPMs ($p = 0.001$), with the prevalence of missing FPMs increasing progressively with age. Participants aged ≤ 30 years had the lowest prevalence (9.0%), followed by those aged 30–50 years (24.7%), while those older than 50 years showed the highest prevalence (39.2%). Regarding dental arch, missing FPMs were significantly more prevalent in the mandibular arch than in the maxillary arch (21.3% vs. 17.6%, respectively), and this difference was also statistically significant ($p = 0.001$).

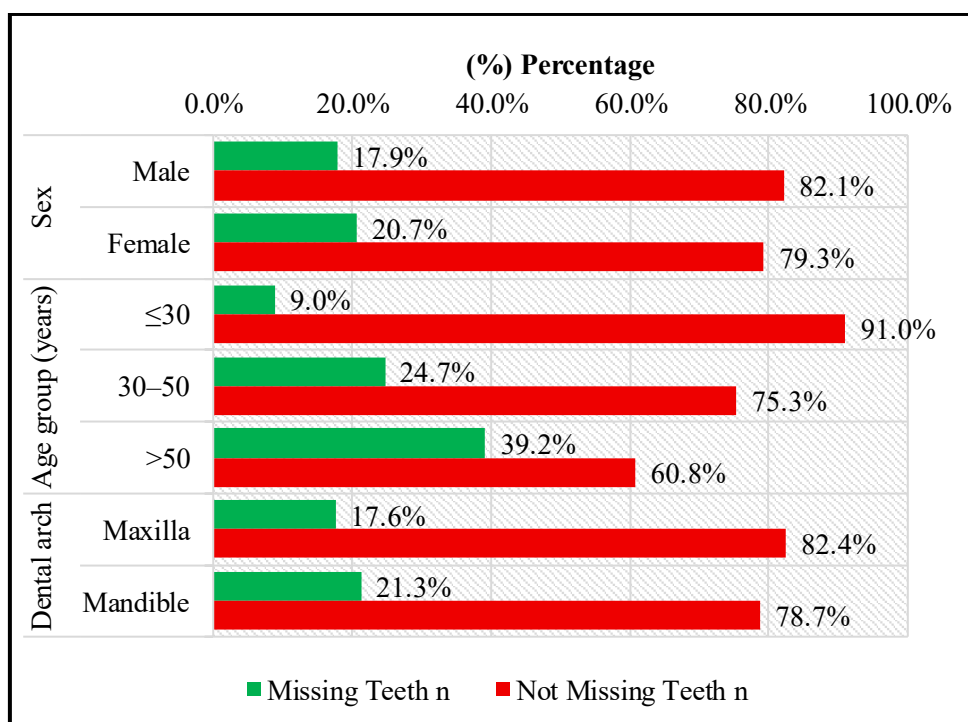


Figure 2. Prevalence of missing FPMs according to study variables

Overall, 8.2% of the examined first permanent molars (FPMs) had undergone endodontic treatment, whereas 91.8% had not received endodontic treatment. As shown in (Table 2), the prevalence of endodontically treated FPMs was slightly higher among males than among females (8.5% vs. 8.0%, respectively); however, this difference was not statistically significant ($p = 0.587$). In contrast, a statistically significant association was observed with age group ($p = 0.001$). The highest prevalence was found among participants aged 30–50 years (10.2%), followed by those aged ≤ 30 years (7.3%), while the lowest prevalence was recorded among participants older than 50 years (5.1%). Regarding dental arch, there was no statistically significant association with endodontic treatment status ($p = 0.796$), although mandibular teeth showed a slightly higher prevalence (8.3%) compared to maxillary FPMs (8.1%).

