

Prevalence of Periapical Lesion with Open Apex- A Retrospective Study

Ramya. G,

Saveetha Dental College and Hospitals,
Saveetha Institute of Medical and Technical Sciences,
Saveetha University,
Chennai-600077.

Email ID: 151701005.sdc@saveetha.com

Phone number : 9962988697

Dr Adimulapu Hima Sandeep

Associate Professor,
Department of Conservative Dentistry & Endodontics,
Saveetha Dental College,
Saveetha Institute of Medical and Technical Sciences,
Chennai - 600077

E-Mail ID: himas.sdc@saveetha.com

Contact: +919003175288

Corresponding Author:

Dr Adimulapu Hima Sandeep

Associate Professor,
Department of Conservative Dentistry & Endodontics,
Saveetha Dental College,
Saveetha Institute of Medical and Technical Sciences,
Chennai - 600077

E-Mail ID: himas.sdc@saveetha.com

Contact: +919003175288

ABSTRACT :

Background : There is an increased incidence of open apices with associated periapical lesions. It is important to induce root closure with no canal wall thickening or continuous lengthening. Open apices still pose a challenge for immediate resolution.

Aim : To find the prevalence of open apex associated with periapical lesions.

Materials & Methodology : The study was performed in the out patient department of Conservative Dentistry & Endodontics. Data required for the study was procured by reviewing patient records & analysed data of patients between June 2019 - February 2021. The data was

analysed using IBM SPSS software Chi-square analysis ($p < 0.05$) & the results interpreted in graphs and tabulations.

Results : The prevalence of open apex with periapical lesion was found to be 63%. The study shows a female predilection ($p < 0.05$) with trauma being the most common etiological factor associated with open apex with periapical lesion ($p < 0.05$).

Conclusion : Pulp necrosis mostly due to trauma (mainly in childhood) can arrest root development in teeth with incomplete root resulting in open apices. Prolonged periods of such cases being left undiagnosed can lead to increased infection & periapical lesions. It is imperative to diagnose & treat them as early as possible.

Keywords : Open apex;Periapical lesion;Trauma;Endodontic;Root closure

Running title : Prevalence of periapical apex with open apex.

INTRODUCTION :

The ultimate goal in the practice of endodontics is to debride & obturate the canal as efficiently as possible. Classically there are 2 types of open apices, the first being a non-blunderbuss where the walls are parallel to slightly convergent as the canal narrows down to the root. The apex is usually tapered [1]. The second type is a blunderbuss in which the walls are divergent & flaring, more especially in the buccolingual direction [2].

The causes of open apices include incomplete development, necrosis of pulp due to caries or trauma before the root formation is completed, extensive apical resorption, over instrumentation, etc. [3–7]. Teeth with open apices usually tend to have thin dentinal walls that are susceptible to fracture before, during and after endodontic treatment [8,9]. Frequently open apices present with periapical lesions, which may or may not be associated with apical resorption [10]. Short roots compromise the crown-root ratio, often affecting long-term prognosis [11].

Fractures of the crown are common following trauma [12]. This can compromise aesthetics, especially in the anterior region and there may be a lack of tooth tissue present. In long standing cases these teeth undergo discolouration [13].

Large open apices pose a challenge in determining the working length, decision on the necessity of root canal preparation & achieving control during obturation. Endodontic management of pulpless, permanent teeth with a wide open blunderbuss apex has long presented a challenge to dentistry because of wide open apex at which obtaining an apical seal is difficult [14].

Any trauma left undiagnosed over a prolonged period of time leads to increased infection & thereby periapical lesion [15].

Our team has extensive knowledge and research experience that has translate into high quality publications [16–25], [26–29], [30–34], [35]

The aim of the study was to find the prevalence of periapical lesions present with open apex.

MATERIALS & METHODOLOGY :

The study was performed at Saveetha Dental College, Chennai. Data required for the study was procured from the Dental Information Archiving Software. A search was done on the digital case sheets recorded between June 2019 - February 2021 ,from the department of Conservative Dentistry and Endodontics. Ethical approval was obtained from the institutional committee. By following simple random sampling 100 cases were procured which were reported to be documented as open apex on diagnosis. Evaluation of the data was done in the presence of additional reviewers ,photographs, radiographs, procedure notes. All the available data were taken ,sorting process done to minimise sampling error. The data was entered methodologically in Excel sheet & verified manually. Incomplete data were excluded. Analysis of the tabulated data was done using the IBM SPSS software analysis. The following parameters were assessed :

- PERIAPICAL LESION - present/absent
- AGE
- GENDER
- ETIOLOGY - Trauma / Other reasons

Descriptive analysis performed & results interpreted in graphs & the data was subjected to statistical analysis Chi-square test. The level of significance was set at $p < 0.05$.

