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Retrospective Panoramic Radiographic Study on Prevalence of Apical Periodontitis and Technical Quality of Root Canal Filling in an Adult Libyan Subpopulation

Samia .S. Alawjali

Department of Conservative Dentistry and Endodontics, Faculty of Dentistry,

University of Benghazi. Libya.

E-mail: sellawjali@yahoo.co.uk

Abstract

The aim of the study was to evaluate the prevalence of apical periodontitis and technical quality of root canal filling in an adult Libyan subpopulation using digital panoramic radiographs. Materials and methods: The Digital panoramic radiographs of 305 patients (155males and 150 females) were evaluated. The periapical status was assessed for the presence or absence of radiographic signs of apical periodontitis (AP) for all teeth except third molars. Also the technical quality of root canal filling was evaluated according homogeneity and apical extension from the radiographic apex. The statistical analysis was performed with Chi-squared test with significant level ($p<0.05$). Results: A total of 7957 teeth were evaluated. 5.5% of teeth were endodontically treated. 6.2% of teeth had AP. The prevalence of endodontic treatment and AP were significantly higher in the maxillary arch than in the mandibular arch. The highest prevalence of endodontically treated teeth and AP were in mandibular first molars. The frequency of AP associated with endodontically treated teeth was significantly higher in females than males. 44.2%

of endodontic treated teeth were adequate length of root filled, 40.5% under filled and 15.3% over filled. 54.7% unacceptable homogeneity. The prevalence of AP was significantly high in association with underfilling and unacceptable homogeneity endodontically treated teeth. Conclusion: The prevalence of endodontically treated teeth and AP in the Libyan subpopulation was within the range reported for other countries. The prevalence of AP was a highly significantly higher in endodontically treated teeth than in non - endodontically treated teeth. The prevalence of endodontically treated teeth and AP were significantly high in maxillary teeth than mandibular teeth and in first molars than premolars and anterior teeth. This study found a significant correlation between AP and inadequate quality of endodontic treatment our findings emphasize that extensive efforts are required to promote periradicular health by improving the standards in the quality of endodontic treatment in Libya.

Keywords: Apical periodontitis, panoramic radiograph, technical quality, root canal filling, Libyan subpopulation

الملخص:

هدف هذه الدراسة هو تقييم معدل انتشار الآفات الذروية والجودة التقنية لحشو الاقنية الجذرية لمجموعة من مرضى الاسنان الليبين البالغين باستخدام الصور الشعاعية البانورامية الرقمية. مواد البحث وطرائقه: تم فحص الصور الشعاعية البانورامية لدى ٣٠٥ مريض (١٥٥ ذكرو١٥٠ انثى) لتقييم حالة الانسجة حول الجذرية وذلك بتحديد وجود او عدم وجود علامات اشعاعية للآفات الذروية (AP) لجميع الاسنان باستثناء الرحاء الثالثة. كذلك تم تقييم الجودة التقنية لحشوات الاقنية الجذرية من خلال تقييم كثافة وطول المادة الحاشية من الذروة الشعاعية. أجري التحليل الاحصائي باختبار chi – square وعد الفرق الدال إحصائيا (P< 5.0) . النتائج: العدد النهائي للأسنان التي قيمت هي ٧٩٥٧ سن. ٥,٥% اسنان المعالجة لبياً ٦,٢% اسنان كانت لها افات ذروية (AP) كانت نسبة انتشار الاسنان المعالجة اللبية والآفات الذروية في الفك العلوي اعلي بفارق دال احصائيا عن الفك السفلي. كانت اعلي نسبه للإسنان المعالجة ولها (AP) الارحاء السفلية الاولي ومعدل انتشار (AP) المرتبطة بالأسنان المعالجة بفارق دال احصائيا اعلي في الاناث عن الذكور.٤٤,٢% من الاسنان المعالجة كانت بطول كافي للمادة الحاشية، ٤٠,٥% نقص

