Annals of Medical Research

DOI: 10.5455/annalsmedres.2019.08.444 2019;26(11):2642-7

Original Article

Outcomes of nonsurgical endodontic treatment in teeth with large periapical lesion

Fatih Aksoy

Adiyaman University, Faculty of Dentistry, Department of Endodontics, Adiyaman Turkey

Abstract

Aim: Present study aimed to evaluate the long-term clinical and radiographical outcomes of non-surgical root canal therapy using calcium hydroxide in anterior teeth with large periapical lesions.

Material and Methods: Clinical and radiographical records of 57 mandibular and 32 maxillary anterior teeth of 74 patients were included in the study. A total of 89 anterior teeth with large periapical lesions ranging in size from 6 to 20 mm were treated endodontically with calcium hydroxide as the intracanal medicament. Teeth were evaluated in two parts as lesion diameters between 6-10 mm and 11-20 mm. All cases were followed up for 24 months and assessed in three categories as complete healing, incomplete healing or no healing (failure).

Results: Complete healing was observed in 74 (83.1%), incomplete healing in 7 (7.9%) and failure in 8 (9%) teeth in all cases at the end of 24-month assessment. There was no positive correlation between the outcome of the therapy and the size of the periapical lesions ($p>0.05$).

Conclusion: Obtained results suggested that non-surgical endodontic treatment was greatly successful in the treatment of teeth with large periapical lesions and it should be considered before surgical procedure.

Keywords: Calcium hydroxide; non-surgical root canal treatment; periapical healing; periapical lesion.

INTRODUCTION

Pulpal necrosis is a recurrent sequence of trauma and if there is a microbial contamination, periapical lesion will develop (1). Apical lesions are a collection of inflammatory chronic procedures that are usually caused by microorganisms or their by-products (2). Thus, primary objective of root canal therapy is to eliminate these bacteria as fully as possible.

The majority of periapical lesions (> 90%) can be classified as dental granulomas, radicular cysts or abscesses (3,4). Natkin et al. (5) analyzed various histological studies related to the size of radiographic lesions. They indicated that the incidence of cysts was 100% with a radiographic lesion size of 200 mm2 or greater. Periapical lesions cannot be diagnosed independently on the basis of radiographic evaluation alone as either radicular cysts or apical granulomas (3,6). If the lesion is apical true cyst (separate from the apex and has an untouched epithelial membrane), it may develop into a presence that is auto-pursue and cannot heal when treated non-surgically (7). In contrast, some clinicians rely that the plurality of cysts will heal after simple non-surgical root canal treatment procedure (8,9). Besides, a big periradicular lesion may communicate directly with the root canal system (apical pocket cyst, (7)) and can heal without surgical intervention. A number of clinical investigations have verified that basic non-surgical endodontic treatment with adequate control of infection can provide the healing of large lesions (10,11). If this therapy fails to resolve the periradicular pathosis, consideration should be given to additive therapy alternatives such as surgical treatment, marsupialization or tube decompression.

Although failures can appear after basic endodontic treatment, success rates after root canal therapy were reported to be quite high (84%-86%) (12,13). Furthermore, it was stated that up to 85% of teeth with periapical lesions can be healed after a standard endodontic treatment (14,15). Clinical assessment, periapical radiography and cone-beam computed tomography (CBCT) imaging are

Received: 01.08.2019 **Accepted:** 30.09.2019 **Available online:** 06.12.2019
Corresponding Author: Fatih AKSOY, Adiyaman University, Faculty of Dentistry, Department of Endodontics, Adiyaman Turkey
E-mail: dr.f.aksoy@gmail.com

often used to evaluate the changes in lesions size, to assess the quality of the root canal treatment and the evaluateprognosis (16,17).

The aim of existing work was to assess the long-term results of nonsurgical basic root canal treatment in mandibular and maxillary anterior teeth with large periapical lesions using calcium hydroxide.