RESULTS :

The total number of patients as recorded for this study with open apex were 100. Among them the number of individuals associated with periapical lesion were 63, while 37 of the individuals in this study with open apex did not have periapical lesion although there was the presence of open apex. The prevalence rate was obtained to be 63%. The mean age of the individuals as observed in this study was 15 years. The gender distribution of the study shows a male predilection (Chi-square $p = 0.000$). The most common etiology associated with open apex with periapical lesion in this study was found to be trauma (Chi-square, $p=0.00$). The most common etiology associated with open apex with periapical lesion in this study was found to be trauma (Chi-square, $p = 0.00$).

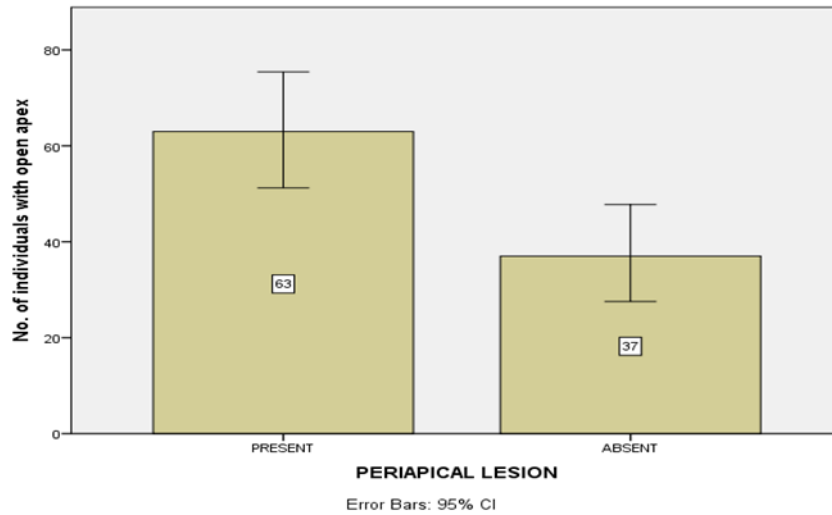


Figure 1 : Bar chart depicting the prevalence of periapical lesions from the assessed open apex case sheets. The X-axis depicts the presence or absence of periapical lesion, the Y-axis depicts the no. of casesheets examined. Prevalence of open apex with periapical lesion was found to be 63%.

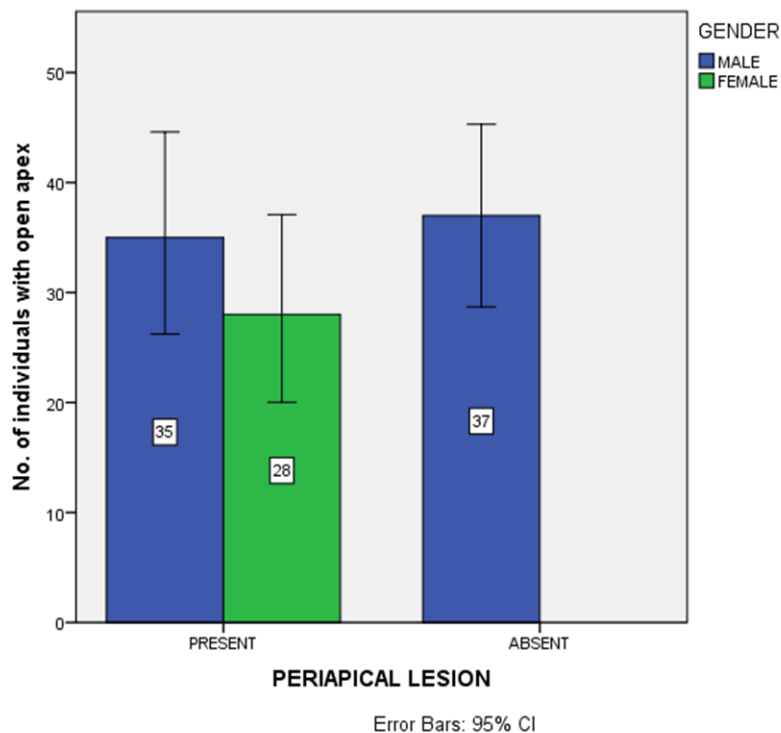


Figure 2 : Bar chart depicts the association between open apex with periapical lesion and the gender distribution as observed in the study. The X-axis depicts the presence or absence of periapical lesions, the Y-axis depicts the number of individuals examined. The blue bar depicts the males while the green bar depicts the females. Females were found to be more commonly associated with open apex and periapical lesions which was statistically significant, $p=0.000$ (Chi square analysis)