في الطول للمادة الحاشية، ١٥,٣% تجاوز في المادة الحاشية ٥٤,٧ % غير مقبول في كثافة الحشوة القنوية. كان انتشار (AP) اعلي بفارق دال احصائيا في الاسنان المعالجة اللبية بحشوة بها نقص في الطول والكثافة غير مقبولة. الخلاصة: معدل انتشار الاسنان المعالجة لبيا ونسبة (AP) في الليبين ضمن نطاق الإحصائيات في الدول الأخرى. كان معدل انتشار (AP) اعلي في الاسنان المعالجة لبيا منه في الاسنان الغير معالجة. وكان انتشار الاسنان المعالجة لبيا و (AP) في اسنان الفك العلوي اعلي منه في اسنان الفك سفلي وكذلك اعلي في الرحاء الاولى عنه في الضواحك والاسنان الامامية بفارق دال احصائي. وجدت هذه الدراسة ارتباط كبير بين (AP) وجودة العلاج اللبي الغير مقبول وتؤكد النتائج التي توصلنا إليها على ضرورة بذل جهود واسعه النطاق لتعزيز صحة الانسجة حول الجذرية من خلال تحسين معايير جودة علاج اللبية في ليبيا .

الكلمات المفتاحية: الآفات الذروية، الصور الشعاعية البانورامية، الجودة التقنية، الحشو الاقنية الجذرية، الليبين.

Introduction:

Apical periodontitis (AP) is an acute or chronic inflammatory lesion in the periradicular tissues which caused by bacteria invasion and colonization of the pulp and root canal system penetrating into the periapical tissue. AP usually develops after necrosis of the pulp and is frequently detected in connection with endodontically treated teeth. [1, 2] Diagnostic measures criteria for AP include the presence of symptoms and clinical signs during clinical examination and analysis of radiographs. Chronic apical periodontitis is frequently asymptomatic and discovered primarily on routine radiographic examination. Different epidemiological cross sectional studies show AP being a widespread condition in different populations and its prevalence varies from 27 to 70%.[3] The crucial factor for a successful healing of the periapical region is adequate root canal therapy with densely homogenous obturation well adapted to the canal walls and with length less than 2mm from the root apex. [4,5] Previous studies reported that the frequency of endodontic treatment ranged from 22%-72%. [4, 6]

Many epidemiological studies which have been carried out in different population have shown that a high prevalence of AP associated with root filled teeth. According to these

studies poor quality of root filling is one of the main features associated with the presence of AP. [2, 7] High prevalence of AP indicates a health problem associated with medical, ethical repercussion and economical. [8,9]

So far, no study has been conducted in Libya on prevalence of AP in non - endodontically treated teeth and endodontically treated teeth and its correlation with quality of root canal treatment. The aims of this study were to evaluate the prevalence of teeth with radiographically detectable periapical lesions in non - endodontically and endodontically treated teeth and to assess the technical quality of root canal treatment in an adult Libyan subpopulation using digital panoramic radiographs.

Materials and methods:

The study was granted the approval by Elaml dental center at Benghazi, Libya. In this retrospective cross-sectional study, a total of 411 digital panoramic radiographs were randomly selected from the records of dental patients who attended the Elaml dental center at Benghazi, Libya for routine dental treatment. Digital panoramic radiographs were taken by using Owandy digital x-ray unit system machine (Italy). The database of digital panoramic radiographs from 411 patients was evaluated. Radiographic images with blurred anterior regions and poor quality were excluded. Also panoramic radiographs with mixed dentition and less than ten remaining teeth, teeth with localized or generalized periodontitis and third molars were excluded. The final sample size in this study was reduced to a total of 305 panoramic radiographs (155males and 150 females) according to exclusion criteria. The panoramic radiographic images were evaluated by one endodontist. The periapical status and the quality of all root filling were assessed for all teeth except the third molars. All teeth were recoding according to Federation Dentaire International (FDI) nomenclature. The following data were recorded on previously prepared form for each patient: sex, teeth present, location and number of endodontically

treated teeth (a tooth with radiopaque material in the root canals) with and without apical periodontitis and technical quality of root canal filling, location and number of non-root filled teeth with apical lesions. In case of the multirooted teeth, the worst scored root was considered.

The technical quality of root canal fillings was assessed according to length from the root apex and homogeneity using the following criteria:

- Length Adequate: The root canal filling was 0-2mm short from radiographic apex.
- Under filling: It was more than 2mm from radiographic apex.
- Overfilling: Excess filling was beyond the radiographic apex.
- Acceptable homogeneity: The radio density of fill was uniform, adapted to root canal walls good condensation and no voids.
- Unacceptable homogeneity: Presence of lateral spaces or voids, poor condensation and unfilled canals.