Table 2. Prevalence of endodontically treated FPMs according to study variables

Variable	Category	Non-Endodontic n (%)	Endodontic n (%)	χ^2	p-value
Sex	Male	2069 (91.5)	191 (8.5)	0.295	0.587
	Female	2498 (92.0)	218 (8.0)		
Agegroup (years)	≤ 30	2095 (92.7)	165 (7.3)	21.713	0.001*
	30–50	1857 (89.8)	211 (10.2)		
	>50	615 (94.9)	33 (5.1)		
Dental arch	Maxilla	2286 (91.9)	202 (8.1)	0.067	0.796
	Mandible	2281 (91.7)	207 (8.3)		

*Statistically significant at $p < 0.05$

The distribution of first permanent molar (FPM) status according to age group, sex, and dental arch is presented in (Table 3). A highly statistically significant association was observed between age group and FPM status ($p = 0.001$). Participants aged ≤ 30 years showed the highest proportion of intact FPMs, whereas participants aged > 50 years demonstrated higher proportions of missing and crowned FPMs, as well as dental implants. A statistically significant association was also observed between sex and FPM status ($p = 0.001$). Females demonstrated higher proportions of restored and missing FPMs than males, whereas males showed relatively higher proportions of remaining roots, crowned FPMs, and dental implants. Regarding dental arch, a statistically significant association was found between dental arch and FPM status ($p = 0.001$). The mandibular arch showed higher proportions of carious, restored, and missing FPMs, whereas the maxillary arch showed slightly higher proportions of intact FPMs and crowned teeth.

Table 3. Distribution of FPM status according to the study variables

Variable	Intact	Caries	Restored	Remaining root	Crowned	Implant	p-value
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	
Age group (years)							0.001
≤ 30	1243 (55.0)	216 (9.6)	357 (15.8)	51 (2.3)	20 (0.9)	5 (0.2)	
30–50	686 (33.2)	118 (5.7)	319 (15.4)	70 (3.4)	121 (5.9)	33 (1.6)	
>50	186 (28.7)	37 (5.7)	32 (4.9)	19 (2.9)	54 (8.3)	33 (5.1)	
Sex							0.001
Male	1039 (46.0)	173 (7.7)	246 (10.9)	78 (3.5)	84 (3.7)	44 (1.9)	
Female	1076 (39.6)	198 (7.3)	462 (17.0)	62 (2.3)	111 (4.1)	27 (1.0)	
Dental arch							0.001
Maxilla	1111 (44.7)	176 (7.1)	327 (13.1)	80 (3.2)	117 (4.7)	38 (1.5)	
Mandible	1004 (40.4)	195 (7.8)	381 (15.3)	60 (2.4)	78 (3.1)	33 (1.3)	

*Statistically significant at $p < 0.05$

(Table 4) presents the distribution of missing and endodontically treated first permanent molars (FPMs) according to age group and sex. The highest proportions of both missing and endodontically treated FPMs were observed among participants aged 30–50 years. However, chi-square analysis revealed no statistically significant association between age group and the prevalence of missing FPMs ($p = 0.338$) or endodontically treated FPMs ($p = 0.210$). Females showed a slightly higher proportion of missing FPMs compared to males; however, this difference was not statistically significant for either missing tooth ($p = 0.213$). Similarly, no statistically significant difference was observed between males and females regarding the prevalence of endodontically treated FPMs ($p = 0.831$).

Table 4. Distribution of missing and endodontically treated first permanent molars according to age group and sex

Category	Missing				Endodontic treated			
	16	26	36	46	16	26	36	46
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Age group								
≤30	46 (21.3)	41 (18.6)	66 (23.7)	50 (19.8)	36 (38.7)	41 (37.6)	51 (47.7)	37 (37.0)
30–50	102 (47.2)	123 (55.7)	145 (52.2)	140 (55.6)	51 (54.8)	58 (53.2)	52 (48.6)	50 (50.0)
>50	68 (31.5)	57 (25.8)	67 (24.1)	62 (24.6)	6 (6.5)	10 (9.2)	4 (3.7)	13 (13.0)
Sex								
Male	102 (47.2)	96 (43.4)	109 (39.2)	98 (38.9)	43 (46.2)	53 (48.6)	52 (48.6)	43 (43.0)
Female	114 (52.8)	125 (56.6)	169 (60.8)	154 (61.1)	50 (53.8)	56 (51.4)	55 (51.4)	57 (57.0)

