

DETECTING THE APICAL CONSTRICTION IN CURVED MANDIBULAR MOLAR ROOTS--- PREFLARED VERSUS NONFLARED CANALS

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Background: Achieving and maintaining correct working length is critical to success in endodontic therapy. This involves placing the file in to the canal to feel the apical constriction, preparing the canal upto that extent and then filling the entire canal upto the apical constriction with gutta percha points. Detection of the apical constriction is affected if the coronal part of the canal is narrow or obstructed due to dentine deposition. This usually happens in curved canals and gives the operator a false feeling of the apical constriction. The aim of this study was to compare the effect on tactile detection of apical constriction in mandibular molars with curved roots, between the preflared and non-flared root canals. **Methods:** This study was carried out at Armed Forces Institute of Dentistry, Rawalpindi, Pakistan, from February to April 2002. Seventy patients coming for the endodontic treatment of their mandibular first molars were selected. The study included only mandibular molars with curved mesial canals. The total no of patients were divided equally into the preflared and non-flared groups. In both groups a No. 15 K file was used to detect or feel the apical constriction but in the preflared group the coronal portion of the canal was flared/prepared using Hedstrom files (No. 25–55) and Gates Glidden Drills No. 02 to No. 05 before inserting the No. 15 file. The tooth was radiographed at this moment and the distance between the tip of the file and the radiographic apex was measured. The location of the tip was classified as: a) Within 1 mm of the radiographic apex, b) Under extended, more than 1 mm of radiographic apex, and c) Over extended, beyond the radiographic apex. **Results:** In the non-flared group 31.4% belonged to group 'a', 40% to group 'b', and 28.57% to group 'c'. In the flared group 80% belonged to group 'a', 5.7 % to group 'b', and 14.28% to group 'c'. **Conclusions:** Results of this study suggest that preflaring greatly improves the tactile sense to feel the apical constriction in curved canals.

Key words: Preflaring; Apical constriction; Curved canals; Mandibular molars; and Working length.

INTRODUCTION

Correct working length is essential for the success of endodontic treatment¹⁻⁴. This allows the dentist to establish the apical extent of instrumentation and filling of the canal. Failure to determine the length of the root accurately may lead to incomplete instrumentation and under filling resulting in problems like persistent pain and discomfort from inflammation of retained pulp tissues^{1,2,4,5}. In addition ledge formation may be developed short of the apex. This makes adequate treatment or retreatment extremely difficult and the creation of a dead space at the apex, which may result in continuous peri radicular lesion and failure.^{2,5}

Failure to accurately determine the length of root may also lead to apical perforation and over filling with increased incidence of postoperative pain, possible infection or cyst formation.^{3,4} In addition one might expect a prolonged healing period and increased failure due to incomplete regeneration of cementum, Periodontal ligament and alveolar bone.^{2,4}

Kutler in 1955 stated that the ideal place to end root canal preparation was the cementodentinal junction.⁶ It is where the pulp tissue changes into the periapical tissue.⁷ Since it is a histological landmark, which cannot be felt clinically or seen radiographically, the most clinically relevant landmark is the apical constriction regardless of whether it is in the cementum or dentine.² When the canal preparation is ended at this point the area behind it being avascular helps in the elimination of the pathogenic microorganisms. Also from a clinical viewpoint it is advantageous to end all preparation at this point because it is a morphological point that can be felt by the clinician.²

The apical constriction normally is located within the apical 2 mm of most teeth.¹ One study showed that early detection of the apical constriction is not a predictable technique⁸, especially in severely constricted canals, which are often narrower near the orifice, owing 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 with tactile senses using precurved patency files.^{2,9,10} This study was carried out to find if preflaring improves the tactile detection of apical constriction in curved canals.

MATERIALS AND METHOD

Seventy patients coming for the endodontic treatment of their mandibular first molar with curved mesial canals were randomly selected. Patients of both sexes, in age group 18–35 years and with symptoms of irreversible pulpitis were

included in the study. Teeth with periapical radiolucency and calcified canals were excluded from the study. The total number was equally divided into the preflared and non-flared groups.

In the non-flared group the tooth was anesthetized. The access cavity was made and the pulp chamber thoroughly debrided of the pulp tissue. A No. 15 K file (Mani Corporation, Japan) was inserted until the apical constriction was felt. The tooth was then radiographed with the file inside to estimate the working length.

In the preflared group the K-file for working length determination was inserted only after the coronal 2/3rd (approximately 15 mm) or the straight part of the canal was prepared using Hedstrom files (Mani Corporation, Japan) up to No. 55 and Gate Glidden drills No. 02 to No 05 (Mani Corporation, Japan). Sodium hypochlorite and hydrogen peroxide were used alternately as irrigants during the flaring procedure.