The parameters used to categorize periapical status were:

- Healthy periapical status: if the periodontal ligament was intact with no signs of periapical pathosis.
- Apical periodontitis (AP) :(Widening of periodontal ligament) if the widening of apical part of the periodontal ligament space was not exceeding two times the width of the lateral periodontal ligament. Or (periapical radiolucency) radiolucency at apical part exceeding two times the width of the lateral part of the periodontal ligament.

To check the reliability of the radiographic examination, a sample of 50 radiographs was re-examined by the same endodontist two weeks later and an agreement of 100% was obtained. The analysis of the data was performed using (SPSS 18.0 Chicago, USA). The Chi-squared test was used to assess the data and determine statistical significance

between different parameters. The significance level was set at $p<0.05$.

Results:

This study consists of 305 patients (150 for females and 155 for males). A total of 7957 teeth were evaluated 3924 (49.3%) teeth for females and 4033(50.7%) teeth for males. Excluding the third molar teeth, the total number of missing teeth was 583. The males had more missing teeth 307(52.7%) than the females 276(47.3%) (Table1). The prevalence of missing teeth of maxillary arch 317 (54.4%) was higher than that of mandibular arch 266 (45.6%). (Table 2) Mandibular first molar was missing more frequently than any other tooth 129(22.1%) followed by the maxillary second premolar 89 (15.3%). Mandibular canine was the least missing teeth 2 (0.3%). (Table3)

Table 1: Distribution of teeth examined, endodontically treated teeth, endodontically treated teeth with apical periodontitis, non- endodontically treated teeth with apical periodontitis and missing teeth according to gender.

Gender	No of teeth examined	No. of Endodontically treated teeth	No. of endodontically treated teeth with Ap.	No. of non-endodontically treated teeth with Ap.	No. of Missing teeth
Female	3924 (49.3%)	219 (49.9%)	131 (53.9%)	98 (39.7%)	276 (47.3%)
Male	4033(50.7%)	220 (50.1%)	112 (46.1%)	149 (60.3%)	307(52.7%)
Total	7957	439	243	247	583

Endodontic treated teeth were detected in 439 teeth (439/7957; 5.5%). No significant difference was detected in the distribution of endodontically treated teeth between genders ($P= 0.9, > 0.05$) (Table 1). The frequency of endodontic treatment of all teeth was significantly higher in the maxillary arch 295(67.2%) than in the mandibular arch144

(32.8%) (P< 0.05) (Table2). The highest prevalence of endodontically treated teeth was in mandibular first molar 67 (15.3%) followed by maxillary first premolar 66 (15%). The mandibular central incisors had the least frequency of endodontically treatment among all teeth types in both arches 1 (0.2%) (Table3).

Table 2: Distribution of teeth examined, endodontically treated teeth, endodontically treated teeth with apical periodontitis, non endodontically treated teeth with apical periodontitis and missing teeth according to dental arch.

Dental Arch	No. of teeth examined	No. of Endodontically treated teeth	No. of endodontically treated teeth with AP	No. of non-endodontically treated teeth with AP	No of missing teeth
Maxillary Teeth	3953 (49.7%)	295(67.2%)	165 (68%)	168 (68%)	317(54.4%)
Mandibular Teeth	4004(50.3%)	144 (32.8%)	78(32%)	79(32%)	266(45.6%)
Total	7957	439	243	247	583

Regarding the periapical status, out of 7957 teeth assessed, 490 (6.2%) teeth had AP and 7467 (93.8%) without AP. The prevalence of AP was highly significantly higher (p<0.0001) in endodontically treated teeth 243(55.4%) than in non -endodontically treated teeth 247 (3.3%). (Table4). As shown in (Table 1), the frequency of AP associated with endodontically treated teeth was significantly higher for females 131(53.9%) teeth than that for males teeth 112 (46.1%). However, the frequency of AP with non -endodontically treated teeth was significantly higher for males 149 (60.3%) than that for females 98 (39.7%). According to dental arches the statistic study shows that. AP with endodontically and non-endodontically treated teeth were significantly higher in maxillary teeth 165 (68%) than in mandibular teeth78 (32%). (Table2)

Among endodontically treated teeth, the highest prevalence of AP was detected in mandibular first molar teeth 38 (15.6%) and maxillary first molar teeth 37 (15.2%)

followed by maxillary first premolar teeth 13.2% and maxillary second premolar teeth 30 (12.3%). However in non-endodontically treated teeth, the highest prevalence of AP was detected in maxillary first molar teeth 35 (14.2%) followed by maxillary second premolar teeth 29(11.7%) and mandibular first molar teeth 28 (11.3%). (Table3).