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	22.840 ^a	1	.000		
Continuity Correction ^b	20.688	1	.000		
Likelihood Ratio	32.034	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	22.611	1	.000		
N of Valid Cases	100				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 10.36.

Figure 3 : Table depicts the Chi-square analysis for association between open apex with periapical lesion and gender distribution as observed in the study, showing a female predilection. P value obtained is 0.000 which is less than 0.05, thereby proving that the results are significant.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	81.104 ^a	1	.000		
Continuity Correction ^b	77.368	1	.000		
Likelihood Ratio	101.129	1	.000		

Fisher's Exact Test				.000	.000
Linear-by-Linear Association	80.293	1	.000		
N of Valid Cases	100				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.54.

Figure 4 : Table depicting the Chi-square analysis performed for association between open apex with periapical lesion and etiology for the same which is $p = 0.000$, $p < 0.05$, thereby proving that the study results are significant. I.e., The most common associated etiology is trauma.

DISCUSSION :

Open apices pose a great difficulty for immediate resolution. The most important aspect is to diagnose & identify the presence of open apex & the incomplete root formation on eliciting history of an open apex & the incomplete root formation on eliciting history of trauma. It is imperative to induce root closure with no canal wall thickening or continuous root lengthening [36].

There are many a negative aspects to open apices as well as their treatment options, these include extraction of MTA beyond the apex, calcific barrier taking prolonged healing period, tooth discolouration - a major drawback if teeth present in aesthetic zone, fracture of tooth pre-operatively, inter- operatively or even post- operatively, failure of the treatment [37–41].

The prevalence of open apex with periapical lesions as perceived in this study was 63%. Previous studies show considerably increased levels of periapical lesions in association with open apices. Also, the incidence of periapical lesions were found to be significantly high among underfilled teeth [42,43]. Our study results were in concordance to the previous studies.

From the data analysed it was reported that the mean age of individuals having open apex associated with periapical lesions in this study was 15 years. No previous literature was observed to have interpreted similar findings.

The gender distribution of the study reveals a female predilection. Among the study population assessed, 72 individuals were male , while 28 were female. About 49% of the males showed association of open apex with periapical lesion.

Although more males had open apex, the association of open apex with periapical lesion was documented higher in females.

Chi-square analysis of association of gender with open apex with periapical lesion, where $p=0.00$, $p < 0.05$, thereby significant.

On assessing to find the most common etiology for open apices, various factors such as trauma, dental caries, internal resorption, accidental exposure were analysed and trauma was ultimately reported as the most common etiology associated. Immature root with a necrosed pulp results mainly due to childhood trauma [44]. Previous studies also cite facts in concordance to our study, that trauma being the widely common etiology [45]. Chi-square analysis performed for the same revealed $p=0.00$, $p < 0.05$, thereby significant.

Management of open apices is a herculean task. Usually chemomechanical debridement is done using K-files, followed by irrigation using chlorhexidine and saline [46]. CaOH, the most preferred followed by MTA & other bioaggregate materials, is chosen and placed periapically. Triple antibiotic paste is also used.

Mostly the multi visit treatment modality is adopted. Hence post reduction of periapical radiolucency, by placement of intracanal medicament, the tooth is obturated. The limitations of this study include, the study being unicentric, geographic trends not assessed and small sample size.

Some of the complications include tooth discolouration, tooth fracture, failure of treatment, etc. [47]. Hence it is important to diagnose & treat the condition as early as possible.

CONCLUSION :

Prolonged period of arrested root development can result in increased infection & thereby periapical lesion. Proper diagnosis and treatment is important to prevent any complications.

ACKNOWLEDGEMENT :

_____The authors would like to acknowledge the help & support rendered by the Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University for their constant assistance with the research.

FUNDING:

_____The present project is funded by

- Saveetha Institute of Medical and Technical Sciences
- Saveetha Dental College and Hospitals
- Saveetha University
- Jembu Printers, PVT.L td, Chennai.