MATERIAL and METHODS

A total of 132 mandibular or maxillary anterior teeth of 105 patients referred to Adiyaman University Faculty of Dentistry, Department of Endodontics or Surgical Clinic with the diagnosis of surgical or non-surgical endodontic treatment due to large periapical lesions between 2016 and 2019 were evaluated in terms of non-surgical endodontic treatment success rate. Patients with a lesion diameter between 6-20 mm and at least 24 months of follow-up were included in the evaluation. Ethical approval was obtained from Adiyaman University Clinical Research Ethics Committee (Approval no: 2019 / 2-3). Clinical and radiographical records of 89 mandibular or maxillary anterior teeth of 74 patients who met these criteria were included in the study. Etiology of apical lesions and localizations of all teeth were recorded.

Sjogren U et al. (14) reported that healing of teeth with periapical lesions greater than 5mm was lower. As the probability of healing was reduced in large lesions, we selected lesion diameter measured between 6-20 mm in periapical radiographs in this study and evaluated the teeth in two parts as lesion diameters between 6-10 mm and 11-20 mm. The largest extent of the lesion was taken into consideration for the measurement of lesion diameter. Lesion dimeters were measured with an image editing software (ImageJ, National Institutes of Health, USA) on periapical radiographs.

In total 57 mandibular anterior teeth including 33 with 6-10 mm lesions and 24 with 11-20 mm lesions were treated and followed. A total of 32 maxillary anterior teeth were treated and followed, including 17 with lesions of 6-10 mm and 15 with lesions of 11-20 mm.

Of the 89 teeth, 64 had percussion, palpation, intraoral and / or extraoral swelling. The remaining teeth had no percussion pain, but had intraoral and / or extraoral swelling. In 60 out of 64 teeth, clinical symptoms subsided between 1-5 days and intraoral and extraoral swelling of all teeth improved within 4-14 days after initial endodontic treatment.

Drainage was achieved in 72 out of 89 teeth and 57 of the 72 teeth have no exude after the first appointment, and drainage were provided the remaining 15 teeth between 2rd and 24th days. Long-term drainage of this type was performed in every two days.

Treatment procedure

An access cavity was prepared and determination of working length was achieved with an apex locator (ProPex II, Dentsply Maillefer) 1 mm short of the apex and confirmed by periapical radiographs. All periapical radiographs (first to final) were obtained with Vista Scan (Germany) intraoral phosphor plate scanner. The evaluation was carried out separately by two trained observers at x3 magnification twice with one week intervals. Although the image quality of some radiographs differed owing to the wearing of the phosphor plate, the lesion margins were readily monitored. Root canals were instrumented to establish a glide path with K-files up to a size #15 (Mani, Mani Inc. Utsunomiya, Tochigi, Japan) and root canals instrumentation was performed with Proteper Next nickel titanium rotary instruments (SX-X1-X2-X3). Final apical preparation size was determined as at least 3 sizes greater than the first file used at the apical. During the instrumentation, root canals were irrigated using copious 3% sodium hypochlorite (NaOCl). When drainage discontinued, calcium hydroxide powder (Merck, Darmstadt, Germany) was mixed with sterile ddH2O to form a paste and applied in to the root canals with lentulo spiral. Calcium hydroxide dressing was replaced at 2-week intervals and kept for 2 months. Sterile cotton pellets put into access cavities and temporarily sealed with glass ionomer cement to prevent any leakage. At obturation visit, calcium hydroxide was removed with the last file used at the apical and then root canals were irrigated by passive ultrasonic irrigation (VDW, Munich, Germany) using 2.5% sodium hypochlorite followed by 17% EDTA and final irrigation was performed with sterile saline. All root canals were dried with sterile paper point and obturated with AH Plus (Dentsply, Maillefer, USA) sealer and gutta percha (DiaDent, South Korea) using cold lateral compaction technique. In two cases, because of the resorption of the apical region, a plug was formed with MTA and the obturation process was completed as previously mentioned (Figure 1-2). Access cavities were subsequently restored with composite resin (Estelite Posterior, Tokuyama, Japan). All endodontic procedures were performed by the same endodontist under rubber dam isolation. Patients were recalled for a clinical and radiographical evaluation at 3-6-12, 18 and 24th months. The radiographic and clinical assessments were made according to the following criteria modified from evaluation procedures used by Weiger R. et al. (18) and Çalışkan M.K. (11):

Complete healing (Success);

- no clinical signs and symptoms and;
- completely disappearance of pre-existing radiolucency on radiography.