Table 3: Distribution of teeth examined, endodontically treated teeth, endodontically treated teeth with apical periodontitis, non- endodontically treated teeth with apical periodontitis and missing teeth according to tooth type.

Tooth Type	No. of teeth examined	No. of Endodontically treated teeth	No. of endodontically treated teeth with AP	No. of non-endodontically treated teeth with AP	No. of missing teeth
Maxilla					
Central incisors	597 (7.5%)	25(5.7%)	12 (4.9%)	11(4.5%)	13(2.2%)
Lateral incisors	602 (7.6%)	25 (5.7%)	19 (7.8%)	23 (9.3%)	8 (1.4%)
Canine	601(7.5%)	31(7.1%)	16(6.6%)	23(9.3%)	9 (1.5%)
First premolar	540 (6.8%)	66 (15%)	32(13.2%)	26(10.5%)	70 (12%)
Second premolar	521(6.5%)	61(13.9%)	30(12.3%)	29(11.7%)	89 (15.3%)
First molar	528 (6.6%)	62 (14%)	37 (15.2%)	35 (14.2%)	82 (14.1%)
Second molar	564 (7.1%)	25 (5.7%)	19 (7.8%)	21(8.5%)	46 (8%)
Mandible					
Central incisor	605 (7.6%)	1(0.2%)	1 (0.4%)	4 (1.6%)	5 (0.9%)
Lateral incisors	607 (7.6%)	3 (0.7)	3 (1.2%)	4(1.6%)	3 (0.5%)
Canine	608 (7.6%)	7 (1.6%)	3 (1.2%)	5 (2%)	2 (0.3%)
First premolar	593 (7.5%)	15 (3.4%)	8 (3.3%)	8 (3.2%)	17 (2.9%)
Second premolar	573 (7.2%)	28 (6.4%)	15 (6.2%)	17 (7%)	37 (6.3%)
First molar	481 (6%)	67 (15.3%)	38 (15.6%)	28 (11.3%)	129 (22.1%)
Second molar	537 (7%)	23 (5.2%)	10 (4.1%)	13 (5.3%)	73 (12.5%)
Total	7957	439	243	247	583

Regarding the technical quality of root canal fillings, the relation between the length of root filling and periapical status is presented in (Table 5). The number of adequate length of root filled teeth was 194 (44.2%), whereas 178(40.5%) were under filled and 67(15.3%) over filled. The AP was presented most frequently in association with the under filled teeth 131 (54%) followed by adequate filled 64 (26.3%) and 48 (19.7%) over filled with high significant difference (P< 0.05). The normal periapical area was observed most frequently in association with the adequate filled 130 (66.3%) followed by under filled 47(24%) and over filled 19 (9.7%) with high significant difference (P< 0.0001).

Table 4: Distribution of teeth examined according to the apical status

Apical status of teeth	No. of teeth examined	No. of non-endodontically treated teeth	No. of endodontically treated teeth
Without apical periodontitis	7467 (93.8%)	7271(96.7%)	196 (44.6%)
With apical periodontitis	490 (6.2%)	247(3.3%)	243 (55.4%)
Total	7957 (100%)	7518 (100%)	439 (100%)

Table 5: Relation between the length of root filling and periapical status

Length of root filling	Number of teeth	Periapical status	
		Normal periapical area	Apical periodontitis
Under filling	178 (40.5%)	47 (24%)	131 (54%)
Adequate	194 (44.2%)	130 (66.3%)	64 (26.3%)
Over filling	67 (15.3%)	19 (9.7%)	48 (19.7%)
Total	439 (100%)	196 (100%)	243 (100%)

(Table 6) shows the relation between the homogeneity of root filling and periapical status. The endodontically treated teeth with unacceptable homogeneity 240(54.7%) was highly significantly higher than that with acceptable homogeneity 199 (45.3%) ($P < 0.0001$).

The prevalence of AP was highly significantly higher in the endodontically treated teeth with unacceptable homogeneity 175(72%) than that with acceptable homogeneity 68 (28%) ($P< 0.05$). The normal periapical area was significantly higher in the endodontically treated teeth with acceptable homogeneity131 (66.8%) than that with unacceptable homogeneity 65 (33.2%) ($P < 0.05$).