Discussion

The current study focused exclusively on the first permanent molars (FPMs), which play a crucial role in the oral cavity and are essential for the harmonious development of a dental arch and play a key part in an individual's oral and general health. The FPM is the first permanent tooth to erupt, and it exerts significant control over the teeth that emerge later, both behind and in front of it, since the other teeth are obligated to place themselves in relation to the already erupted first molar, frequently resulting in occlusion. FPM is also the largest tooth in the oral cavity, bearing the most occlusal load, and it affects the vertical distance between the maxilla and mandible, occlusal height, and esthetic dimensions. In addition, their extensive root surface area makes them important anchoring units in orthodontic treatment [12]. FPMs may be lost for several reasons, including Dental cavities, periodontal disorders, cracked teeth, mispositioned teeth, impacted teeth, retained deciduous teeth, orthodontic therapy, prosthetic considerations, supernumerary teeth, radiotherapy preparation, and other pathological conditions. Absence of FPMs hurts occlusion and is considered costly, time-consuming, and stressful for young children [13, 14].

In the present study, the prevalence of missing FPMs was 19.4%, whereas 80.6% of the examined FPMs were present. The prevalence of missing FPMs observed in this study was lower than that reported in a previous study conducted among the Libyan population by Elbego AA et al., which found that 32% of FPMs were reported to be missing [15], as well as another study by El-Zuki M et al. [16]. present results are also lower than previous studies; Halicioglu K et al. [17], Rezaie M et al. [13], Safadi R et al. [18], Almugla YM. [6], and Atieh [19] showed 43.2%, 32.3%, 40%, 31.3%, 39.2%, and 57.1%, respectively. Differences in the prevalence of missing FPMs among studies may be attributed to variations in study populations, age distributions, sampling methods, geographical locations, and differences in access to preventive and restorative dental care. Several previous studies have focused primarily on younger populations, whereas the present study included a wider age range, from 13 to 82 years. These differences should be considered when comparing the findings of the present study with those of previous investigations. The present study found that missing PFM were significantly more prevalent among females than among males. These findings were comparable to those of research conducted in a suburban area of Chennai, India [14], an urban population in South Brazil [20], and in northern Turkey [21], which also reported a higher prevalence of missing PFM among females.

One possible explanation is that females generally experience earlier pubertal development and earlier eruption of permanent teeth, which may result in longer exposure of FPMs to the oral environment and cariogenic challenges [22]. In contrast to the current results in Al Hofuf, Eastern Province [23], Saudi Arabia. Jizan region of Saudi Arabia [24], United Arab Emirates [25], Al-Madinah Al-Munawarah [26], and Greece [27]. This gap could be ascribed to the fact that prior research examined all teeth and did not focus on FPMs, as the current study did. As a result, their research included upper anterior teeth as well, which caught women's attention due to esthetic concerns, resulting in a larger female-to-male ratio in their studies [28]. Regarding dental arch, missing FPMs were significantly more prevalent in the mandibular arch than in the maxillary arch (21.3% vs. 17.6%). This finding is consistent with previous studies conducted by Elbego AA. [15], and Özmen et al. [21]. It was also noted that lower missing FPMs occurred more frequently than upper missing FPMs. These findings are also consistent with those of Saheeb et al. [18] (33.4% vs. 45.6%), Almugla YM. [6] (17.4% vs. 35.2%), Halicioglu K et al. [17] (15.08% vs. 26.8%), Safadi R et al. [18] (27.4% vs. 72.6%), and Rezaie M et al. [12] (22.6% vs. 33.5%). The increased susceptibility of mandibular FPMs to caries and subsequent tooth loss may be related to their eruption timings, morphology, and greater susceptibility to plaque accumulation in the mandibular posterior region. However, the present finding differed from those reported by Årtun J and Thalib L. [29], Alesia K et al. [30], and Alshamrani HA et al. [31], who found (5.1%), (10.9%), and (5.2%), respectively, although not significantly. The investigation of FPMs was limited to initial caries that were not shown by the radiographic images employed, as well as preventive actions across national borders. Furthermore, FPM loss and decay were examined across a wide age range and with a large sample size. The variation

between studies could also be explained by differences in the demographic characteristics of the study populations, particularly age distribution, as well as variations in sample sizes, diagnostic methods, and the inclusion criteria used across studies [28].