Incomplete healing;

- no clinical signs and symptoms and;
- radiographically reduction in size of the periapical radiolucency.

No healing (Failure);

- clinical signs and/or symptoms and;
- radiographically expansion or no change in size of the pre-existing lesion.

Statistical analysis

Statistical analyses was performed by the help of Statistical Package for the Social Sciences for Windows version 24.0 (IBM SPSS Corp.; Armonk, NY, USA) software package. Kappa test was used to evaluate the interobserver agreement and the correlation between initial and final size of the lesions. Chi-square test was applied for the determination of statistically significant differences between the outcomes of treatments. A P value of < 0.05 was considered as statistically significant.

RESULTS

A total of 74 participant consisting of 33 females and 41 males aged from 22 to 55 were included in this study. No significant difference was found in terms of age and sex when lesion sizes and teeth locations were considered (p>0.05).

Periapical lesion caused by trauma were 30 teeth in the mandibula and 17 teeth in the maxilla. The teeth with lesion due to previous endodontic treatment were 8 and 11 in mandibula and maxilla respectively. Lesions due to caries or old restoration were 7 and 16 in mandibula and maxilla respectively. Complete healing period ranged from 6 to 24 months in these cases (Figure 3).

Table 1.Success, incomplete healing and failure rates of treated teeth according to the lesion diameter and location of teeth

Initial size of lesion (mm)	Location of tooth	Success (n/%)	Incomplete (n/%)	Failure (n/%)
6-10	Mandibular anterior	28 (84.8%)[a]	3(9.1%)[b]	2(6.1%)[b]
	Maxillary anterior	15(88.2%)[a]	1(5.9%)[b]	1(5.9%)[b]
11-20	Mandibular anterior	19 (79.2%)[a]	2(8.3%)[b]	3(12.5%)[b]
	Maxillary anterior	12(80%)[a]	1(6.7%)[b]	2(13.3%)[b]
	Total	74 (83.1)[a]	7 (7.9%)[b]	8 (9%)[b]

Superscript a and b indicate significant differences within the rows (p < 0.05).

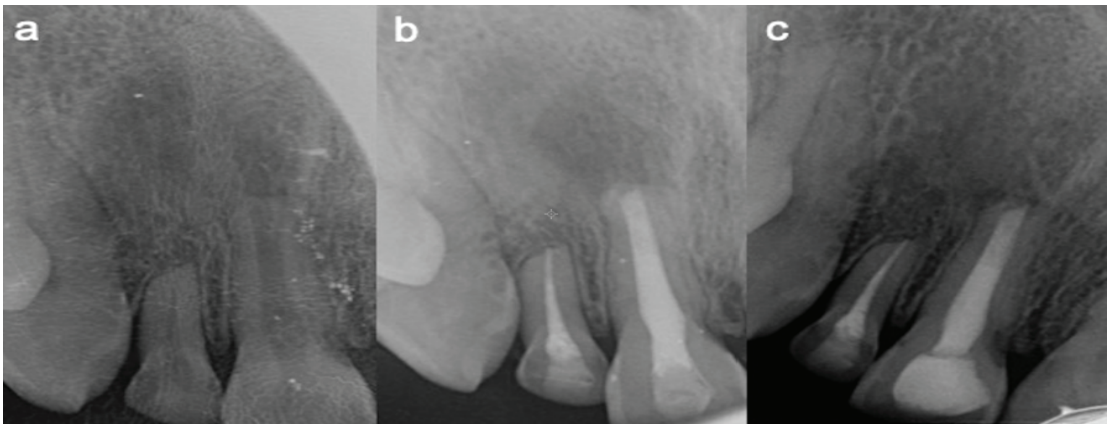

Figure 1. Preoperative periapical radiograph of maxillary right central and lateral incisors showing external root resorption with large periapical lesion in central incisor due to trauma (a). Postoperative radiograph demonstrating apical plug using MTA in central incisor (b). 24 months follow-up radiograph showing periapical healing (c).