CONFLICT OF INTEREST :

None declared.

REFERENCES :

1. [Li C, Zheng Z, Deng X, Zhang L, Wang B, Guo Q, et al. Apexification Management of Mandibular Second Premolar with a Blunderbuss Apex and Periapical Lesion of an Adult Patient \[Internet\]. Vol. 2019, Case Reports in Dentistry. 2019. p. 1–4. Available from: <http://dx.doi.org/10.1155/2019/7546842>](http://dx.doi.org/10.1155/2019/7546842)
2. Heithersay GS. Stimulation of root formation in incompletely developed pulpless teeth [Internet]. Vol. 29, Oral Surgery, Oral Medicine, Oral Pathology. 1970. p. 620–30. Available from: [http://dx.doi.org/10.1016/0030-4220\(70\)90474-3](http://dx.doi.org/10.1016/0030-4220(70)90474-3)
3. Ingle JI, Beveridge EE. Endodontics. 1976. 811 p.
4. Kumar S, Kumar T, Keshav V, Arora S, Singla A. Open apex solutions: One-step apexification, salvaging necrosed teeth with open apex [Internet]. Vol. 31, Endodontology. 2019. p. 173. Available from: http://dx.doi.org/10.4103/endo.endo_61_18
5. Pawar A, Kokate S, Shah R. Management of a large periapical lesion using BiodentineTM as retrograde restoration with eighteen months evident follow up [Internet]. Vol. 16, Journal of Conservative Dentistry. 2013. p. 573. Available from: <http://dx.doi.org/10.4103/0972-0707.120934>
6. Morse DR, O'Larnic J, Yesilsoy C. Apexification: review of the literature. Quintessence Int. 1990 Jul;21(7):589–98.
7. Diogenes A, Henry MA, Teixeira FB, Hargreaves KM. An update on clinical regenerative endodontics [Internet]. Vol. 28, Endodontic Topics. 2013. p. 2–23. Available from: <http://dx.doi.org/10.1111/etp.12040>
8. Sjogren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. J Endod. 1990 Oct;16(10):498–504.
9. Paryani K, Kim SG. Regenerative endodontic treatment of permanent teeth after completion of root development: a report of 2 cases. J Endod. 2013 Jul;39(7):929–34.
10. Das AN, Geetha K, Kurian AV, Nair R, Nandakumar K. Interdisciplinary Approach to a Tooth with Open Apex and Persistent Sinus [Internet]. Vol. 2015, Case Reports in Dentistry. 2015. p. 1–4. Available from: <http://dx.doi.org/10.1155/2015/907324>
11. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries A clinical study of 1,298 cases [Internet]. Vol. 78, European Journal of Oral Sciences. 1970. p. 329–42. Available from: <http://dx.doi.org/10.1111/j.1600-0722.1970.tb02080.x>
12. Bashutski JD, Wang H-L. Periodontal and endodontic regeneration. J Endod. 2009 Mar;35(3):321–8.
13. Tariq A. The Management of a Persistent Periapical Lesion in Endodontically Treated Teeth: About Two Case Reports [Internet]. Vol. 4, Open Access Journal of Dental Sciences. 2019. Available from: <http://dx.doi.org/10.23880/oajds-16000213>
14. Saunders WP, Saunders EM. Coronal leakage as a cause of failure in root-canal therapy: a review [Internet]. Vol. 10, Dental Traumatology. 1994. p. 105–8. Available from: <http://dx.doi.org/10.1111/j.1600-9657.1994.tb00533.x>
15. Trope M. Treatment of the Immature Tooth with a Non-Vital Pulp and Apical Periodontitis [Internet]. Vol. 54, Dental Clinics of North America. 2010. p. 313–24. Available from: <http://dx.doi.org/10.1016/j.cden.2009.12.006>
16. Muthukrishnan L. Imminent antimicrobial bioink deploying cellulose, alginate, EPS and

