

Original Article

Postoperative Healing after Endodontic Treatment of Teeth with Apical Periodontitis in Controlled diabetic Patients: A Cohort Prospective Study

Hesham Essameldin Ali¹, Suzan Abdul Wanees Amin²

¹ Restorative and dental materials department , National research center, Giza

² Department of Endodontics, Cairo University

E-mail: doc_mesho2004@hotmail.com

Received: 25-1-2019

Accepted For Publishing: 11-7-2019

Abstract

Aim: The purpose of the study was to assess whether postoperative periapical healing of apical periodontitis & postoperative pain differ in patients with controlled diabetes type 2 compared to diabetes-free patients after receiving one-visit root canal treatment. **Subjects and Methods:** in a cohort prospective study, Forty six necrotic mature teeth with apical periodontitis of patients 18-60 years old were divided into 2 groups. A) Control group diabetic free patients B) Diabetic group who suffered from controlled diabetes mellitus type 2. Protaper files were used for mechanical preparation together with sodium hypochlorite irrigation and EDTA as a final flush. All procedures were done in single visit; follow-up was done up to 12 months using standardized digital radiographs. **Results:** preoperative swelling was significantly greater in diabetic group ($P=0.047$). Also, duration of session was significantly greater in diabetic group ($p=0.016$). In addition, there was a significantly greater postoperative pain incidence after 12 hours in diabetic group ($P=0.027$). While, no difference was found regarding postoperative healing at different follow up intervals in both groups. **Conclusion:** Generally necrotic teeth with periapical periodontitis were successfully treated regarding the healing of the periapical lesions. Single visit endodontic treatment of necrotic teeth with apical periodontitis, could be successfully done in controlled diabetic patients.

Keywords: Diabetes mellitus; postoperative pain; periapical healing; single visit; periapical periodontitis; digital radiography.

1. Introduction

Diabetes mellitus (DM) is a disorder characterized by hyperglycemia and can manifest itself as types 1 and 2⁽¹⁾. DM alters many functions of the immune system and is commonly associated with delayed healing and compromised immune responses⁽²⁾. This predisposes to chronic inflammation, progressive tissue breakdown, and diminished tissue repair capacity⁽³⁾. DM can be

considered a predisposing factor for endodontic infections⁽⁴⁾. DM can serve as a disease modifier of apical periodontitis (AP) in the sense that individuals with diabetes can be more prone to develop primary and periapical disease^(5,6). AP was found to be more prevalent in untreated teeth in individuals with DM type 2^(7,8). The prognosis for root filled teeth is worse in diabetic patients, showing a higher rate of root canal failure with increased prevalence of persistent chronic

apical periodontitis^(9,10). Females with long-duration diabetes can have more root canal-treated teeth with AP than others with short-duration diabetes and non-diabetic females⁽¹¹⁾. Men with type 2 diabetes, who received endodontic treatments, were more likely to develop residual lesions after treatment⁽⁵⁾. Patients with diabetes recorded a reduced likelihood of success of endodontic treatment in cases with preoperative periradicular lesions⁽¹²⁾. Thus, the aim of this cohort study was to assess the postoperative healing and pain in controlled diabetes type 2 patients compared to non-diabetic patients when teeth with apical periodontitis received a single visit root canal treatment.

2. Materials and Methods

Thirty seven patients were recruited [20 patients in the control group and 17 in the diabetes group]. Inclusion criteria 1-Necrotic anterior and premolar teeth with apical periodontitis without previous intervention were selected from outpatient clinic of endodontics Dentistry Department, Faculty of Oral and Dental Medicine, Cairo University, Egypt. 2-Patient 'age ranged between 18-60 years old. Exclusion criteria 1-Patient with any bone or immunosuppressed diseases and pregnant patients. 2-Uncontrolled diabetic patients. 3-Patients with type I diabetes mellitus. 4-Teeth with open apex.

All patients signed informed consent after clearly explain the procedure of the study. Diabetic patients were asked to deliver the result of glycated hemoglobin test with them on the beginning of the root canal treatment visit. Also diabetic patients were obligated to take their medications regularly as prescribed by the physician to keep the blood glucose at normal level. Preoperative pain was recorded as a baseline record using numerical rating scale(NRS)⁽¹³⁾. The involved tooth was anaesthetized by 1.8 ml of mepivacaine with vasoconstrictor.