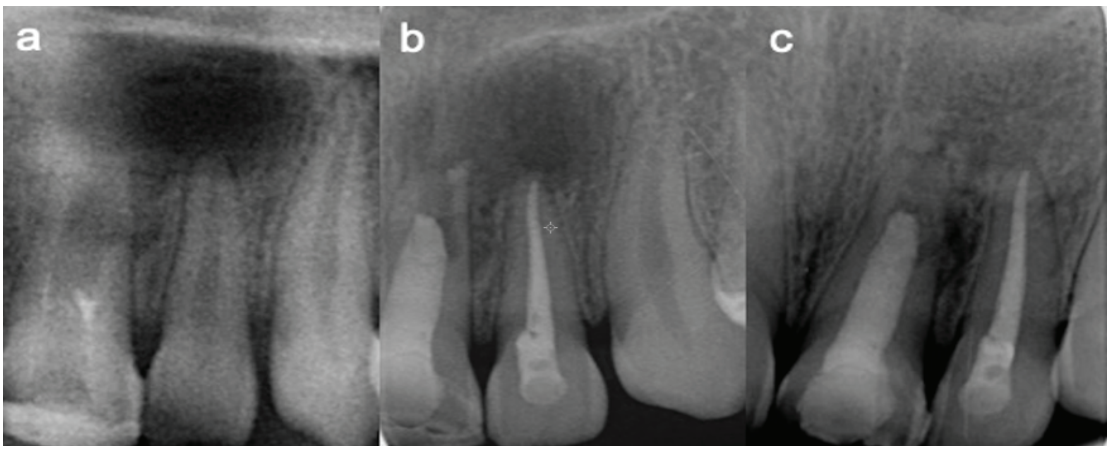

Figure 2. Preoperative periapical radiograph of maxillary left central and lateral incisors showing large periapical lesion and external root resorption in central incisor (a). Postoperative radiograph demonstrating apical plug using MTA in central incisor (b). 24 months follow-up radiograph showing healing of the lesion. Note the small amount of root development at left central incisor (c)

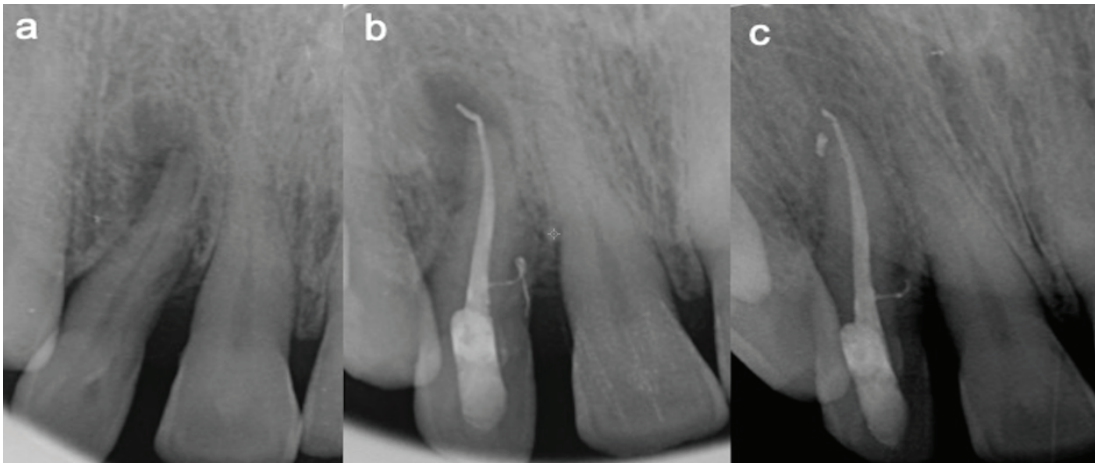

Figure 3. Preoperative periapical radiograph of maxillary right lateral incisor (a). Postoperative radiograph showing sealer penetration to lateral canal thanks to copious irrigation (b). 24 months follow-up radiograph showing healing of the lesion and partially resorbed and migrated sealer (c).

