10.5005/jp-journals-10024-1293

ORIGINAL RESEARCH

An *in vivo* Study to determine the Effects of Early Preflaring on the Working Length in Curved Mesial Canals of Mandibular Molars

Azhar Iqbal, Iftikhar Akbar, Mahmoud K AL-Omiri

ABSTRACT

Aim: To evaluate the effects of a preflaring method on the determination of working length in the curved mesial canals of mandibular molars.

Materials and methods: Ninety mandibular molars with apical curvature of 30 to 40° were selected and randomly divided into two groups; each containing 45 teeth. In the first group, the initial instrumentation was performed with preflaring on the mesiobuccal canal (preflared group), and in the second group; the instrumentation was performed without preflaring on the mesiobuccal canal (nonpreflared group). A size 15 K-file was inserted in the mesiobuccal canals until the apical constriction could be felt by tactile sensation and a radiograph was taken to identify the distance between the file tip and radiographic apex. The location of the tip was classified as (a) within 1 mm of the radiographic apex, (b) more than 1 mm of the radiographic apex, or (c) overextended beyond the radiographic apex. The collected data was statistically analyzed and probability value was set to be ≤0.05.

Results: The file tip was significantly closer to the true working length in the canals with early preflaring compared to the canals without early preflaring ($p < 0.005$). In the preflared group; 75.5% of the cases had the file tip in location 'a', 13.3% in location 'b', and 11.1% in location 'c'. In the nonpreflared group; 33.3% of the cases had the file tip in location 'a', 53.3% in location 'b' and 13.3% in location 'c'.

Conclusion: Preflaring the coronal portion of curved canals greatly improved the access to the apical constriction, and thus enhanced correct working length determination. If the coronal portion of the curved canals is not preflared, the clinician cannot discern the accuracy of what they feel apically. Thus, preflaring is a highly recommended procedure especially in curved canals for better determination of correct working length.

Keywords: Working length, Curved canals, Preflaring, Mesiobuccal canal.

How to cite this article: Iqbal A, Akbar I, AL-Omiri MK. An *in vivo* Study to determine the Effects of Early Preflaring on the Working Length in Curved Mesial Canals of Mandibular Molars. J Contemp Dent Pract 2013;14(2):163-167.

Source of support: Nil

Conflict of interest: None declared

INTRODUCTION

The determination of correct working length is critical for the success of endodontic treatment.[1-3] The cleaning, shaping and obturation of the root canal system cannot be accomplished accurately unless the working length is determined precisely.[4-6]

If one fails to determine the working length accurately, it may lead to incomplete instrumentation and under-filling which may result in problems, like persistent pain and discomfort, from inflammation of retained pulp tissues.[1-3,7]

Furthermore, failure to accurately determine and maintain working length may result in the length being too long, which may lead to perforation through the apical constriction. Destruction of the constriction may lead to overfilling or overextension and an increased incidence of postoperative pain. In addition, one might expect a prolonged healing period and lower success rate due to incomplete regeneration of cementum, periodontal ligament and alveolar bone.[7-9]

In 1955, Kutler stated that the ideal place to end root canal treatment was the cementodentinal junction.[10] It is a histological landmark, where the pulp tissue changes into the periapical tissue,[11] and cannot be felt clinically or seen radiographically. When the canal preparation ends at this point, the area behind it being avascular helps in the elimination of the pathogenic microorganisms. From a clinical point of view, it is advantageous to end all preparations at this point because it is a morphological point that can be felt by the clinician.[2]

There has been debate as to the optimal length of canal preparations and the optimal level of canal obturation.[12]

Most dentists agree that the desired end point is the apical constriction, which is not only the narrowest part of the canal,[13] but also a morphologic landmark[14-17] that can help to improve the apical seal.

The apical constriction normally is located within the apical 2 mm of most teeth.[1] Some studies showed that early detection of the apical constriction was not a predictable technique,[18,19] especially in severely constricted canals, which are often narrower near the orifice due to the chronic calcific pulpal degeneration in the pulp chamber.[2] If the shape behind the constriction is created, it becomes significantly easier to locate the constriction by tactile sense using precurved patency files.[2,20,21] If the coronal portion of the canal is not constricted, an experienced clinician may detect an increase in resistance as the file approaches the apical 2 to 3 mm. In this region, the canal frequently constricts before exiting the root.