An access cavity preparation was performed in each tooth followed by deroofting and flaring of the access. Determination of working length was done using an electronic apex locator and confirmed by a radiograph using bisecting angle technique. Cleaning and shaping

was carried out using ProTaper Universal rotary system, SX was used first for coronal flaring followed by S1 to the full working length. Then S2, F1 till F5 were used to the full working length. Each file was lubricated using EDTA gel. Each canal was irrigated with 1ml sodium hypochlorite 2.5 % between file sizes using 27 gauge needle (C-KJECT disposable dental needles, Korea) inserted apically as deep as possible without being locked in the canal. Final irrigation was carried out using 5 ml of 17% EDTA for 1 min, followed by distilled water as a final flash. The canals were dried using paper points and obturated by lateral compaction technique using ProTaper pre-fitted Gutta percha size F5. Using Endofill (Zinc Oxide Eugenol based sealer).

Each tooth received a permanent filling of Glass Ionomer. All the procedures were performed in a single visit. Postoperative radiograph was taken using a film holder as a baseline record at the end of the visit using a stent prepared previously for standardization. All patients were requested to fill the numerical rating scale (NRS) at intervals 12, 24, 48, 72 hours and 7 days to return it at the next visit. Each patient was given a pack of 2 Placebo capsules to be taken in case of pain only; one tablet was first taken followed by the other if no relief was achieved after one hour. A prescription of antibiotic (amoxicillin and clavulanic acid) was given in case of swelling. Emergency visit was scheduled in case of extreme pain &/or swelling. Worth to mention no incision or drainage was done.

For this study in both groups there are A) independent variables include Include all preoperative factors like age, gender, preoperative pain, swelling and diameter of radiolucency, in addition to all intraoperative factors like presence of pus. B) Primary outcome: Periapical healing at 0, 3, 6, 9, 12 months after root canal treatment was the primary outcome. Periapical healing measured by modification of index of Strindberg study⁽¹⁴⁾ used for radiographic healing assessment using the same parameters applied with the preoperative radiograph (figure 1).

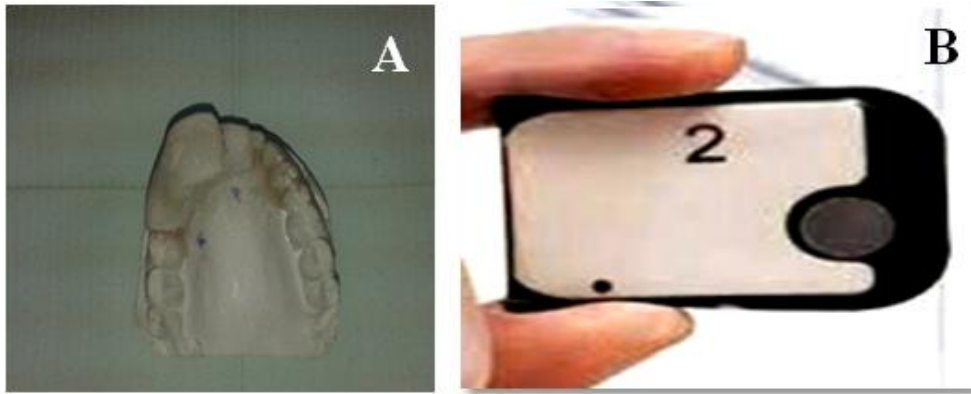


Figure (1): (A) Occlusal stent on a study cast, (B) Image plate to be processed by Digora Dental Imaging System.