Lesions of 6–10 mm diameter (50teeth) healed in 47 (87.5%) cases consisting of 43 (79.2%) (28 mandibular, 15 maxillary) complete healing and 4 (3 mandibular, 1 maxillary) incomplete healing (Table 1). Lesions with a diameter ranging from 11 to 20 mm (39 teeth) healed in 34 (77.8%) cases including 31 (66.7%) (19 mandibular, 12 maxillary) of complete healing and 3 (11.1%) (2 mandibular, 1 maxillary) of incomplete healing (Table 1). There was no positive correlation between the outcome of the therapy and the size of the periapical lesions ($p>0.05$).

No statistically marked difference was found between maxilla and mandibula in terms of healing rates ($p>0.05$). In evaluation of a total of 89 teeth, complete healing was observed in 74 (83.1%), incomplete healing in 7 (7.9%), failure in 8 (9%) and a statistically significant difference was found ($p<0.05$) (Table 1).

DISCUSSION

In the present study, our aim was to investigate the clinical and radiographic success rate of non-surgical endodontic therapy in maxillary or mandibular anterior teeth with large periapical lesion (6-20 mm diameter range) with a follow-up of at least 24 months.

The most prevalent chronic inflammatory procedures observed in the jaws are periapical lesions; they are the result of a pulp infection due to trauma or caries which causes tissue necrosis and invades the apical region (19). Treatment choices for managing large periapical lesions range from treatment with non-surgical root canal procedure and/or apical surgery to extraction. Non-surgical endodontic treatment which is simpler and more protective can be considered in the treatment of large lesions (10). Occasionally, surgery might be necessary if healing does not occur and the problem persists. Some clinical studies have verified that basic non-surgical endodontic therapy with adequate control of infections can encourage the healing of large lesions (15,18). Considering the fact that, we preferred non-surgical endodontic treatment to follow the long-term outcomes of teeth with periapical lesions sized 6mm to 20mm.

The main purpose of endodontic treatment is to prevent / eradicate the formation of apical lesions by cleaning, shaping, disinfecting and filling the root canal system and keeping the tooth functional. Mechanical instrumentation alone does not eliminate microorganisms or their products from the root canals entirely. Peters et al. (20) showed that more than 35% of the root canal walls left untouched even with contemporary nickel-titanium rotary instrumentation methods. Thus, the reduction or elimination of microbes and biofilms is achieved by mechanical instrumentation, irrigation with tissue-solving and antimicrobial irrigants, and administration of antimicrobial medicaments in the root canal between appointments. So, we preferred to use 2.5% NaOCl and 17% EDTA combinations, which are the most commonly used irrigation solutions in endodontic treatment as irrigants (21) with the Protaper Next Rotary system files for shaping and cleaning the root canals.

Drainage is substantial for protective and therapeutic approach in teeth with large periapical lesions. Histological studies support the need for drainage (22). Symptoms are reduced when direct and immediate drainage from localized swelling or abscesses or cysts is achieved. In the present study, drainage was achieved in 72 out of 89 teeth.

An assessment of radiographic results and the existence or lack of clinical signs and symptoms of the treated tooth at the moment of recall are the basis for the achievement of endodontic treatment. Some trials describe achievement based on rigorous radiographic healing (23), while others consider a successful endodontically treated tooth if it stays in the oral cavity and functions (24). Besides histological evaluation (22) and cone-beam computed tomography (CBCT) imaging (17) can help the assessment of outcomes of treatments in large lesions. In our study, periapical radiographic and clinical evaluation was considered to evaluate the healing of teeth.

