Scholars Journal of Applied Medical Sciences (SJAMS) **ISSN 2320-6691 (Online)**
Sch. J. App. Med. Sci., 2016; 4(12D):4503-4507 **ISSN 2347-954X (Print)**

(An International Publisher for Academic and Scientific Resources)
www.saspublishers.com DOI: 10.36347/sjams.2016.v04i12.060

Original Research Article

Evaluation of the effect of access cavity location on apical seal of maxillary anterior teeth

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Abstract: The purpose of this study was to evaluate the effect of access cavity location on apical seal in maxillary anterior teeth. 40 maxillary incisors were selected. They are single root -one canal, with close apex, without caries and root cracks. The specimens were divided into 3 groups and negative and positive control groups (n=10) by random simple sampling. Group 1: teeth with lingual access cavity, Group 2: teeth with labial access cavity, Group 3: teeth with incisal access cavity. Root canal preparation was performed with step-back technique described by Mullaney. The canals were obturated with gutta-percha (Gapadent, china) and AH26 (Densply, USA) with laterally compaction technique. Axial surfaces of teeth were coated with 2 layer of nail varnish except apical foramen. In positive control group only one gutta percha cone was placed into canal without using nail varnish. In negative control group all surfaces of root even apical foramen was coated with 2 layer of nail varnish. All groups were placed in methylene blue dye for 4 days. Then specimens were stored in open air for 24 hours to dye drying. Teeth were cut in buccolingual direction with fine diamond disc. They were evaluated for dye penetration in millimeters with stereomicroscope (25 times magnification). Data was analyzed by ANOVA test. There was no significant difference between 3 groups in dye penetration. But there was comparable trend in dye penetration. Location of access cavity preparation statically does not influence apical seal in anterior teeth. But incisal access cavity trends in minimal apical leakage. Lingual - cingulum access cavity preparation trends in maximum apical leakage.
Keywords: apical leakage, access cavity location.

INTRODUCTION:

Root canal therapy is a method for tooth preservation. Prevention or repairment of peri-radicular lesion is a major goal of root canal therapy. Microorganisms and their products are the main reasons of pulpal diseases and peri-radicular lesions [1]. Proper cleaning and shaping of root canal are important for elimination and reduction of microorganisms. Proper obturation of root canal with apical, lateral and coronal seal is essential for preventing the re-infection of root canal system [2]. Several factors influence endodontic treatment outcomes, such as access cavity preparation and its location. Access cavity location affects cleaning, disinfecting and filling of the root canal system. Access cavity preparation is the first key step in root canal treatment [3]. The proper mechanical and chemical preparation of root canal is needed to reduce the microbial burden of root canal. Access cavity location can affect amount of instrumented surfaces of root canal, bacterial biofilm removal and irrigant accessibility to it [4].

The goals of access cavity preparation are: straight line access to root canal (for its maximum cleaning), tooth structure preservation and elimination of pulpal horn at anterior teeth [5-7].Un-proper access cavity leads to errors such as ledge, canal transportation, perforations, zipping, elbows, etc, that they affect treatment outcome[8].

The access cavity preparation of anterior teeth is traditionally on lingual tooth surface. It has minimal distance to pulp chamber. Incisal access cavity preparation is anatomically suggested and it preserves maximum tooth structure and esthetic [9]. In maxillary lateral incisors, un-proper lingual access cavity leads to

insufficient instrumentation of distal curve of apical one third of root canal [3]. So, the lingual access cavity preparation is suggested in maxillary lateral incisors [9]. Lingual access cavity preparation is not suggested in mandibular incisors because it is un-straight and dentinal buldge remains in the coronal one third of root canal. It may lead to failure in recognition and debriding of its second canal [5].

It is suggested in mandibular incisors with post and core treatment plan, incisal-labial access cavity creates more straight line access and cingulum preservation and stronger tooth structure [9]. Researchers have indicated that labial access cavity is smaller than lingual one, so tooth weakness is minimal [6]. In patients with limited mouth opening after trauma or with class ll div 2 dentition or teeth with resin bonded cast, labial access cavity is preferred. Todays, their esthetical problem can be solved by laminate or veneers. Proper seal of root canal filling prevents root canal system and peri-apical tissues from contamination with oral microflora. It seals apical one third of root canal from tissue fluid [2]. Apical microleakage due to un-sufficient seal is one of the common reasons for root canal treatment failure [10]. There are several methods for microleakage evaluation, such as : radioisotope[11-13] , electrochemical technique[14] , indian ink [15,16] , methylene blue [17] , bacterial leakage[18-21] , saliva[22-24] , fluid filtration[18] .This study evaluated the access cavity location on apical seal in maxillary incisors by dye (methylene blue) penetration. The aim of this study is determining the most proper access cavity location with minimum microleakage.