Table 6: Relation between the homogeneity of root filling and periapical status

Homogeneity of root filling	Number of teeth	Periapical status	
		Normal periapical area	Apical periodontitis
Acceptable homogeneity	199 (45.3%)	131 (66.8%)	68 (28%)
Unacceptable homogeneity	240(54.7%)	65 (33.2%)	175(72%)
Total	439 (100%)	196 (100%)	243(100%)

Discussion

The present study is retrospective cross sectional study used to evaluate the prevalence of AP and technical quality of endodontic treatment teeth for selected, adult patient attending Elaml dental center at Benghazi, Libya. For evaluation periapical status and root canal treatment, some epidemiological studies have used periapical radiographs whereas others panoramic radiographs or both. As full mouth periapical radiographs are not used routinely in Elaml dental center, this study relied on digital panoramic radiographs, because of their availability and their convenience: All teeth can be seen on single radiography, radiation dose is reduced compared to the full mouth periapical

radiograph survey and the speed at which panoramic radiographs can be exposed and processed is high. Study by (Muhammed and Manson –Hing, 1982) they found no statistically significant difference between panoramic radiographs and periapical radiographs in detection of AP.[10] The accuracy of panoramic radiographs in the detection of AP was investigated by (Ahlqwist et al., 1986) and they reported agreement of 76% and 90% for single and multirooted teeth, respectively. [11] Furthermore, modern panoramic machine produce better quality image even in anterior region. In addition digital panoramic images may be assessed by using enhancing software that enhances evaluation. Therefore, the panoramic radiograph could be considered as acceptable diagnostic tool for detection of apical periodontitis. [12]

This study consists of 155 male and 150 female. A total of 7957 teeth were evaluated (49.3%) teeth for females and (50.7%) teeth for males. The males had more missing teeth (52.7%) than the females 47.3%, the reason for it might be female increased awareness of oral health importance and increased level of oral health care.

The result of this study on a group of Libyan dental patients has shown overall prevalence of endodontically treated teeth was 5.5% for all examined teeth. This prevalence was higher than the results of previous studies in different populations from different parts of the world; 2.4% in Spanish population [7] , 2.0% in Irish population[13], 2.3% in Kosovar population [14], 4.8% in Dutch population [15] 3.7% in Turkish population [2] , 1.6% in Sudanese population [16] and lower than 21.5% in Finland population [17], 20% in Belarusian population [18] , 13.2 % in Palestinian population [19] , 12.2 % in Nigerian population [20], 6.3 % in Saudi population [21]. This low prevalence of endodontically treated teeth in our study may attributed to the country health care services and in Libya, endodontic treatment is relatively expensive; that is why patients prefer to extract their diseased teeth. This approved in this study where the number of missing teeth 583 was higher than endodontically treated teeth 439.In The present study found that no

significant difference was detected in the distribution of endodontically treated teeth between genders (P>0.05). This finding is in agreement with other studies previously. [2, 12, 16] According to the findings from other studies which reported that the frequency of endodontically treated teeth was significantly higher in females. [15, 19] The prevalence of endodontically treated teeth was significantly higher in the maxillary arch (67.2%) than in the mandibular arch (32.8%) (P< 0.05) this finding is in agreement with other studies previously reported. [18, 19, 21, 22, 23, 24, 25] According to tooth type, the highest prevalence of endodontically treated teeth was in mandibular first molar (15.3%) followed by maxillary first premolar (15%). The mandibular central incisors had the least frequency of endodontically treatment among all teeth types in both arches 1 (0.2%). Similar to previous reports [19, 26, 27], this selected population revealed the most frequent missing teeth, endotontically treated teeth and the highest AP frequency were first mandibular molars [9, 19, 21, 26, 27]. A possible explanation of this result is the early eruption time of the first molar teeth will expose them more irritants, caries, operative procedures, and pulpal disease, and subsequently are subjected more often to endodontic treatment and extraction. [9, 19]

Regarding the periapical status, the prevalence of teeth with AP in this study was 6.2% for all teeth examined. This prevalence is similar to that found by previous studies in different population 6.2% in Lodz [28] , 6.6% in Belgium[8] and lower than 16% in Norway [29], 12% in Belarusian [18], 7.6% in Denmark[30] , 15.1% in Palestinian population [19] and 7.4 % France [31] . Also higher than 4.15% in Saudi population[21] , 4% Moroccan[32], 3.3% Sudanese population[16], 3.4% Canada[33], 1.4% Turkey[25], 2.6% Ireland[13]. These differences in prevalence in different populations may attribute to the variation in methodology (study design, investigation methods, sample selection and evaluation criteria) and difference in oral health policies among countries. .