In the present research, OPG was employed to detect caries; nevertheless, this kind of imaging is not considered best for this specific purpose due to the lack of fine details and the inherent nature of OPG's two-dimensional illustration of a three-dimensional object. Furthermore, the data used were obtained from only one source. In addition, this study was conducted retrospectively and was not accompanied by a clinical examination of the patients involved [14]. In addition, differences in oral health practices and preventive interventions, such as topical fluoride administration and the use of dental fissure sealants, should be promoted via regular oral health education programs for children. Accordingly, the study's conclusions suggest that dental professionals should strive to preserve the natural dentition as their ultimate goal. Epidemiological data based on the prevalence and distribution of endodontically treated teeth may provide valuable insights into oral health status, treatment needs, and patterns of dental care within a population [32].

In the present study, endodontically treated first permanent molars (FPMs) represented 8.2% of all examined teeth, which was greater than the prevalence of 5.5% reported in a previous Libyan study conducted in 2020 [33]. Internationally, the prevalence of endodontically treated teeth varies considerably across different populations. In Finland, reported prevalences of root canal treatment have ranged from 6.6% [34,35] to 21.5% [36,37,38]. Other studies have reported lower prevalences, including 2.4% in the Spanish population [39], 2.0% in the Irish population [40], 3.7% in the Turkish population [41], 2.3% in the Kosovar population [42], 4.8% in the Dutch population [43], 6.3% in the Saudi population [44], and 1.6% in the Sudanese population [45]. In contrast, higher prevalence has been reported in the Belarusian population 20% [46], 12.2% in the Nigerian population [47] and 13.2% in the Palestinian population [48]. The differences in the prevalence of endodontically treated teeth among populations may reflect variations in several factors, including age distribution, oral health status, access to dental services, treatment preferences, socioeconomic conditions, and healthcare systems. Age is particularly important when comparing findings across studies, as the likelihood of caries and the cumulative need for endodontic treatment generally increase with age. Therefore, differences in age distribution should be carefully considered when interpreting variations in the prevalence of endodontically treated teeth between populations.

In the Present study, the prevalence of endodontically treated first permanent molars (FPMs) was slightly higher among males (8.5%) than females (8.0%); however, this difference was not statistically significant. This finding is consistent with the result reported by Samia in Libya [33] and several previous studies. [41, 45, 49]. In contrast, other studies have reported a higher prevalence of endodontically treated FPMs among females, as reported by Oglah F et al. in Baghdad [50] and data from another study [43,48]. These inconsistencies may be related to differences in study populations, age distributions, sampling methods, the types of teeth evaluated, and discrepancies in the study methodology, which counted the rate of missing FPMs as a percentage of all missing teeth rather than individually.