METHOD AND MATERIAL:

This study is an experimental study. 40 maxillary incisors were selected. They were single root -one canal teeth, with close apex, without caries and root cracks (evaluating by radiography). Teeth were taken in 2.5% Naocl for one hour. Then they were irrigated with normal saline. All of their debris was scrubbed by scalpel. They were stored in 100% humidity. The specimens were divided into 3 groups and 2 negative and positive control groups by random simple sampling. There were 10 specimens in each group.

Group 1: Teeth with lingual access cavity; entrance point of bur was in the center of palatal surface, exactly top of the cingulum. Then standard access cavity was prepared.

Group 2: Teeth with labial access cavity; entrance point of bur was in the center of labial surface and bur was perpendicular to tooth long axis. Access cavity extension has 2 millimeters distance to incisal edge. Access cavity location was top of the cingulum. It removes pulpal horns in mesiodistal dimension.

Group 3: Teeth with incisal access cavity; entrance point of bur was slightly lower than incisal edge at lingual surface. It was parallel to tooth long axis. The cervical line angel of access cavity was in center of lingual surface. It contains half of buccolingual width of incisal edge. It removed pulp horns in mesiodistal dimension.

Penetration for access cavity was performed by tungsten carbide bur, high-speed handpiece and water spray. Then an un-cutting end bur was used for completing it. A #10 k-flex file was entered into canal until it has been observed in the apex. The length of #10 k-flex file was measured as initial length. Then working length was determined 1milimeter shorter than initial length. Root canal preparation was performed by hand files in step-back technique described by Mullaney. Filing was performed by push and pull movements and saline irrigation. Then apex was prepared 3 numbers larger than initial file (the file that it bonded into canal in working length). Coronal third of the root canal was prepared with gates gliden #2 or #3 to eliminate the lingual dentinal bulge. The canals were obturated with gutta percha (Gapadent, china) and AH26 (Densply, USA) in laterally compaction technique. Access cavity was restored with composite (Kerr, USA). They were incubated in 100% humidity for 24hours in order to complete sealer setting.

Axial surfaces of teeth were coated with 2 layer of nail varnish except apical foramen. In positive control group only one gutta percha cone was placed into canal without using nail varnish. In negative control group all surfaces of root even apical foramen was coated with 2layer of nail varnish. All groups were placed in methylene blue dye for 4 days. Then specimens were stored in open air for 24 hours to let the dye dry. Teeth were cut in buccolingual direction with fine diamond disc. They were evaluated for dye penetration in millimeters with stereomicroscope (25 times magnification). Data was analyzed by ANOVA test.

RESULT AND DISCUSSION :

The most dye penetration was in group 1 with the average of 5.20±0.64 millimeter. However, the least dye penetration was in group 2 with the average of 4.73±0.64 millimeter. In group 3 dye penetration was 4.90±0.59 millimeter (Table-1). Differences between groups in dye penetration were analyzed by ANOVA test (Table-2) and it indicated no significant differences between 3 groups with P-Value of 0.25.

Table 1: Dye penetration (in millimeter) in each group

group	N	Mean	SD	Min	Max
1	10	5.20	0.64	4	6
2	10	4.73	0.64	3.5	5.5
3	10	4.90	0.59	4	5.75
Overall	30	4.94	0.64	3.5	6

Table 2: Differences between groups in dye penetration

differences	Sum of squares	SD	MEAN	Carnal F	p-value
Between groups	1.2	2	0.6	1.48	0.25
Within the groups	10.6	27	0.4		
overall	11.8	29			

Access cavity preparation is the first key step in root canal treatment. Access cavity provides a path to maximum cleaning, shaping and root canal filling [5]. There are few studies about access cavity location in anterior maxillary teeth in literature [3-5]. Vander sluis and *et al.;* (2005) have shown differences in leakage of straight and embowed canals so in this study only straight canal teeth were used[25].