In the curved canals, it is very difficult to achieve the correct working length. In such cases, if the preflaring of the coronal portion of the canal behind the curvature is done then it becomes easier to achieve the ideal working length of 1 to 2 mm short of the apex.[2,23,24]After applying the early preflaring method, the file could penetrate closer to the true working length.[25]

Morgan and Montgomery[26] presented the crown down technique in 1984. This technique indicates the cleaning and shaping of the coronal portion of the canal and incremental progression to the apical area.[26] The main aim of this technique was to decrease the microorganisms which may be pushed apically later.[19,24,27] Khan found that preflaring greatly improved the determination of correct working length in curved canals.[23] Stabholz et al[28] found that in 76% of the teeth that underwent preflaring, the apical constriction was felt. Others found that if the curved canals were preflared, it was possible for an expert to detect the apical constriction, a reference for correct working length, in about 75% of cases.[29] On the other hand, if the canals were not preflared, determination of the apical constriction, i.e. the correct working length was possible only in about one-third of cases.[30]

Most previous studies used either hedstrom or rotary files to do preflaring. Hedstrom files are well known for having more potential to fractures than K-files, while the rotary files are expensive and require further special training. On the other hand, Gates Glidden drills are less expensive, easily available and most of the general dentists are well aware of and accustomed to their use.

Consequently, the aim of the current study was to evaluate the effects of preflaring method on the determination of working length in the curved mesial canals of mandibular molars using Gates Glidden drills and K-files.

MATERIALS AND METHODS

A total of 90 patients (55 males and 35 females) aged 25 to 30 years old (mean age: 28 ± 3 years old) were randomly selected from patients who attended the Department of Endodontics, Pakistan Institute of Medical Sciences, Islamabad, Pakistan. Patient's informed consent was obtained before they participated in the study. The study was approved by Pakistan Institute of Medical Sciences, Islamabad.

Each participant was included in the study if have a curved mesial root of lower first or second molar that requires endodontic treatment. A total of 90 lower molar teeth were included in the study. The patients were divided into two groups: A preflared and a nonpreflared group.

An experienced endodontist followed the following procedure for all teeth in the study. First, a radiograph was taken for each tooth using EndoRay X-ray holder (Dentsply, Rinn). Then, the canal curvature was measured using Schneider's method[31] to ascertain the inclusion criteria. The Schneider's method involves marking a point at the middle of the file at the level of the canal orifice. A straight line was drawn aligned parallel to the file image from point 'a' to a point where the instrument deviated from the line, point 'b'. The angle formed by the intersection of the lines was measured as the canal curvature.[31] Next, anesthesia, access cavity preparation and isolation using rubber dam was performed on every patient. The coronal two thirds portion of the curved mesiobuccal canals were inactively prepared using sizes 1 to 6 Gates Glidden drills (Mani Co., Japan). Then, a size 15 K-file (Mani Co., Japan) was inserted in the canal, concerning the reference point, until the apical constriction was felt by using the tactile sensation. A radiograph was taken by using the EndoRay, X-ray holder applying the X-ray tube 15 to 20° mesially to the original. The distance from the tip of file to the apex of the root was measured radiographically (radiographic apex length). The readings were classified according to the method described by Stabholz et al[28] as: (a) within 1 mm of the apex, (b) more than 1 mm away from the apex, and (c) overextending the length of the canal. For the other group (nonpreflared group), the same procedure as above was carried out without preflaring the mesiobuccal canals.

Statistical Analysis

The data were analyzed using software called Statistical Package for Social Sciences (SPSS, version 11, Chicago,

USA). Chi-square test was applied to calculate the significant differences between the working lengths of the two groups.

RESULTS

Table 1 presents the distribution of the study sample according to the location of the file in relation to the root apex (radiographic apex length) in both groups. In the nonpreflared group, the location of tip of the file in 33.3% of the cases was in location 'a', 53.3% in location 'b', and 13.3% in location 'c'. In the preflared group, the location of tip of the file in 75.5% of the cases was in location 'a', 13.3% in location 'b', and 11.1% in location 'c'.

Chi-square test showed significant differences between groups in terms of the location of the file tip in relation to root apex. The working length in the preflared group was more accurately determined than in the nonpreflared group ($\chi^2 = 10.59$, df = 2, p = 0.005).

DISCUSSION

This study demonstrated that with early preflaring in the root canal preparation, file penetration would be closest to the true working length. On the other hand, during working length determination without preflaring, the file was located within 1 mm from the radiographic terminus in only 33.3% of cases. Meanwhile, the file could not reach the radiographic terminus or passed it in the rest of nonpreflared cases. This can be interpreted as the canal entrance or the coronal part inhibits the file from reaching the apex and gives a false feeling of apical constriction.