Periapical radiographs were taken using paralleling technique with an intra oral film holder, which allows for accurate reproduction of the periapical area and the least amount of distortion.¹¹ The distance from the tip of the file to the apex of the root was measured radiographically. A double blind procedure was carried out to minimize the operator's error and the mean of the two readings for a single X-ray was taken as a reading. The readings were classified according to the method described by Stabholz *et al* as: a) within 1 mm of the apical constriction, b) more than 1 mm away from the apical constriction, and c) overextending the length of canal.¹⁰ The results were then analyzed based upon the frequency distribution of patients in various groups.

RESULTS

The results of this study are summarized in Table-1 and 2 and Figure-1.

Table-1: Frequency of patients in different groups of file tip to radiographic apex length.

| Group | Non Flared (n= 35) | | Flared (n = 35) | |
|--------------|--------------------|------------|-----------------|------------|
| | Number | Percentage | Number | Percentage |
| Within 1 mm | 11 | 31.4% | 28 | 80% |
| >1 mm | 14 | 40% | 2 | 5.7% |
| Overextended | 10 | 28.57% | 5 | 14.28% |

Table-2: Mean (\pm SD) file tip to radiographic apex length of the flared and nonflared groups.

| Group | Non Flared | Flared |
|----------------|------------------|-------------------|
| Within 1 mm | 0.66 \pm 0.13 | 0.66 \pm 0.12 |
| More than 1 mm | 1.38 \pm 0.20 | 1.6 \pm 0.28 |
| Overextended | -1.23 \pm 0.14 | -1.86 \pm 0.11* |

* $p < 0.05$

Figure-1: Number of cases in various groups of nonflared and preflared canals.

Results of the study show a significant improvement in feeling of the apical constriction with preflaring of the canal. It also shows that overextension of the file out of the canal is also reduced when the canal is preflared which means less debris extrusion into the bone and thus less postoperative problems.

DISCUSSION

This study indicates that if the working length estimation is carried out in the beginning without preflaring, only 29% of the time the file is binding at the apex. Rest of the time it is either not reaching the apex or is crossing the apex. The reason may be the constricted orifice of the canal or the coronal part of it, which binds the file before it actually reaches the apex and gives the operator a false impression of the apical constriction feeling. If the coronal part of the canal is prepared before going for the working length determination, most of the obstruction in the coronal part of the canal is removed and there is improvement in the feeling of apical constriction as the file is only binding at the apex. This is supported by the results, which show that with preflaring of the canal 80% of the time the apical constriction is felt within the apical 1mm. Our study also shows that with preflaring of the canal the ratio of crossing the apex with working length file is also reduced. Thus the chances of pushing the infected material out of the apex are also reduced. Stabholz and his associates carried out a similar study on determination of working length after Preflaring¹⁰. They concluded that with preflaring they were able to place the file within 1 mm of the radiographic apex 75% of the time as compare to 32% of the time without preflaring. Ibarrola and his associates also had similar results with Root ZX apex locators. They were able to get better results with apex locators when the canal was preflared because the working length file would go deeper.⁹ Our study thus supports the previous studies carried out on similar technique. Preflaring is also the basis of crown down pressure less technique.¹² It has the following advantages¹³:

- a. During the preparation of a curved canal, the working length taken initially is reduced. Most of this reduction takes place in coronal 2/3rd of the canal. Doing the apical preparation at the end allows the operator to take and maintain the working length more accurately¹.
- b. Preparing the coronal part of the canal removes most of the necrotic material and thus the chance of pushing debris apically is also reduced¹⁴.
- c. With coronal flaring not only the volume of irrigating solution inside the canal is increased but it also allows deeper penetration of the irrigating needle, thus potentiating the effect of the solution. Moreover, the inflammatory potential of the irrigating chemicals crossing the apex is also reduced as the pistoning effect of the preparatory files is diminished.
- d. Early coronal enlargement allows straight-line access to the apical 3rd of the canal, which allows more controlled preparation of the more important apical area.
- e. Early removal of restrictive dentine in the coronal 2/3rd gives the clinician better tactile sensation of the apical part².
- f. A preflared canal allows for more efficient debris removal.
- g. With coronal restrictive dentine removed, a #10 and #15 file readily moves into the apical area reducing the need and expense to use #6 and #8 files.
- h. The need for pre curving the files is reduced. Fewer files need precurving and those that do aren't curved as much.

CONCLUSION

Results of this study indicate that Preflaring greatly improves the quality of tactile detection of the apical constriction as it removes most of the obstruction from the coronal part of the canal. Preflaring is thus highly recommended procedure, especially in curved canals, for detection of apical constriction during biomechanical preparation of root canal system.

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