A statistically significant association was observed between age group and endodontic treatment status ($p = 0.001$). The highest prevalence of endodontically treated first permanent molars (FPMs) was observed among people aged 30-50 years (10.2%), followed by those aged ≤ 30 years (7.3%), whereas the lowest prevalence was found among participants over 50 years (5.1%). These findings are consistent with the results reported by Oglah F et al. [50], who found the highest frequency of root canal treatment among individuals aged 26 - 49 years. Closely followed by the younger group (8 to 25 years), similarly, Farrel and Burk [51] reported the highest incidence of endodontic treatment among patients aged 21 to 30. Saunders and Saunders [52] also reported lower frequencies of endodontic treatments among patients younger than 25 and older than 50 years. RCT is the therapy for endodontic disease, which develops throughout life; therefore, older people are more likely to have it. As a result, studies with senior participants [36,37,38] have a higher prevalence of RCTs compared to studies with younger participants [34,35,53]. Regarding dental arch, no statistically significant association was observed between dental arch and endodontic treatment status ($p = 0.796$), though mandibular FPMs showed a slightly greater prevalence of endodontic treatment (8.3%) than maxillary FPMs (8.1%). The absence of a statistically significant difference suggests that the observed variation may be due to random differences within the study sample. Previous studies have reported varying patterns regarding the distribution of endodontically treated teeth between the maxillary and mandibular arches. For example, Oglah F et al. [50] and Ingle and Taintor [54] reported higher proportions of treated maxillary FPMs (68%) and mandibular FPMs (32%).

Furthermore, variations in the results of endodontically treated teeth rates may be attributed to variation in the types of teeth examined, the study population, age distribution, sample size, diagnostic criteria, as well as health care -relation factor. Despite the importance of these teeth, only a limited number of studies have investigated the prevalence and Status of FPMs, particularly among the adult population. To the best of our knowledge, this is the first study in Tripoli, Libya, to investigate the prevalence and distribution of different FPMS conditions, including caries, restoration, crowns, missing teeth, remaining root, and implant, in relation to demographic factors. Regarding age group, sex, and dental arch, the FPMs status was determined to be statistically significant in the current study. Females demonstrated higher proportions of restored and missing teeth compared with males, whereas males showed relatively higher proportions of remaining roots,

crowned teeth, and implants. Regarding dental arch, a significant association was found between tooth status and arch. The mandibular arch showed higher proportions of carious, restored, and missing FPMs, whereas the maxillary arch showed slightly higher proportions of intact teeth and prosthetic restorations. Early prevention measures beginning around the age of 6-7 years may help reduce the occurrence and progression of caries in permanent molars [30-32]. To prevent tooth decay and further caries progression in children's FPMs, regular dental care visits at intervals of no more than six months, together with appropriate preventive and restorative care, are recommended. First permanent molars are critical teeth in the mouth for maintaining the integrity of the dental arches; thus, they require special attention during dental examinations and comprehensive preventive measures, including fissure sealant, topical fluoride treatments, and effective home oral hygiene practices.

Conclusion

This study showed a considerable burden of dental conditions and previous dental treatment among the examined FPMs. While intact FPMs were the most common finding, a substantial proportion of FPMs were missing, restored, or endodontically treated. FPM status varied significantly according to age, sex, and dental arch, with older participants showing higher rates of missing FPMs and previous restorative treatment. Missing FPMs were more common among females and in the mandibular arch, whereas the prevalence of endodontically treated FPMs was mainly associated with age.

Limitations

The study was conducted in three private dental centres in Tripoli, where access to dental care and oral health awareness may differ from public access, which limits the generalizability of the results. Second, panoramic radiographs were used as the primary source of data without comprehensive clinical examination, which may have limited the detection and characterisation of certain dental conditions. Third, the limited availability of comparable studies from Libya, particularly from Tripoli, restricted comparisons with local data.

Recommendations

Future studies should include participants from both public and private dental facilities across different regions of Libya to improve the representativeness of the findings. Clinical examinations should be combined with panoramic radiographs and standardised indices, such as the MFDS/DMFS index, where appropriate, to enhance diagnostic accuracy. Further research is also needed to establish national baseline data on the status of first permanent molars and to support evidence-based oral health planning and preventive strategies.

Disclaimer

This article has not been previously presented or published and is not part of a thesis project.

Conflict of Interest

The authors declare no financial, personal, or professional conflicts of interest.

Acknowledgments

We would like to express our sincere gratitude to Dr Abdullah Durda, owner of Al Shams Dental Clinic, for his valuable support and for facilitating access to the clinical setting and patients required for this study.