Sjögren et al. (14) discovered that the application of calcium hydroxide at least 1-week dressing effectively eradicates microbial infection in root canals. Calcium hydroxide's precise mechanism of action is still questionable. It stated that direct contact between calcium hydroxide and periapical tissue for osseoinductive purposes was useful (25). Accumulating previous evidence indicated that treatment with calcium hydroxide results in a high frequency of periapical healing, and some large periapical lesions, particularly in young patients, have reduced or disappeared only 1 or 3 months after treatment (15,26). Thus, calcium hydroxide paste was used in the present study to benefit its' anti-bacterial and osseoinductive feature. Consistent with previous studies (15,26), we found that in 81 (7 incomplete healing) out of 89 teeth treated with calcium hydroxide, the healing started visibly in 3 months and continued during the 24-month follow-up.

Matsumoto et al. (27)showed that the prognosis for the treatment of small periapical lesions is greater than large lesions. On the contrary Strindberg (23) and Sjögren et al. (14) discovered no important distinctions in the frequency of healing between periapical lesions bigger than 5 mm and less than 5 mm. Weiger R. et al. (18) revealed the rate of complete healing in teeth with large lesion 63% at 2 years follow-up and increased to 93% within the 5-year follow-up period. Verma et al. (28) reported that, higher concentrations of NaOCl had greater healing (81.4%) than low concentration of NaOCl (72.1%) in mandibular molar teeth with periapical lesion and completed the study with 12 months follow-up. Çalışkan M.K. (11) treated 42 teeth with large periapical lesions and stated that complete healing was observed in 73.8%, incomplete healing in 9.5% and failure 16.7%.

In comparing the outcomes of the present study with those of several other studies, there are some problems because of variations in the length of observation periods, criteria included for the evaluation of the periapical healing and the variety of teeth treated. Besides that, unfortunately information in the literature is very limited to compare the findings of our study with previous studies.

Consequently, in accordance with previously studies, non-surgical root canal treatment including calcium hydroxide dressing resulted in 83.1% complete healing and 7.9% incomplete healing in anterior teeth with large periapical lesions in our study. Basic endodontic treatment failed in 8 teeth (9%) and gone under surgery for apicoectomy. Since there was no clinical symptom or signal, and a reduction in lesion size, 7 teeth with incomplete healing might heal completely at future controls (18). Çalışkan M.K. (11) found that the rate of failure in teeth with periapical lesion ranging in size from 11 to 18 mm was significantly higher than in teeth with a diameter of 7-10 mm lesion. In current study, although the healing in the teeth with 6-10 mm lesions was slightly better, no significant difference was observed in terms of the success of endodontic treatment compared to teeth with 11-20 mm lesions.

CONCLUSION

Bearing in mind research limitations, favorable results obtained in the present study suggested that basic non-surgical endodontic treatment was greatly successful in the treatment of teeth with large periapical lesion between 6 and 20 mm diameters, and it should be considered before surgical procedure. In order to achieve complete success in simple endodontic treatment, further investigations including microbiological, histological and clinical studies are needed.

Competing interests: The authors declare that they have no competing interest.
Financial Disclosure: There are no financial supports.
Ethical approval: The present study was approved by the Ethical Committee of Adiyaman University (Approval no: 2019 / 2-3).