- synthetic polymers for 3D bioprinting of tissue constructs. *Carbohydr Polym.* 2021 May 15;260:117774.
17. PradeepKumar AR, Shemesh H, Nivedhitha MS, Hashir MMJ, Arockiam S, Uma Maheswari TN, et al. Diagnosis of Vertical Root Fractures by Cone-beam Computed Tomography in Root-filled Teeth with Confirmation by Direct Visualization: A Systematic Review and Meta-Analysis. *J Endod.* 2021 Aug;47(8):1198–214.
 18. Chakraborty T, Jamal RF, Battineni G, Teja KV, Marto CM, Spagnuolo G. A Review of Prolonged Post-COVID-19 Symptoms and Their Implications on Dental Management. *Int J Environ Res Public Health* [Internet]. 2021 May 12;18(10). Available from: <http://dx.doi.org/10.3390/ijerph18105131>
 19. Muthukrishnan L. Nanotechnology for cleaner leather production: a review. *Environ Chem Lett.* 2021 Jun 1;19(3):2527–49.
 20. Teja KV, Ramesh S. Is a filled lateral canal - A sign of superiority? *J Dent Sci.* 2020 Dec;15(4):562–3.
 21. Narendran K, Jayalakshmi, Ms N, Sarvanan A, Ganesan S A, Sukumar E. Synthesis, characterization, free radical scavenging and cytotoxic activities of phenylvilangin, a substituted dimer of embelin. *ijps* [Internet]. 2020;82(5). Available from: <https://www.ijpsonline.com/articles/synthesis-characterization-free-radical-scavenging-and-cytotoxic-activities-of-phenylvilangin-a-substituted-dimer-of-embelin-4041.html>
 22. Reddy P, Krithikadatta J, Srinivasan V, Raghu S, Velumurugan N. Dental Caries Profile and Associated Risk Factors Among Adolescent School Children in an Urban South-Indian City. *Oral Health Prev Dent.* 2020 Apr 1;18(1):379–86.
 23. Sawant K, Pawar AM, Banga KS, Machado R, Karobari MI, Marya A, et al. Dentinal Microcracks after Root Canal Instrumentation Using Instruments Manufactured with Different NiTi Alloys and the SAF System: A Systematic Review. *NATO Adv Sci Inst Ser E Appl Sci.* 2021 May 28;11(11):4984.
 24. Bhavikatti SK, Karobari MI, Zainuddin SLA, Marya A, Nadaf SJ, Sawant VJ, et al. Investigating the Antioxidant and Cytocompatibility of *Mimusops elengi* Linn Extract over Human Gingival Fibroblast Cells. *Int J Environ Res Public Health* [Internet]. 2021 Jul 4;18(13). Available from: <http://dx.doi.org/10.3390/ijerph18137162>
 25. Karobari MI, Basheer SN, Sayed FR, Shaikh S, Agwan MAS, Marya A, et al. An In Vitro Stereomicroscopic Evaluation of Bioactivity between Neo MTA Plus, Pro Root MTA, BIODENTINE & Glass Ionomer Cement Using Dye Penetration Method. *Materials* [Internet]. 2021 Jun 8;14(12). Available from: <http://dx.doi.org/10.3390/ma14123159>
 26. Rohit Singh T, Ezhilarasan D. Ethanolic Extract of *Lagerstroemia Speciosa* (L.) Pers., Induces Apoptosis and Cell Cycle Arrest in HepG2 Cells. *Nutr Cancer.* 2020;72(1):146–56.
 27. Ezhilarasan D. MicroRNA interplay between hepatic stellate cell quiescence and activation. *Eur J Pharmacol.* 2020 Oct 15;885:173507.
 28. Romera A, Peredpaya S, Shparyk Y, Bondarenko I, Mendonça Bariani G, Abdalla KC, et al. Bevacizumab biosimilar BEVZ92 versus reference bevacizumab in combination with FOLFOX or FOLFIRI as first-line treatment for metastatic colorectal cancer: a multicentre, open-label, randomised controlled trial. *Lancet Gastroenterol Hepatol.* 2018 Dec;3(12):845–55.