References

1. Kurokawa M, Kanzaki H, Tokiwa H, et al. The main area in normal occlusion and mandibular prognathism. *Angle Orthod*. 2016;86(1):87-93. doi:10.2319/111114-807.1
2. Demirci M, Tuncer S, Yucekur AA. Prevalence of caries on individual tooth surfaces and its distribution by age and gender in university clinic patients. *Eur J Dent*. 2010;4(3):270-9.
3. Almarghani A. Prevalence, predictors, and reasons for permanent tooth extraction among high school students in Saudi Arabia: a national cross-sectional study. *Cureus*. 2022;14(6):e28687. doi:10.7759/cureus.28687
4. Almahdi HM, Alabdrabulridha Z, Alabbas J, Saad AA, Alarka I, Alghatm S, Alqasem H. Permanent first mandibular molar: loss prevalence and pattern among Saudis in Al-Ahsa. *Eur J Dent*. 2022. doi:10.1055/s-0042-1757904
5. Alhabdan YA, Albeshr AG, Yenugadhathi N, Jradi H. Prevalence of dental caries and associated factors among primary school children: a population-based cross-sectional study in Riyadh, Saudi Arabia. *Environ Health Prev Med*. 2018;23(1):60. doi:10.1186/s12199-018-0750-z
6. Almuqla YM. Prevalence of missing first permanent molars in a selected population in a university dental clinic setting: a retrospective radiographic study. *Int J Clin Pediatr Dent*. 2021;14(2):269-72. doi:10.5005/jp-journals-10005-1941