On the contrary, the preflaring of the coronal part of the canal could enhance the tactile sense to the apical constriction and the file would have better retention in this location. Hence, in 75.5% of cases apical constriction was felt within 1 mm of the apex and the number of cases where the file passed the apex had considerably decreased. This would lead to prevention of debris harbor throughout the apex.[7] The above findings concur the results of previous studies.[7,9,23,28] The estimated working length will decrease while instrumentation is performed, and early preflaring of the coronal portion of the canal is associated with lowest variations in detecting the proper working length.[7,9,23,28] Furthermore, Ibarrola et al[19] found that coronal preflaring before working length determination with an electronic apex locator significantly improves the accuracy at which the apex locator was able to identify the apical constriction.

Luiten[32] reported that apical transportation in preflared canals was minimal and preflaring was associated with better shaping of canals. This is in agreement with the present study as it was found that early coronal preflaring assisted in canal cleaning and enhanced the tactile sensation to apical constriction. It also reduced the zipping possibility which could lead to overextension and overfilling. This would reduce post-treatment pain and discomfort, and minimize potential treatment failures.

A study[23] similar to the present study has shown that, after preflaring of the coronal portion of the curved canals, the tip of instruments reached within 1 mm of the radiographic apex in 75% of the cases. But without preflaring of the coronal portion of the curved canals, the tips of instruments were within 1 mm of the radiographic apex in only 31% of the cases. Khan and Sobhi[23] showed that in the nonpreflared group, they found that the tip of the instrument was within 1 mm of the radiographic apex in 31.4% of the cases, more than 1 mm of the radiographic apex in 40% of the cases, and overextending beyond the radiographic apex in 28.57% of the cases. In the preflared group, they found that the tip of the instrument was within 1 mm of the radiographic apex in 75% of the cases, more than 1 mm of the radiographic apex in 5.7% of the cases, and overextending beyond the radiographic apex in 14.28% of the cases.

The present study supports the results of the previous studies including that of Khan and Sobhi.[23] However in this study, a slightly different technique was used for early preflaring where Gates Glidden drills were used instead of hedstrom or rotary files. The reason behind this was that Gates Glidden drills are less expensive, easily available and most of the general dentists are well aware of and accustomed to their use. On the other hand, rotary files are expensive, not easily available and most of the general dentists are not well aware of and accustomed to their use

Table 1: The distribution of the study sample according to the location of the file in relation to the root apex in both groups (n = 90, 45 in each group)

File location	*Nonpreflared group*	*Preflared group*	*Total*
	Number of patients (%)	*Number of patients (%)*	*Number of patients (%)*
Within 1 mm of apex	15 (33.3)	34 (75.5)	49 (54)
More than 1 mm from apex	24 (53.3)	6 (13.3)	30 (33.3)
Overextending the apex	6 (13.3)	5 (11.1)	11 (12.2)
Total	45 (99.9)	45 (99.9)	90 (99.5)

because of lack of continuing dental education facilities. In addition, hedstrom files have more potential for breakage.

Consequently, this study supports the expansion of using early preflaring technique not only to the specialists in endodontics but to the general dentists as well.

Early removal of restrictive dentin in the coronal two thirds gives the clinician more tactile sensation of the apical part.[22] Also, a preflared canal allows for more efficient debris removal. In addition, with coronal restrictive dentin removed, size 10 and 15 files readily move into the apical area reducing the need and expense to use size 6 and 8 files. Furthermore, the need for precurving the files is reduced and consequently reduces the chance of fracturing the files and the associated complications.

CONCLUSION

Preflaring of the coronal portion of curved canals greatly improved the access to the apical constriction, which is the apical reference for correct working length determination. If the coronal portion of the curved canals is not preflared and left constricted, the clinician cannot discern the accuracy of what they feel apically because quite often the file binds or sticks more coronally than apically. Thus, preflaring is a highly recommended procedure especially in curved canals for better determination of correct working length.

ACKNOWLEDGMENTS

The authors would like to thank Professor Dr Ansar Maxood for his support during the conduction of this study. Thanks also to Pakistan Institute of Medical Sciences, Islamabad and Al Jouf University, Sakaka, for providing the facilities for this study.