Fatih AKSOY ORCID: 0000-0002-2782-2608

REFERENCES

1. Sundqvist G. Bacteriological studies of necrotic dental pulps. (Odontological Dissertations no. 7) 1976 Umea, Sweden: Umea University.
2. Nair PNR. Pathogenesis of Apical Periodontitis and the Causes of Endodontic Failures. Crit Rev Oral Biol Med 2004;15:348–81.
3. Bhaskar SN. Periapical lesion-types, incidence and clinical features. Oral Surgery, Oral Med Oral Pathol 1966;21:657–71.
4. Lalonde ER, Luebke RG. The frequency and distribution of periapical cysts and granulomas: An evaluation of 800 specimens. Oral Surg Oral Med Oral Pathol 1968;25:861–8.
5. Natkin E, Oswald RJ, Carnes LI. The relationship of lesion size to diagnosis, incidence, and treatment of periapical cysts and granulomas. Oral Surg Oral Med Oral Pathol 1984;57:82–94.
6. Lalonde ER. A new rationale for the management of periapical granulomas and cysts: an evaluation of histopathological and radiographic findings. J Am Dent Assoc 1970;80:1056–9.
7. Nair PN. New perspectives on radicular cysts: do they heal? Int Endod J 1998;31:155–60.
8. Bhaskar SN. Nonsurgical resolution of radicular cysts. Oral Surg Oral Med Oral Pathol 1972;34:458–68.
9. Morse DR, Wolfson E, Schacterle GR. Nonsurgical repair of electrophoretically diagnosed radicular cysts. J Endod 1975;1:158–63.
10. Oztan MD. Endodontic treatment of teeth associated with a large periapical lesion. Int Endod J 2002;35:73–8.
11. Çalışkan MK. Prognosis of large cyst-like periapical lesions following nonsurgical root canal treatment: a clinical review. Int Endod J 2004;37:408–16.
12. Torabinejad M, Anderson P, Bader J, et al. Outcomes of root canal treatment and restoration, implant-

supported single crowns, fixed partial dentures, and extraction without replacement: A systematic review. J Prosthet Dent 2007;98:285–311.
13. Salehrabi R, Rotstein I. Endodontic Treatment Outcomes in a Large Patient Population in the USA: An Epidemiological Study. J Endod 2004;30:846–50.
14. Sjögren U, Hägglund B, Sundqvist G, et al. Factors affecting the long-term results of endodontic treatment. J Endod 1990;16:498–504.
15. Çalıskan MK, Şen BH. Endodontic treatment of teeth with apical periodontitis using calcium hydroide: a long-term study. Dent Traumatol 1996;12:215–21.
16. Huumonen S, Orstavik D. Radiological aspects of apical periodontitis. Endod Top 2002;1:3–25.
17. Van der Borden WG, Wang X, Wu M-K et al. Area and 3-dimensional Volumetric Changes of Periapical Lesions after Root Canal Treatments. J Endod 2013;39:1245–9.
18. 18. Weiger R, Rosendahl R, Lost C. Influence of calcium hydroxide intracanal dressings on the prognosis of teeth with endodontically induced periapical lesions. Int Endod J 2000;33:219–26.
19. Mirković S, Tadić A, Đurđević-Mirković T et al. Comparative analysis of accuracy of diagnosis of chronic periapical lesions made by clinical and histopatological examination. Med Pregl 2012;65:277–80.
20. Peters OA, Schonenberger K, Laib A. Effects of four Ni-Ti preparation techniques on root canal geometry assessed by micro computed tomography. Int Endod J 2001;34:221–30.
21. Dutner J, Mines P, Anderson A. Irrigation Trends among American Association of Endodontists Members: A Web-based Survey. J Endod 2012;38:37–40.
22. Fujii H, Machida Y. Histological study of therapy for infected nonvital permanent teeth with incompletely formed apices. Bull Tokyo Dent Coll 1991;32:35–45.
23. Strindberg L. The dependence of the results of pulp therapy on certain factors-an analytical study based on radiographic and clinical follow-up examination. Acta Odontol Scand 1956;14:1–175.
24. Friedman S, Abitbol S, Lawrence HP. Treatment Outcome in Endodontics: The Toronto Study. Phase 1: Initial Treatment. J Endod 2003;29:787–93.
25. Ghose LJ, Baghdady VS, Hikmat YM. Apexification of immature apices of pulpless permanent anterior teeth with calcium hydroxide. J Endod 1987;13:285–90.
26. Çalışkan MK, Türkün M. Periapical repair and apical closure of a pulpless tooth using calcium hydroxide. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;84:683–7.
27. Matsumoto T, Nagai T, Ida K et al. Factors affecting successful prognosis of root canal treatment. J Endod 1987;13:239–42.
28. Verma N, Sangwan P, Tewari S et al. Effect of Different Concentrations of Sodium Hypochlorite on Outcome of Primary Root Canal Treatment: A Randomized Controlled Trial. J Endod 2019;45:357–63.