7. Wang JD, Chen X, Frencken J, Du MQ, Chen Z. Dental caries and first permanent molar pit and fissure morphology in 7- to 8-year-old children in Wuhan, China. *Int J Oral Sci.* 2012;4(3):157-60.
8. Macek MD, Beltran-Aguilar ED, Lockwood SA, Malvitz DM. Updated comparison of caries susceptibility of various investigations of permanent first molars. *Clin Exp Health Sci.* 2023;13:105-13.
9. Salehrabi R, Rotstein I. Endodontic treatment outcomes in a large patient population in the USA: an epidemiological study. *J Endod.* 2004;30(12):846-50.
10. García-Cortés JO, Medina-Solís CE, Loyola-Rodriguez JP, Mejía-Cruz JA, Medina-Cerda E, et al. Dental caries experience, prevalence and severity in Mexican adolescents and young adults. *Rev Salud Publica.* 2009;11(1):82-91.
11. Izzetti R, Nisi M, Aringhieri G, Crocetti L, Graziani F, et al. Basic knowledge and new advances in panoramic radiography imaging techniques: a narrative review on what dentists and radiologists should know. *Appl Sci.* 2021;11(17):7858.
12. Rezaie M, Ghapanchi J, Haghnegahdar A, Khojastehpour L, Khorshidi H, Heidari H. A radiographic evaluation of missing of permanent first molars in a group of Iranian children and adults: a retrospective study. *Int J Dent.* 2018;2018:5253965.
13. Arrow P. Dental enamel defects, caries experience and oral health-related quality of life: a cohort study. *Aust Dent J.* 2017;62(2):165-72.
14. George B, John J, Saravanan S, Arumugham IM. Prevalence of permanent tooth loss among children and adults in a suburban area of Chennai. *Indian J Dent Res.* 2011;22(2):364.
15. Elbego AAA, Alakandarani RB, ElZuki MA, Al Bego MA, Al Beeju MA. Radiographic assessment of permanent first molars in Libyan subpopulation. *Int Dent J.* 2024;74:S87.
16. Zuki M, Alaskandrani R, Elbego A, Albego M, Albego M. Retrospective cross-sectional radiographic assessment of permanent first molars in a Libyan sub-population. *Jordan J Dent.* 2025;2(2):30-6.
17. Halicioglu K, Toptas O, Akkas I, Celikoglu M. Permanent first molar extraction in adolescents and young adults and its effect on the development of third molar. *Clin Oral Investig.* 2014;18(5):1489-94. doi:10.1007/s00784-013-1121-1
18. Al-Safadi R, Al-Safadi R, et al. Prevalence of first permanent molar loss in a population of Saudi adolescents and young adults. *Int J Recent Trends Sci Technol.* 2018;5:6577-84.
19. Atieh MA. Tooth loss among Saudi adolescents: social and behavioral risk factors. *Int Dent J.* 2008;58(2):103-8. doi:10.1111/j.1875-595x.2008.tb00184.x
20. Hugo FN, Hilgert JB, De Sousa Mda L, da Silva DD, Pucca GA Jr. Correlates of partial tooth loss and edentulism in the Brazilian elderly. *Community Dent Oral Epidemiol.* 2007;35(3):224-32.
21. Ozmen B. Evaluation of permanent first molar tooth loss in young population from North Turkey. *Balkan J Dent Med.* 2019;23(1):20-3.
22. Poureslami P, Pouradeli S, Poureslami H, Shahrokhi E. Evaluation of health status of first permanent molar teeth among 12-year-old students in rural areas of south Kerman, Iran. *J Oral Health Oral Epidemiol.* 2018;7(1):33-8.
23. Almahdi HM, Alabdrabulridha Z, Alabbas J, Saad AA, Alarka I, Alghatm S, Alqasem H. Permanent first mandibular molar: loss prevalence and pattern among Saudis in Al-Ahsa. *Eur J Dent.* 2023;17(3):840-4. doi:10.1055/s-0042-1757904
24. Yahya I, Nahari HH, Kinani HM. Reasons for permanent teeth extraction in Jizan region of Saudi Arabia. *IOSR J Dent Med Sci.* 2015;14:86-9.
25. Hashim R, Salah A, Hamid A. Reasons for permanent teeth extraction in the United Arab Emirates. *J Int Oral Health.* 2019;11(5):304-8.
26. Al Ameer HM, Awad S. Reasons for permanent teeth extraction in Al-Madinah Al-Munawarah. *J Adv Med Med Res.* 2017;24(7):1-6.
27. Chrysanthakopoulos NA, Konstantinos CV. Reasons and risks of permanent teeth extraction: the general dental practice in Greece. *Int J Med Dent.* 2013;17(4):315-21.
28. Ahmad FA, Alrashidi AM, Alajmi B. Causes and patterns of tooth loss among patients attending Riyadh Elm University hospital: a cross-sectional study. *Oral Health Dent Sci.* 2019;3(4):1-5.
29. Artun J, Thalib L. Mesial migration and loss of first molars among young adolescents in Kuwait. *Community Dent Health.* 2011;28(2):154-9.
30. Alesia K, Khalil HS. Reasons for and patterns relating to the extraction of permanent teeth in a subset of the Saudi population. *Clin Cosmet Investig Dent.* 2013;5:51-6. doi:10.2147/CCIDE.S49403
31. Al-Shammari KF, Al-Ansari JM, Al-Melh MA, Al-Khabbaz AK. Reasons for tooth extraction in Kuwait. *Med Princ Pract.* 2006;15(6):417-22. doi:10.1159/000095486
32. Molven O. Tooth mortality and endodontic status of a selected population group: observations before and after treatment. *Acta Odontol Scand.* 1976;34(2):107-16.
33. Alawjali S. Retrospective panoramic radiographic study on prevalence of apical periodontitis and technical quality of root canal filling in an adult Libyan subpopulation. 2020.
34. Huuonen S, Vehkalahti MM, Nordblad A. Radiographic assessments on prevalence and technical quality of endodontically-treated teeth in the Finnish population, aged 30 years and older. *Acta Odontol Scand.* 2012;70(3):234-40.
35. Huuonen S, Suominen AL, Vehkalahti MM. Prevalence of apical periodontitis in root filled teeth: findings from a nationwide survey in Finland. *Int Endod J.* 2017;50(3):229-36.
36. Ainamo A, Soikkonen K, Wolf J, Siukosaari P, Erkinjuntti T, Tilvis R, et al. Dental radiographic findings in the elderly in Helsinki, Finland. *Acta Odontol Scand.* 1994;52(4):243-9.
37. Närhi TO, Leinonen K, Wolf J, Ainamo A. Longitudinal radiological study of the oral health parameters in an elderly Finnish population. *Acta Odontol Scand.* 2000;58(3):119-24.
38. Soikkonen KT. Endodontically treated teeth and periapical findings in the elderly. *Int Endod J.* 1995;28(4):200-3.

