A Study on The Shape of a Canal Prepared With 'TWO-FILE' Technique

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ABSTRACT

'Two-File' 방식에 의한 근관 형성시 근관의 형태에 관한 연구

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이 연구의 목적은 'Two File' 방식에 의한 근관형성시 근관의 형태변화 및 전이정도를 분석하고 이를 기존의 근관형성방법과 비교하고자 하는 것이다. 만곡된 근관을 가진 투명한 레진블럭 상에서 step back방식, crown down방식 및 'Two File' 방식으로 근관형성을 시행하고 이를 똑같은 위치가 재현가능한 고정틀에 위치시킨 후 사진의 이중노출 기법을 이용하여 근관형성 전후의 근관의 형태변화 및 전이정도를 분석한 결과 다음과 같은 결과를 얻었다.

1. step back방식의 경우 형성된 근관이 taper하지 못하고 불규칙한 형태를 보였으며 근관의 전이정도도 다른 두 가지 엔진구동 방식에 의한 경우에 비해 유의하게 컸다($p < 0.05$)
2. crown down방식의 경우 형성된 근관이 taper한 형태를 보였고, 근관의 전이 정도도 step back방식에 의한 경우보다 유의하게 작았다($p < 0.05$).
3. 'Two File' 방식의 경우 형성된 근관이 taper한 형태를 보였으며 근관의 전이정도도 step back방식에 의한 경우보다 유의하게 작았으나 crown down방식에 의한 경우와 유의할 만한 차이는 없었다($p < 0.05$).

주요어 : 근관형성, 형태, 전이, 'Two File' 방식, 이중노출 기법

Ⅰ. INTRODUCTION

Cleaning and shaping of root canals are important phases in endodontic therapy. Instrumentation objec tives include debriding the root canal system, contin uously tapering in a conical form, and maintaining the original shape and position of the apical foramen[1]. However, ledge formation, transportation of the apical foramen, and nontapered hourglass shaped preparation are problems frequently observed after the instrumentation on curved root canals[2,3].

A number of preparation techniques and instru ments have been studied with the aim of providing an optimum shape at the end of the preparation. This has resulted in improvements in the file tip design, changes in the cutting surface, and changes in the materials of which the instruments are made. One of the most endodontic significant advances that may alleviate the problem of straightening curved canals is the nickel titanium file[4].

Root canals can be prepared manually or with the aid of a mechanical device. Preparing the root canals manually is highly technique sensitive and labor intensive. This has led to the introduction of various engine driven instruments. New products and instru ments may enhance endodontic treatment with respect to both its quality and its speed.

Many of the new nickel titanium instruments have increased taper in the hope that the greater flare along the active element of the instrument shaft will create automatically the flare required in the canal shape. And a technique which uses as few files as possible is preferred because exchanging a file to another file is a tedious procedure. We developed

'Two File' technique, in which we use only two nick el titanium files to carry out most of canal prepara tion procedures.

The aim of this study was to assess the ability of a new 'Two File' technique to shape simulated curved canals in clear resin blocks.

Ⅱ. MATERIALS and METHODS

Thirty six clear casting resin blocks(Densply Maillefer, Ballaigues, Switzerland) containing simu lated root canals with apical and coronal diameters of 0.15mm and 0.35mm(±0.02mm), respectively, were used for this study.

The blocks were divided into 3 groups of 12: Group 1 was instrumented with K Flexofiles (Densply Maillefer), Group 2 and Group 3 were instrumented with ProFiles of 6% taper and ISO sized tips (Densply Maillefer). The working length (WL) was established with an ISO size 10 instrument.

Group 1

Group 1 was instrumented with K Flexofiles by means of the step back technique. An ISO size 15 K Flexofile was placed to the length of the canal by means of a filing and a reciprocal reaming (watch winding) action until the file fit loosely in the canal. This was repeated with successively larger files until an ISO size 25 file reached the WL. Successively larger files were inserted at 0.5 to 1.0mm steps short of each other until the midcanal area was instru mented to an ISO size 60 file. Patency was verified after each file size by introducing an ISO size 10 file to the WL. Copious irrigation with water ensured that the canal was free of resin debris.

Group 2

Group 2 was instrumented in a crown down man ner at a constant rpm of 250 as recommended by the manufacturer with the ProFile 6% taper instruments with apical sizes corresponding to ISO sizes 15, 20, 25, and 30[5]. A size 25 ProFile was introduced one half to two thirds of the way down the canal. The instrument was withdrawn when resistance was felt and was followed by a size 30 ProFile to approxi mately the same length. a size 20 ProFile was then used two thirds to three quarters of the way down the canal, and then a size 15 ProFile was used to the