La turno and zillich RM. (1985) have evaluated the most proper access cavity location by means of radiographs and Mannan was evaluated it by amount of instrumentation and cleaning [5, 4]. This study evaluated it by their apical sealing ability. Apical sealing is clinically important to successfully treatment outcomes. Torabinejad and *et al.;* (1990) and also khayat and *et al.;* (1993) shown that fillings with gutta percha immediately leak [26, 27] but last decades it is used commonly in dental offices [28, 29] so in this study root canals were filled with gutta percha and AH26 sealer. There are several methods to evaluate sealing ability of root canal filling such as fluid filtration, bacterial infiltration toxin and dye extraction that they are difficult to use [30]. Apically or coronally dye penetration is common to assess adaptation of root canal materials. It is sensitive and easy to use [31]. Ahlberg and *et al.;* in 1995 shown methylene blue in comparison to the indian ink has lower molecular weight and molecular size thus it has more penetration ability and accuracy [32]. It is smaller than bacteria. If it does not penetrate to the gap between gutta percha and canal walls, bacteria and their products will not [33]. The results of this study are similar to Mannan study [4]. There are statically no difference between three methods of access cavity preparation (p value =0.25) but there was a trend to dye penetration. Dye penetration in lingual access cavity preparation was the highest. Dye penetration in incisal access cavity was the lowest. It can be related to access cavity location and its accessibility to root canal.

Zillich and Jerome in 1981 evaluated accessibility of access cavity to the root canal in maxillary lateral incisors by means of radiography. They concluded it is desirable to preparing access cavity slightly buccally in encisal edge [3]. Mannan and *et al.;* in 2001 evaluated effects of access cavity location and its shape on amount of instrumented surface of root walls in anterior maxillary teeth. It was measured by black ink remaining on walls. They concluded maximum instrumented surfaces were in lingual access cavity [4]. Logani and *et al.;* in 2009 evaluated effects of lingual and labial access cavity preparation on structural preservation and accessibility to apex. They concluded labial access cavity preparation provides a straight line access to apex of canal. It is also more conservative than lingual access cavity [34].

Common Location of access cavity in maxillary anterior teeth is on lingual, although some previous study, similarly to our study, shown lingual access cavity preparation is not the most favorite one. Selection of its proper location can depend on clinical situation, patient cooperation and esthetic considerations. In this study dye penetration was measured only in cutting surfaces, but it could not assess penetration of whole areas in root canal.

CONCLUSION:

Location of access cavity preparation does not statically influence apical seal in anterior teeth. But incisal access cavity trends in minimal apical leakage. Lingual-cingulum access cavity preparation trends in maximum apical leakage.

REFERENCES:

1. Peters LB, Wesselink PR, Moorer WR. The fate and the role of bacteria left in root dentinal tubules. International Endodontic Journal. 1995 Mar 1; 28(2):95-9.
2. Cohen s & Hargreaves KM. Pathways of the pulp. 10 th ed. St Louis: Mosby 2010: 149, 349-352 .