REFERENCES

1. Ingle JI. Endodontic cavity preparation. In: Endodontics (4th ed). Philadelphia: Lea & Febiger 1994:191-208.
2. Cohen S, Burn RC. Cleaning and shaping the root canal system. In: Pathways of the pulp (5th ed). St Louis: CV Mosby 1991: 174-88.
3. Sobhi MB, Manzoor MA. An in vitro study of change in working length following instrumentation of first molar teeth. J Coll Physicians Surg Pak 2002;2(2):71-73.
4. Inoue N, Skinner DH. A simple and accurate way of measuring root canal length. J Endod 1985;11:42.
5. Zahn Z. Determination of working length in endodontics. Radiographic method. ZWR 1991;100(1):30-35.
6. Seltzer S, Soltanoff W, Sinai I, Smith J. Biologic aspects of endodontics. Periapical tissue reactions to root canal fillings short of and beyond the apex. Oral Surg Oral Med Oral Pathol 1973;36:725-26.
7. Oguntebi B, Slee AM, Tanzer JM, Langeland K. Predominant microflora associated with human dental periapical abscesses. J Clin Microbiol 1982;15:964.
8. Pascon EA, Introcaso JH, Langeland K. Development of predictable periapical lesion monitored by subtraction radiography. Endod Dent Traumatol 1987;3:192-208.
9. Kutler Y. Microscopic investigation of root apexes. J Am Dent Assoc 1995;50:544-52.
10. Calleteau JG, Mullaney TP. Prevalence of teaching apical patency and various instrumentation and obturation techniques in United States dental school. J Endod 1997;23:394-96.
11. Green D. A stereomicroscopic study of the root apices of 400 maxillary and mandibular teeth. Oral Surg 1986;9:249.
12. Schilder H. Cleaning and shaping the root canal. Dent Clin North Am 1974;18:269.
13. George JW, Michanowicz AE, Michanowicz JP. A method of canal preparation to control apical extrusion of low temperature thermoplasticized gutta percha. J Endod 1987;13(1):18-23.
14. Fahid A. Coronal root canal preparation. Dent Study J 1983;61:46-48.
15. Palmer MJ, Weine FS, Healey HJ. Position of the apical foramen in relation to endodontic therapy. J Can Dent Assoc 1971;8: 305-08.
16. Teo CS, Chan NC, Loh HS. The position of the apical foramen of the permanent incisors. Aust Dent J 1988;33:51-55.
17. Berman LH, Fleishman SB. Evaluation of the accuracy of the Neosono-D electronic apex locator. J Endod 1984;10:164-67.
18. Stabholz A, Rotstein I, Torabinejad M. Effect of preflaring on tactile detection of apical constriction. J Endod 1995;21:92-94.
19. Ibarrola JL, Chapman BL, Howard JH, Knowles KI, Ludlow MO. Effect of preflaring on Root Zx Apex locators. J Endod 1999;25(9):625-26.
20. Ounsi HF, Haddad G. In vitro evaluation of the reliability of the Endex electronic apex locator. J Endod 1998;24:120-21.
21. Farber JP, Bernstein M. The effect of instrumentation on root canal length as measured with an electronic device. J Endod 1983;9:114-15.
22. Caldwell JJ. Change in working length following instrumentation of molar canals. Oral Surg 1986;11:114.
23. Khan IU, Sobhi MB. Detecting the apical constriction in curved mandibular roots. J Ayub Med Coll 2003;15:47-49.
24. Gera T, Manjunath MK, Loomba K. An in vitro study of the shaping ability of two rotary endodontic instruments in curved root canals. Asian J Oral Health Allied Sci 2011;1(1):1-92.
25. Jubach T. Tactile assist to working length determination. Practical Endod 1995;1:28-30.
26. Morgan LA, Montgomery S. An evaluation of the crown down pressureless technique. J Endod 1984;10(10):491-93.
27. Weine FS, Endodontic therapy (4th ed). St Louis: CV Mosby 2004;30:3427.
28. Davis D, Marshal JG, Baumgartner JC. Effect of early coronal preflaring on working length change in curved canals using rotary nickel titanium versus stainless steel instruments. J Endod 2002;28(6):438-41.
29. Sinan A, Georgelin-Gurgel M, Diemer F. Evaluation of the preparation of the coronal part of the mesial canals of lower molars. Odontostomatol Trop 2011;34(133):13-21.
30. Nie M, Zhao XC, Peng B, Fan MW, Bian Z. Evaluation of preparation of curved root canals using hand used ProTaper. Zhonghua Kou Qiang Yi Xue Za Zhi 2009;44(5):262-65.
31. Schneider SW. Comparison of the canal preparation in straight and curved root canal. Oral Surg 1971;32:271-75.

32. Walton RE, Torabinejad M. Principles of endodontics (3rd ed). Philadelphia: WB Saunders 2002:200-02.

ABOUT THE AUTHORS

Azhar Iqbal

Assistant Professor, Department of Conservative Dentistry, Faculty of Dentistry, Al Jouf University, Sakaka, Saudi Arabia

Iftikhar Akbar

Assistant Professor, Department of Conservative Dentistry, Faculty of Dentistry, Al Jouf University, Sakaka, Saudi Arabia

Mahmoud K AL-Omiri (Corresponding Author)

Senior Consultant and Professor, Faculty of Dentistry, University of Jordan, Amman 11942, Jordan, e-mail: alomirim@yahoo.co.uk