In the present study, the prevalence of AP was a highly significant higher ($p<0.0001$) in endodontically treated teeth (55.4%) than in non-endodontically treated teeth (3.3%) this result in agreement with other previous studies reported a significant higher percentage of AP associated with endodontically teeth in range (16.8-46%) in comparison with non- endodontically teeth.

The results of the present study showed that the frequency of AP associated with endodontically treated teeth was significantly higher for females teeth (53.9%) than that for males teeth (46.1%). this result consistent with other previous studies. [14, 21, 34] However, in some epidemiological studies, gender was reported to have no effect on the presence of AP. According to dental arches this study shows that AP with endodontically and non-endodontically treated teeth were significantly higher in maxillary teeth (68%) than in mandibular teeth (32%), this findings are in agreement with previous studies [19, 31, 35]. Although other previous studies reported that no significant difference between the frequency of AP with endodontically treated teeth in maxillary and mandibular arch. [14, 24] The highest prevalence of AP was detected in mandibular and maxillary first molar teeth followed by maxillary premolar teeth. This finding is in agreement with previous studies [3, 9, 16, 19]. They possess the most complex root canal anatomy [26, 4].

The aim of root canal treatment is to mechanically and chemically clean, shape and three dimensionally fill the root canal system to prevent periapical inflammation and to provide a good environment for healing of any apical inflammation. Quality of root canal filling is one of the most important factors for endodontic treatment success. In the present study, the technical quality of the root canal filling is evaluated by two criteria: the length of the root canal filling from the radiographic apex and the homogeneity and density of the canal obturation. In the present study, the root filling length was found to be adequate in 44.2% of the teeth, whereas (40.5%) were under filled and (15.3%) over filled.

The apical periodontitis was significantly more in the under filled teeth (54%), in adequate filled (26.3%) and (19.7%) over filled.

Statistical analysis revealed that under filled teeth are significantly more prone to develop an apical radiolucency than overfilled teeth, $p<0.005$ this finding is in agreement with other studies [19, 36,37] however, which is contrary to the result of previous studies reported that overfilled were more frequently associated with an apical periodontitis [20,33,38]. Under filling cause the development of apical periodontitis due to remnants of dentin or infected pulp in the apical part of the root canal. Previous studies have shown that 10-46% of teeth with adequate length of root filling had periapical periodontitis [33, 39, 40].

In the present study, the endodontically treated teeth with unacceptable homogeneity (54.7%) were highly significantly higher than that with acceptable homogeneity (45.3%). The prevalence of Apical periodontitis was highly significantly higher in the endodontically treated teeth with unacceptable homogeneity and inadequate compacted (72%) than that with acceptable homogeneity (28%). These findings are consistent with previous studies reported that 30-60 % of endodontically treated teeth showing voids, non-homogenous and inadequate compacted and approximately 60-96% of these had apical periodontitis [24,33,38,39,40]

This study has been designed to gather data from digital panoramic radiographs. They were examined at a single time point with no information was available regarding when the endodontic treatments are performed. A radiograph provides only static information of a dynamic process. Therefore, it was not possible to determine whether a periapical lesion is healing or not. However the study was focused on the prevalence of apical periodontitis, not on the outcome of endodontic therapy it will help us to provide the basic knowledge about overall prevalence of the AP and the relation between quality of root canal treatment and the apical periodontitis.

Conclusion

This study provides an epidemiological data about apical periodontitis and root canal treatment in Libyan subpopulation. The prevalence of endodontically treated teeth and apical periodontitis in the Libyan subpopulation were within the range reported for other countries. The prevalence of AP was highly significantly higher in endodontically treated teeth than in non-endodontically treated teeth. The prevalence of endodontically treated teeth and apical periodontitis were significantly high in maxillary teeth than mandibular teeth and in first molars than premolars and anterior teeth. This study found a significant correlation between apical periodontitis and inadequate quality of endodontic treatment. Our findings emphasize that extensive efforts are required to promote periradicular health by improving the standards in the quality of endodontic treatment in Libya.

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