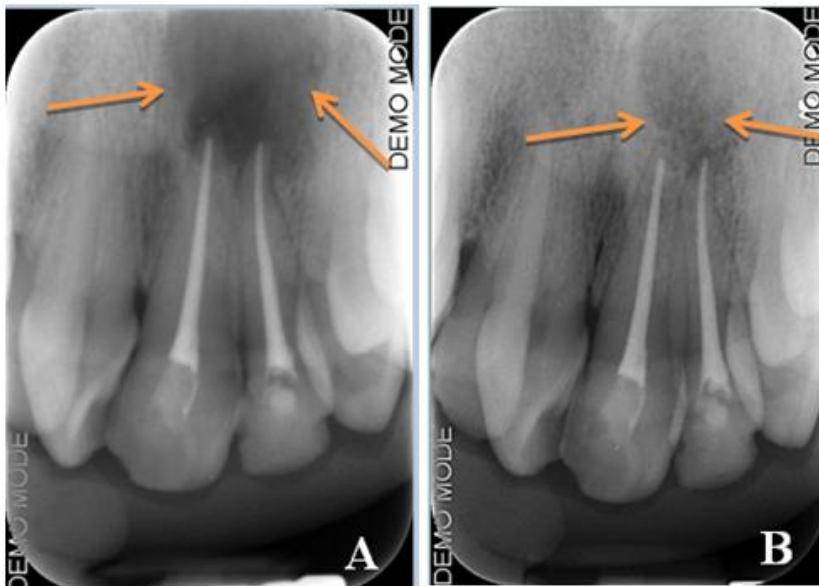


Figure (2): A female control-group patient with periapical radiolucency related to upper left anterior area (A) postoperative “baseline” radiograph for the treated teeth #21 and #22 showing radiolucent lesions in the normal patient; (B)) A 12-month follow-up radiograph showing nearly complete healing of the periapical lesion.

3. Results

Results showed that there was no statistically significant difference between the two groups regarding the demographic data; smoking habit, tooth type and tooth arch. While statistically significant difference in the mean age values between control and diabetes groups was found ($p=0.001$) where diabetic patients were older than non-diabetic ones (table 1). Clinical and radiographic findings showed no difference between the two tested regarding preoperative pain,

presence of fistula, presence of previous restoration and diameter of radiolucency. On the other hand, preoperative swelling found to be more in diabetics ($n=7$) than non-diabetics ($n=1$) ($p=0.047$).

The presence of pus, sealer extrusion from apex and the level of root end filling in relation to the apex as an intraoperative findings was not different between both groups while the duration of session was statistically

significant in control group 92.83 minutes than diabetics group 75.22 minutes ($p=0.016$). (Figure 2).

Post-operative pain findings obtained by numerical rating scale showed a significant difference between diabetic ($n=17$) and non-diabetic group ($n=8$) in postoperative pain incidence after 12 hours ($p=0.027$). In other words, the control group patients showed

higher incidence of no pain than those of the diabetes group. While no difference was found between the two groups after 24, 48, 72 and 168 hours. Radiographic post-operative findings indicated that control and diabetes groups did not show any significant difference in terms of healing after 3, 6, 9 and 12 month (Table 2)

	Group A (Control)	Group B (Diabetes)	P-value
Age (years)			
Mean +SD	35.17+12.3	46.91+10.94	0.001*
Smoking [n (%)]			
Yes	9 (64.3%)	5 (35.7%)	0.337
No	14 (43.8%)	18 (56.3%)	
Gender [n (%)]			
Male	11(64.7%)	6(35.3%)	0.127
Female	12(41.4%)	17 (58.6%)	
Tooth type [n (%)]			
Anterior	18(54.5%)	15(45.5%)	0.326
Premolar	5(38.5%)	8(61.5%)	
Tooth arch[n (%)]			
Maxillary	20(54.1%)	17(45.9%)	0.459
Mandibular	3(33.3%)	6(66.7%)	

Table (1): Baseline demographic characteristics of the participants with the results of chi-square test and student t-test for the two groups.

4. Discussion

The diagnosis of pulpal and periapical status was determined, on the basis of chief complain, sensitivity testing, history of trauma and pain as well as clinical and radiographic examination⁽¹⁴⁻¹⁶⁾. In the diabetic patients, the metabolic control status was determined preoperatively by measuring glycated hemoglobin (HbA1c).

In this study, the endodontic treatment was completed in a single visit in both groups. A number of studies concluded that there was no significant difference between single and multiple visits root canal treatment in terms of postoperative complications for teeth with infected root canals⁽¹⁷⁾. Moreover, the prevalence of post obturation pain was found to be significantly lower in single visit approach at short term follow up period⁽¹⁷⁾. Numerical rating scale (NRS) was used to evaluate pain intensity. This scale has been used

Variables		Group				Chi-square P value
		Control		Diabetes		
		n	%	n	%	
Healing after 3 month	Dropped out	1	4.3	0	0	0.746
	Not healed	1	4.3	1	4.3	
	Uncertain	11	47.80	10	43.6	
	Healed	10	43.6	12	52.1	
Healing after 6 month	Dropped out	2	8.7	1	4.3	0.456
	Not healed	0	0	1	4.3	
	Uncertain	3	13	6	26.2	
	Healed	18	78.3	15	65.2	
Healing after 9 month	Dropped out	2	8.7	1	4.3	0.411
	Not healed	0	0	1	4.3	
	Uncertain	2	8.7	5	21.7	
	Healed	19	82.6	16	69.7	
Healing after 12 month	Dropped out	2	8.7	1	4.3	0.337
	Not healed	0	0	1	4.3	
	Uncertain	1	4.3	4	17.4	
	Healed	20	87	17	74	

Table (2): Table showing the frequency of postoperative healing at 3, 6, 9, 12 month between control and diabetes groups.

periodically after being explained to the patients on a paper, according to an approved protocol, at 12, 24, 48, 72 hours and 168 hours after root canal treatment^(18,19).