29. Raj R K, D E, S R. β -Sitosterol-assisted silver nanoparticles activates Nrf2 and triggers mitochondrial apoptosis via oxidative stress in human hepatocellular cancer cell line. *J Biomed Mater Res A*. 2020 Sep;108(9):1899–908.
30. Vijayashree Priyadharsini J. In silico validation of the non-antibiotic drugs acetaminophen and ibuprofen as antibacterial agents against red complex pathogens. *J Periodontol*. 2019 Dec;90(12):1441–8.
31. Priyadharsini JV, Vijayashree Priyadharsini J, Smiline Girija AS, Paramasivam A. In silico analysis of virulence genes in an emerging dental pathogen *A. baumannii* and related species [Internet]. Vol. 94, *Archives of Oral Biology*. 2018. p. 93–8. Available from: <http://dx.doi.org/10.1016/j.archoralbio.2018.07.001>
32. Uma Maheswari TN, Nivedhitha MS, Ramani P. Expression profile of salivary micro RNA-21 and 31 in oral potentially malignant disorders. *Braz Oral Res*. 2020 Feb 10;34:e002.
33. Gudipani RK, Alam MK, Patil SR, Karobari MI. Measurement of the Maximum Occlusal Bite Force and its Relation to the Caries Spectrum of First Permanent Molars in Early Permanent Dentition. *J Clin Pediatr Dent*. 2020 Dec 1;44(6):423–8.
34. Chaturvedula BB, Muthukrishnan A, Bhuvanaraghan A, Sandler J, Thiruvengkatachari B. *Dens invaginatus*: a review and orthodontic implications. *Br Dent J*. 2021 Mar;230(6):345–50.
35. Kanniah P, Radhamani J, Chelliah P, Muthusamy N, Joshua Jebasingh Sathiya Balasingh E, Reeta Thangapandi J, et al. Green synthesis of multifaceted silver nanoparticles using the flower extract of *Aerva lanata* and evaluation of its biological and environmental applications. *ChemistrySelect*. 2020 Feb 21;5(7):2322–31.
36. Hulsmann M, Peters OA, Dummer PMH. Mechanical preparation of root canals: shaping goals, techniques and means [Internet]. Vol. 10, *Endodontic Topics*. 2005. p. 30–76. Available from: <http://dx.doi.org/10.1111/j.1601-1546.2005.00152.x>
37. Rafter M. Apexification: a review. *Dent Traumatol*. 2005 Feb;21(1):1–8.
38. Vier FV, Figueiredo JAP. Prevalence of different periapical lesions associated with human teeth and their correlation with the presence and extension of apical external root resorption [Internet]. Vol. 35, *International Endodontic Journal*. 2002. p. 710–9. Available from: <http://dx.doi.org/10.1046/j.1365-2591.2002.00554.x>
39. Simon S, Goldberg M. Regenerative Endodontics: Regeneration or Repair? [Internet]. *The Dental Pulp*. 2014. p. 267–76. Available from: http://dx.doi.org/10.1007/978-3-642-55160-4_19
40. Simon S, Smith AJ, Lumley PJ, Cooper PR, Berdal A. The pulp healing process: from generation to regeneration [Internet]. Vol. 26, *Endodontic Topics*. 2012. p. 41–56. Available from: <http://dx.doi.org/10.1111/etp.12019>
41. Ajagannavar S, Jain J, Jayasheel A, Bali P, Jain C. Management of a fractured nonvital tooth with open apex using mineral trioxide aggregate as an apical plug [Internet]. Vol. 7, *International Journal of Oral Health Sciences*. 2017. p. 44. Available from: http://dx.doi.org/10.4103/ijohs.ijohs_17_17
42. Özbaş H, Aşçı S, Aydın Y. Examination of the prevalence of periapical lesions and technical quality of endodontic treatment in a Turkish subpopulation [Internet]. Vol. 112, *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2011.

- p. 136–42. Available from: <http://dx.doi.org/10.1016/j.tripleo.2011.01.010>
43. Katz J, Rotstein I. Prevalence of Periapical Lesions in Patients with Osteoporosis [Internet]. Vol. 47, *Journal of Endodontics*. 2021. p. 234–8. Available from: <http://dx.doi.org/10.1016/j.joen.2020.10.019>
 44. Allard U, Palmqvist S. A radiographic survey of periapical conditions in elderly people in a Swedish county population [Internet]. Vol. 2, *Dental Traumatology*. 1986. p. 103–8. Available from: <http://dx.doi.org/10.1111/j.1600-9657.1986.tb00135.x>
 45. Dugas NN, Lawrence HP, Teplitsky PE, Pharoah MJ, Friedman S. Periapical health and treatment quality assessment of root-filled teeth in two Canadian populations. *Int Endod J*. 2003 Mar;36(3):181–92.
 46. Eriksen HM, Berset GP, Hansen BF, Bjertness E. Changes in endodontic status 1973?1993 among 35-year-olds in Oslo, Norway [Internet]. Vol. 28, *International Endodontic Journal*. 1995. p. 129–32. Available from: <http://dx.doi.org/10.1111/j.1365-2591.1995.tb00286.x>
 47. Kvist T. *Apical Periodontitis in Root-Filled Teeth: Endodontic Retreatment and Alternative Approaches*. Springer; 2017. 136 p.