Original Article

Severely curved mandibular molar teeth managed by Nickel titanium K -flex files and balanced force technique

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Abstract

The aim of this study was to evaluated the effectiveness of Nickel titanium K files in maintaining root canal curvature of severely curved mandibular molar teeth. 15 mandibular first and second molar teeth having the curvature more than 25 degree were involved in this study. Working length measuring X-ray and post operative x-ray after canal preparation by balanced force technique using Ni Ti K files were taken by using special type of X-ray device (Crawford X-ray device). Radiographs were converted into computerized digital image and developed for curvature measurements. Curvatures of the canals were measured by Schneider method (1971). The difference in angle between pre-operative and post operative measurements was treated as straightening of canals. The use of Ni-Ti files resulted showed less straightening that means only 1.8 degree of canal curvature

Keywords: straightening, canal preparation, nickel-titanium files, K-flex files.

Introduction:

Successful endodontics is based upon a treatment triad of access cavity, canal preparation and obturation[13]. Cleansing and shaping (i.e. canal preparation) of the root canal is considered to be the most important phase of the triad and is the key to successful endodontics[15]. It removes the necrotic pulp debris from the root canal space and also enhances the three-dimensional obturation of the canal.

It is very much difficult to attain these goals with traditional instruments and instrument techniques especially in curved root canal. When instrumentation on curved root canal files tend to straighten and tendency of instrument to move to outer wall, even if pre curved they can cause zipping, tearing of apex of curved canals and create an elbow coronal to the apical zip.[9]

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Insufficient shaping will result in less effective condensation of the material and poor sealing of all pathways of root canal space allows microleakage of tissue exudates and re-infection by micro organisms, which creates an unfavorable biological environment for tissue healing to take place. (Robert.1983)

Enlargement of a curved canal by conventional techniques leads to an hourglass shape with a resulting elbow and a teardrop-shaped foramen for which they coined the phase "Zip"(Weine *et al.*1975).An elliptical or teardrop foramen transportation.(Schilder . 1974)

After many years of experimentation Roan et al, introduced the "Balanced force" concept of canal preparation in 1985. Several studies have found balanced force to be an effective way to maintain the canal curvature.

The Nitinol nickel- titanium (NiTi) alloy has been introduced as a possible adjunct or replacement for SS alloys in the manufacture of endodontic files and instrument. the greater flexibility possessed by nickel titanium files should allow instrumentation to be completed with less changes to the canal shape when compared with stainless steel files[2].This article present the ability of Ni Ti instruments in maintaining the curvatures of the severely curved root canals during preparation.

Materials and Methods:

This study was conducted in faculty of Dentistry, Department of Conservative Dentistry and Endodontics, BSMMU, and partly in the Department of Civil

Engineering ,BUET, Dhaka. The sample size of this study specimen and specified for preparation with Ni ti files(Dentsply). Preparations of specimen were divided into two- Coronal cavity preparation and radicular cavity preparation.

Coronal cavity preparation:

Access cavity was prepared using accelerated speed contra angle hand piece with adequate cooling arrangement. The roofs of pulp chamber were removed. The pulp chamber content were removed by sharp excavator. The canal orifice was explored by endodontic explorer.

Radicular cavity preparation:

Any residual pulp tissue removed from the root canal with a barbed broach. Then the preparation of specimen were completed into several phase.

1. Phase One:

Working length was established by radiograph. Intra oral radiograph was taken in parallel technique using Crawford film holder. Radiograph were converted into computerized digital image and development for curvature measurements[11].

Curvature measurement:

On the working length measuring X-ray, the degrees of curvature were measured by Schneider (1971) method[10]. In the image a line was traced tangent to the chamber floor (line f). The intersection of 'f' line with instrument (i) determined point A. On the instrument, 1 mm below A, the point À was determined. The point at which the canal deviates from this line to begin the canal curvature was marked point C. The point A, À and C were united determined the line 'a'. Other points were marked on the apical foramen and tip of the instrument after magnifying the image by magnifying glass. The point of apical foramen was named by point 'B' and tip of the instruments were B'. The points B, B' and C were united and formed an angle 'α'. This angle was curvature of root canal. This angle was measured by using special type of survey equipment named 'Total Station' Sokkia, Japan.

2.Phase two:

Now all canals of the tooth were prepared by balanced force technique. After completing the preparation of canals irrigation has done by irrigating solution. Recapitulation has done in every increased the number of file. During canals preparation every set of files was restricted in preparation maximum five canals[3].

3. Phase three:

The root canals were ready for obturation which was done with gutta parcha and zinc oxide eugenol in lateral condensation technique.

4. Phase four:

Post operative x-ray was taken in parallel technique using the same Crawford film holder. Than post operative radiographs were also converted into computerized digital image, developed and measuring utilizing the same principles and equipments as described for the measurements of preoperative canal curvature. The difference in angle found between the pre operative and post operative measurements was defined as the degree of straightening of root canal during instrumentation[11].

Result:

The curvature was changed with nickel titanium instrument after biomechanical preparation of canals. The summarized data were then presented in the form of tables and graphs.

1. Root canal curvature before and after preparation:

Table 1: shows that the mean curvature of canal before preparation was 31.6 degrees and changed the curvature into 29.8 degree after biomechanical preparation.

	Curvature(degree)	
	Before preparation	After preparation
Instrument		
Nickel titanium	31.6 ± 5.8	29.8±5.

2. The straightening of root canal following root canal preparation:

Table 2: shows that the straightening of root canal curvature after biomechanical preparation were 1.8 degrees.

	Straightening of root canal curvature (degree)	
Instrument	Mean	SD
Nickel titanium	1.8	1.3

3.Instrument fracture during canal preparation:

Table 3: shows that fracture of instrument during root canals preparation about 6.7%.

	Fracture of instrument	
Instrument	Yes	No
Nickel titanium	1(6.7)	14(93.3)

Discussion:

Although successful therapy depends on many factors, one of the most important steps in any root canal treatment is canal preparation[6]. Most of the root canals are curved; whereas endodontic instruments are manufactured from straight metal blanks. This result is uneven force distribution in certain contacts areas and tendency of the instrument to straighten itself inside the root canal[7].

The advent of strong yet flexible Ni ti endodontic instrument remove of this traditional constrains imposed by more rigid stainless steel instruments also reported that the Ni ti hands files where more effective in maintaining the original path of curved canals[2].

In this article all severely curved canals were prepared by balanced force technique, because balanced force technique produced significantly less deviation from the centre of the original curved canal (Backmen *et. al.* 1992).

In this study one nickel-titanium file was separated during instrumentation. Thus, clinically, it must be considered that curved canals with small radii may occur, which might increase the risk of separation of nickel titanium instruments due to cyclic fatigue[11]. As nickel titanium instruments are stressed around curved canals with smaller radius, the instruments exceed their elastic limit and separation may occur. This assumption can be confirmed by the findings reported recently by Jardine and Gulabivala, (2000). But the relation between the radii and effects of instrumentation not evaluated in this study.

Weine FS *et al.* (1988) reported that although several nickel-titanium instruments were fractured the degree of curvature did not affected the instrumentation result (curvature were well maintained).

This study compared the canal curvatures before and after instrumentation. Because the angulation at which the radiograph is taken extremely important[12], custom-made bite blocks were used. This step enabled a comparison between the preoperative and postoperative angles without possible differences in radiographic angulation playing a role.

Conclusion:

Ni ti K files were more effective in maintaining the root canal curvature of severely curved root canals of biomechanical preparation of root, was associated with one instrument fracture.

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