3. Zillich RM, Jerome JK. Endodontic access to maxillary lateral incisors. Oral Surgery, Oral Medicine, Oral Pathology. 1981 Oct 31; 52(4):443-5.
4. Mannan G, Smallwood ER, Gulabivala K. Effect of access cavity location and design on degree and distribution of instrumented root canal surface in maxillary anterior teeth. International endodontic journal. 2001 Apr 1; 34(3):176-83.
5. LaTurno SA, Zillich RM. Straight-line endodontic access to anterior teeth. Oral Surgery, Oral Medicine, Oral Pathology. 1985 Apr 30; 59(4):418-9.
6. Madjar D, Kusner W, Shifman A. The labial endodontic access: a rational treatment approach in anterior teeth. The Journal of prosthetic dentistry. 1989 Mar 31; 61(3):317-20.
7. Krapež J, Fidler A. Location and dimensions of access cavity in permanent incisors, canines, and premolars. Journal of Conservative Dentistry. 2013 Sep 1; 16(5):404.
8. Ove A. Peters. Current challenges and concepts in the preparation of root canal systems: a review. J Endod 2004; 30: 559-567.
9. Mauger MJ, Waite RM, Alexander JB, Schindler WG. Ideal endodontic access in mandibular incisors. Journal of endodontics. 1999 Mar 31; 25(3):206-7.
10. Torabinejad M, Rastegar AF, Kettering JD, Ford TR. Bacterial leakage of mineral trioxide aggregate as a root-end filling material. Journal of Endodontics. 1995 Mar 31; 21(3):109-12.
11. Dow PR, Ingle JI. Isotope determination of root canal failure. Oral Surgery, Oral Medicine, Oral Pathology. 1955 Oct 1; 8(10):1100-4.
12. Rhome BH, Solomon EA, Rabinowitz JL. Isotopic evaluation of the sealing properties of lateral condensation, vertical condensation, and Hydron. Journal of endodontics. 1981 Dec 31; 7(10):458-61.
13. Ximenez-Fyvie LA, Ximénez-García C, Carter-Bartlett PM, Collado-Webber FJ. Accuracy of endodontic microleakage results: auto radiographic vs. volumetric measurements. Journal of endodontics. 1996 Jun 30; 22(6):294-7.
14. Jacobson SM, Von Fraunhofer JA. The investigation of microleakage in root canal therapy: an electrochemical technique. Oral Surgery, Oral Medicine, Oral Pathology. 1976 Dec 1; 42(6):817-23.
15. Shemesh H, Souza EM, Wu MK, Wesselink PR. Glucose reactivity with filling materials as a limitation for using the glucose leakage model. International endodontic journal. 2008 Oct 1; 41(10):869-72.
16. Dummer PM, Kelly T, Meghji A, Sheikh I, Vanitchai JT. An in vitro study of the quality of root fillings in teeth obturated by lateral condensation of gutta-percha or Thermafil obturators. International Endodontic Journal. 1993 Mar 1; 26(2):99-105.
17. Zmener O, Banegas G, Pameijer CH. Coronal microleakage of three temporary restorative materials: an in vitro study. Journal of endodontics. 2004 Aug 31; 30(8):582-4.
18. Veríssimo DM, Vale MS. Methodologies for assessment of apical and coronal leakage of endodontic filling materials: a critical review. Journal of oral science. 2006; 48(3):93-8.
19. Torabinejad M, Ung B, Kettering JD. In vitro bacterial penetration of coronally unsealed endodontically treated teeth. Journal of endodontics. 1990 Dec 31; 16(12):566-9.
20. Chailertvanitkul P, Saunders WP, Saunders EM, MacKenzie D. Polymicrobial coronal leakage of super EBA root-end fillings following two methods of root-end preparation. International endodontic journal. 1998 Sep 1; 31(5):348-53.
21. Wolcott JF, Hicks ML, Himel VT. Evaluation of pigmented intraorifice barriers in endodontically treated teeth. Journal of endodontics. 1999 Sep 30;25(9):589-92.
22. Magura ME, Kafrawy AH, Brown CE, Newton CW. Human saliva coronal microleakage in obturated root canals: an in vitro study. Journal of Endodontics. 1991 Jul 31; 17(7):324-31.
23. Khayat A, Lee SJ, Torabinejad M. Human saliva penetration of coronally unsealed obturated root canals. Journal of Endodontics. 1993 Sep 30; 19(9):458-61.
24. Pisano DM, DiFiore PM, McClanahan SB, Lautenschlager EP, Duncan JL. Intraorifice sealing of gutta-percha obturated root canals to prevent coronal microleakage. Journal of endodontics. 1998 Oct 31; 24(10):659-62.
25. Van der Sluis LW, Wu MK, Wesselink PR. An evaluation of the quality of root fillings in mandibular incisors and maxillary and mandibular canines using different methodologies. Journal of dentistry. 2005 Sep 30; 33(8):683-8.
26. Torabinejad M, Ung B, Kettering JD. In vitro bacterial penetration of coronally unsealed endodontically treated teeth. Journal of endodontics. 1990 Dec 31; 16(12):566-9.
27. Khayat A, Lee SJ, Torabinejad M. Human saliva penetration of coronally unsealed obturated root canals. Journal of Endodontics. 1993 Sep 30; 19(9):458-61.
28. Shashidhar C, Shivanna V, Shivamurthy GB, Shashidhar J. The comparison of microbial leakage in roots filled with resilon and gutta-percha: An in vitro study. Journal of Conservative Dentistry. 2011 Jan 1; 14(1):21.
29. Peng L, Ye L, Tan H, Zhou X. Outcome of root canal obturation by warm gutta-percha versus cold lateral condensation: a meta-analysis. Journal of Endodontics. 2007 Feb 28; 33(2):106-9.

30. Veríssimo DM, Vale MS. Methodologies for assessment of apical and coronal leakage of endodontic filling materials: a critical review. Journal of oral science. 2006; 48(3):93-8.
31. Bodrumlu E, Tunga U. The apical sealing ability of a new root canal filling material. American journal of dentistry. 2007 Oct; 20(5):295-8.
32. Ahlberg KM, Assavanop P, Tay WM. A comparison of the apical dye penetration patterns shown by methylene blue and India ink in root-filled teeth. International Endodontic Journal. 1995 Jan 1; 28(1):30-4.
33. Shahi S, Zand V, Oskoee SS, Abdolrahimi M, Rahnema AH. An in vitro study of the effect of spreader penetration depth on apical microleakage. Journal of oral science. 2007; 49(4):283-6.
34. Logani A, Singh A, Singla M, Shah N. Labial access opening in mandibular anterior teeth--An alternative approach to success. Quintessence International. 2009 Jul 1; 40(7).