39. Jiménez-Pinzón A, Segura-Egea JJ, Poyato-Ferrera M, Velasco-Ortega E, Ríos-Santos JV. Prevalence of apical periodontitis and frequency of root-filled teeth in an adult Spanish population. *Int Endod J*. 2004;37(3):167-73.
40. Loftus JJ, Keating AP, McCartan BE. Periapical status and quality of endodontic treatment in an adult Irish population. *Int Endod J*. 2005;38(2):81-6.
41. Tassoker M, Akgunlu F. Radiographic evaluation of periapical status and frequency of endodontic treatment in a Turkish population: a retrospective study. *J Istanbul Univ Fac Dent*. 2016;50(2):10-6.
42. Kamberi B, Hoxha V, Stavileci M, Dragusha E, Kuçi A, Kqiku L. Prevalence of apical periodontitis and endodontic treatment in a Kosovar adult population. *BMC Oral Health*. 2011;11:32.
43. Peters LB, Lindeboom JA, Elst ME, Wesselink PR. Prevalence of apical periodontitis relative to endodontic treatment in an adult Dutch population: a repeated cross-sectional study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2011;111(4):523-8.
44. Alrahabi M, Younes HB. A cross-sectional study of the quality of root canal treatment in Al-Madinah Al-Munawwarah. *Saudi Endod J*. 2016;6(1):31-6.
45. Ahmed I, Ali RW, Mudawi AM. Prevalence of apical periodontitis and frequency of root-filled teeth in an adult Sudanese population. *Clin Exp Dent Res*. 2017;3(4):142-7.
46. Kabak Y, Abbott PV. Prevalence of apical periodontitis and the quality of endodontic treatment in an adult Belarusian population. *Int Endod J*. 2005;38(4):238-45.
47. Oginni AO, Adeleke AA, Chandler NP. Root canal treatment and prevalence of apical periodontitis in a Nigerian adult subpopulation: a radiographic study. *Oral Health Prev Dent*. 2015;13(1):85-90.
48. Mukhaimer R, Hussein E, Orafi I. Prevalence of apical periodontitis and quality of root canal treatment in an adult Palestinian sub-population. *Saudi Dent J*. 2012;24(3-4):149-55.
49. Ilić J, Vujašković M, Tihaček-Šojić L, Milić-Lemić A. Frequency and quality of root canal fillings in an adult Serbian population. *Srp Arh Celok Lek*. 2014;142(11-12):663-8.
50. Oglah D, Zeidan B, Gholam M. Evaluation of endodontic treatment in three specialized private clinics in Baghdad (retrospective study). *Mustansiria Dent J*. 2018;8(3):233-6. doi:10.32828/mdj.v8i3.333
51. Farrel TH, Burke FJT. Root canal treatment in General Dental Service, 1948-1987. *Br Dent J*. 1989;166(6):203-8.
52. Saunders WP, Saunders EM. Endodontics and the elderly patient. *Restorative Dent*. 1988;4(1):4-9.
53. León-López M, Cabanillas-Balsera D, Martín-González J, Montero-Miralles P, Saúco-Márquez JJ, Segura-Egea JJ. Prevalence of root canal treatment worldwide: a systematic review and meta-analysis. *Int Endod J*. 2022;55(11):1105-27. doi:10.1111/iej.13822
54. Ingle JI, Taintor JF. *Endodontics*. 2nd ed. Philadelphia: Lea & Febiger; 1976.