Regarding postoperative pain, a previous study⁽²⁰⁾ has shown no significant association between preoperative swelling within 24 hours and postoperative pain. Regarding healing, the preoperative soft tissue swelling was not a prognostic indicator for postoperative healing⁽²¹⁾. Another study⁽²²⁾ showed a significant association of preoperative gingival swelling with the healing rate. High susceptibility of diabetes to preoperative swelling could be due to being more prone to infection and altered cell metabolism.

The size of preoperative lesion may affect postoperative pain and periapical healing. The effect of preoperative size of the periapical lesion on periapical healing has been analyzed by Ng et al⁽²¹⁾ who found a significant influence on the success of primary root canal treatment with smaller lesions improving periapical health. On the other hand, other studies^(23,24) found no significant difference in success rate between teeth with small (<5mm) or large (\geq 5mm) periapical lesions.

During treatment of patients in the control group, problems related to the teeth to be treated or to lack of cooperation of some patients resulted in significantly

longer session duration for one tooth (92 minutes) than needed with diabetic patients (75 minutes).

Five diabetic patients took antibiotic compared to one patient in the control group with no significant difference, due to development of postoperative swelling which necessitated antibiotic prescription. This could be due to diabetic patients are more susceptible to infection processes caused by reduced oxygen diffusion through the capillary wall⁽²⁵⁾. Neutrophil suppression and bacterial synergism imply a commonly delayed and severe infection process.

Significantly more patients suffered from postoperative pain at 12 hours in the diabetes group compared to control group. This could be due to the fact that diabetic patients could develop nerve damage over time throughout the body. This nerve damage could result in no symptoms at all, while it might result in pain which could exaggerate the dental pain⁽²⁶⁾.

Control and diabetes groups did not show any significant difference regarding healing after 3, 6, 9 and 12 month. Similar results were obtained by Lopez-Lopez et al⁽⁸⁾, Britto et al⁽⁵⁾, Marotta et al⁽⁶⁾ and Ng et al⁽²¹⁾. On the other hand, Fouad and Burleson⁽²⁷⁾ reported that cases with a preoperative peri-radicular lesions less successful than cases without preoperative peri-radicular lesions. This is attributed to larger sample size which could allow smaller difference in success rate. In addition, some studies trend to converge on a positive association between diabetes and a larger number of periapical lesions⁽²⁸⁾.

5. Conclusion

Both groups (control and diabetes) with necrotic teeth and periapical periodontitis were successfully treated regarding the healing of the periapical lesions. Single visit could be done in diabetic patients on condition that their medical status is stable and their blood glucose level is controlled. Healing could take up to 1 year to be obviously seen.

References

1. Mealey BL, Oates TW. Diabetes mellitus and periodontal diseases. *J Periodontol.* 2006;77(8):1289–303.
2. Delamaire M, Maugeudre D, Moreno M, Le Goff MC, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. *Diabet Med.* 1997;14(1):29–34.
3. Iacopino AM. Periodontitis and diabetes interrelationships: role of inflammation. *Ann Periodontol.* 2001;6(1):125–37.
4. Ueta E, Osaki T, Yoneda K, Yamamoto T. Prevalence of diabetes mellitus in odontogenic infections and oral candidiasis: an analysis of neutrophil suppression. *J Oral Pathol Med.* 1993;22(4):168–74.
5. Britto LR, Katz J, Guelmann M, Heft M. Periradicular radiographic assessment in diabetic and control individuals. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2003;96(4):449–52.
6. Marotta PS, Fontes T V, Armada L, Lima KC, Rôças IN, Siqueira JF. Type 2 diabetes mellitus and the prevalence of apical periodontitis and endodontic treatment in an adult Brazilian population. *J Endod.* 2012;38(3):297–300.
7. Segura-Egea JJ, Jiménez-Pinzón A, Ríos-Santos J V, Velasco-Ortega E, Cisneros-Cabello R, Poyato-Ferrera M. High prevalence of apical periodontitis amongst type 2 diabetic patients. *Int Endod J.* 2005;38(8):564–9.
8. López-López J, Jané-Salas E, Estrugo-Devesa A, Velasco-Ortega E, Martín-González J, Segura-Egea JJ. Periapical and endodontic status of type 2 diabetic patients in Catalonia, Spain: a cross-sectional study. *J Endod.* 2011;37(5):598–601.
9. Wang C-H, Chueh L-H, Chen S-C, Feng Y-C, Hsiao CK, Chiang C-P. Impact of diabetes

- mellitus, hypertension, and coronary artery disease on tooth extraction after nonsurgical endodontic treatment. *J Endod.* 2011;37(1):1–5.
10. Segura-Egea J, Castellanos-Cosano L, Machuca G, López-López J, Martín-González J, Velasco-Ortega E, et al. Diabetes mellitus, periapical inflammation and endodontic treatment outcome. *Med oral, Patol oral y cirugía bucal.* 2012;17(2):356–61.
 11. Falk H, Hugoson A, Thorstensson H. Number of teeth, prevalence of caries and periapical lesions in insulin-dependent diabetics. *Scand J Dent Res.* 1989;97(3):198–206.
 12. Fouad AF. Diabetes mellitus as a modulating factor of endodontic infections. *J Dent Educ.* 2003;67(4):459–67.
 13. Jalalzadeh SM, Mamavi A, Shahriari S, Santos FA, Pochapski MT. Effect of pretreatment prednisolone on postendodontic pain: a double-blind parallel-randomized clinical trial. *J Endod.* 2010;36(6):978–81.
 14. Molander A, Warfvinge J, Reit C, Kvist T. Clinical and radiographic evaluation of one- and two-visit endodontic treatment of asymptomatic necrotic teeth with apical periodontitis: a randomized clinical trial. *J Endod.* 2007;33(10):1145–8.
 15. Penesis V a, Fitzgerald PI, Fayad MI, Wenckus CS, BeGole E a, Johnson BR. Outcome of one-visit and two-visit endodontic treatment of necrotic teeth with apical periodontitis: a randomized controlled trial with one-year evaluation. *J Endod.* 2008;34(3):251–7.
 16. Peters LB, Wesselink PR. Periapical healing of endodontically treated teeth in one and two visits obturated in the presence or absence of detectable microorganisms. *Int Endod J.* 2002;35(8):660–7.
 17. Su Y, Wang C, Ye L. Healing rate and post-obturation pain of single- versus multiple-visit endodontic treatment for infected root canals: a systematic review. *J Endod.* 2011;37(2):125–32.
 18. Torabinejad M, Cymerman JJ, Frankson M, Lemon RR, Maggio JD, Schilder H. Effectiveness of various medications on postoperative pain following complete instrumentation. *J Endod.* 1994;20(7):345–54.
 19. Ryan JL, Jureidini B, Hodges JS, Baisden M, Swift JQ, Bowles WR. Gender differences in analgesia for endodontic pain. *J Endod.* 2008;34(5):552–6.
 20. Ng Y-L, Glennon JP, Setchell DJ, Gulabivala K. Prevalence of and factors affecting post-obturation pain in patients undergoing root canal treatment. *Int Endod J.* 2004;37(6):381–91.
 21. Ng Y-L, Mann V, Gulabivala K. A prospective study of the factors affecting outcomes of nonsurgical root canal treatment: part 1: periapical health. *Int Endod J.* 2011;44(7):583–609.
 22. Kim S. Prognostic factors influencing clinical outcome of nonsurgical endodontic treatment. *J Korean Acad Conserv Dent.* 2010;35(6):436.
 23. Sjögren U, Figdor D, Persson S, Sundqvist G. Influence of infection at the time of root filling on the outcome of endodontic treatment of teeth with apical periodontitis. *Int Endod J.* 1997;30(5):297–306.
 24. Sjogren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. *J Endod.* 1990;16(10):498–504.
 25. Bender IB, Bender AB. Diabetes mellitus and the dental pulp. *J Endod.* 2003;29(6):383–9.

26. JL J. Harrison's endocrinology. 3rd editio. Powers AC, editor. cooper city, USA: Macgraw hill; 2004. Apical Periodontitis: A Critical Literature Review of Human Studies. J Endod. 2017;43(3):370-376.
27. Fouad AF, Burleson J. The effect of diabetes mellitus on endodontic treatment outcome: data from an electronic patient record. J Am Dent Assoc. 2003;134(1):43-51.
28. Tibúrcio-Machado CD, Bello MC, Maier J. Influence of Diabetes in the Development of