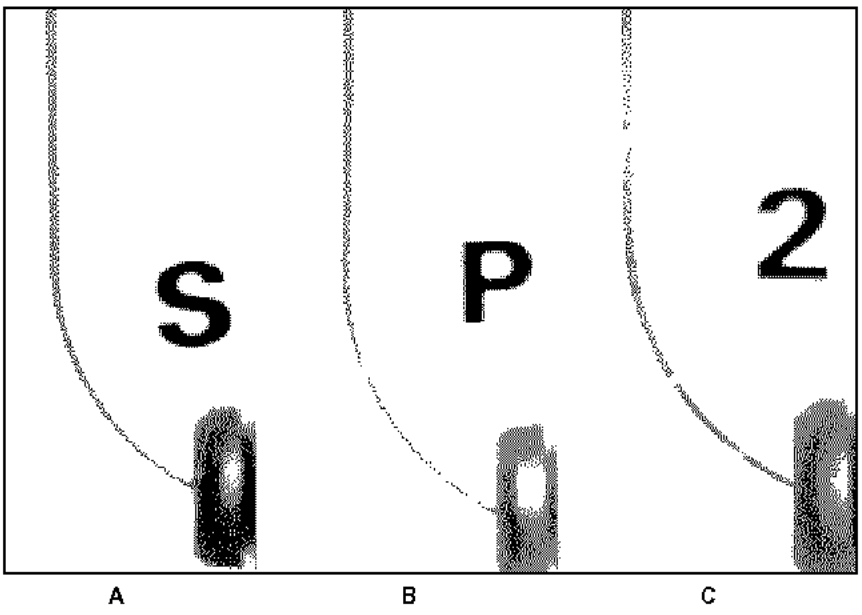

Fig. 1. Double exposure images of root canal space before and after preparation. Red portion represents unprepared canal space and pink portion represents prepared canal space. A, step back technique (group 1). B, crown down technique (group 2). C, 'Two File' technique (group 3)

WL. If a size 15 ProFile failed to reach the WL, ProFiles of sizes 15, 20, 25, and 30 were sequentially used. After a size 15 ProFile reached the WL, a size 20 ProFile was used to the WL in the same manner. Preparation was complete when a size 25 ProFile reached the WL.

Group 3

Group 3 was instrumented by means of 'Two File' technique. A size 20 ProFile was used to prepare the canal. The instrument was withdrawn when resis tance was felt and was followed by a size 30 ProFile. These procedures were repeated. After a size 20 ProFile reached two thirds to three quarters of the way down the canal, Gates Glidden drills were used to flare the canal orifice. Then an ISO size 15 K Flexofile was used to the WL. And a size 20 and 30 ProFiles were used repeatedly. After a size 20 ProFile reached the WL, a size 30 ProFile was used two or three times more to prepare the canal. Preparation was complete when a size 25 ProFile reached the WL.

All procedures were performed by one operator (H.P.). All the root canals were stained and pho tographed before and after instrumentation. A mounting device was developed and used to accu rately locate the camera and the resin blocks at the same position. For visual comparisons a double expo sure of the same frame of the film was obtained by photographing the stained original canal path, then blocking the film winder and then re exposing the same frame with the widened canal after reposition ing in the mounting device. A 1:20 scale was estab lished by projecting the resulting slides over a fixed distance onto a hard projection screen. Measureme nts were made at 7 different levels: 1, 2, 3, 4, 5, 6, and 7 mm from the apical foramen. At each level, 4 measurements were made: total canal width, outer canal width, inner canal width, and amount of trans portation from the original axis. The original canal axis served as a reference point for all measure ments. Another examiner who was unaware of the instrumentation techniques used performed all mea surements. The analysis of variance test used for the statistical analysis of data.

Ⅲ. RESULTS

Change in Total Canal Width

ProFiles in group 2 and 3 caused a taper widening in total canal width (Fig 1). But the K Flexofiles caused greater, nontapered widening of canal space than did the ProFiles, significantly wider change (0.47~0.62mm) at apical 1mm to 3mm ($p < 0.05$), and the widest change (0.75~0.77mm) at apical 4 mm to 5 mm.

Change in Outer Canal Width

ProFiles in group 2 and 3 caused a taper widening of the canal space to the outer side of the curvature, which is the finest at the apical side, and wider at the coronal side (Fig 1). The outer shape of the canal prepared by ProFiles resembled a graceful curve. But the K Flexofiles caused a rather severe widening (0.32~0.34mm) at apical 1mm to 4mm, and maxi mum widening (0.34mm) at apical 2mm to the outer side of the curvature (Table 1). The outer curvature of the canal prepared with K Flexofiles was irregular.

Change in Inner Canal Width

ProFiles in group 2 and 3 caused a taper widening of the canal space to the inner side of the curvature (Fig 1). K Flexofiles caused great and nontapered widening of canal space to the inner side of the cur vature. It caused significantly greater widening (0.42 ~0.50mm) than did the ProFiles at apical 4mm to 5 mm ($p < 0.05$) and maximum widening (0.52mm) at the apical 6 mm.

Amount of Transportation From the Original Axis

ProFiles in group 2 and 3 transported the canal slightly away from the original axis (0.05~0.12mm) to the outer side of the curvature at the apical part, but the amount was insigificant (Table 1). K Flexofiles transported the canal to the outer side of the curvature at the apical part, maximally (0.17 mm) at the apical 1 mm. They greatley transported

Table 1. Mean values of total, outer, inner, canal width, and amount of transportation(in millimeters with SD in parentheses).

Distance from apex		1mm	2mm	3mm	4mm	5mm	6mm	7mm
Total canal width	group1	0.47 (±0.07)	0.55 (±0.08)	0.62 (±0.05)	0.75 (±0.03)	0.77 (±0.04)	0.72 (±0.07)	0.72 (±0.05)
	group2	0.32 (±0.03)	0.40 (±0.02)	0.44 (±0.03)	0.51 (±0.02)	0.60 (±0.03)	0.69 (±0.04)	0.77 (±0.03)
	group3	0.27 (±0.02)	0.35 (±0.01)	0.42 (±0.02)	0.49 (±0.01)	0.56 (±0.02)	0.62 (±0.03)	0.67 (±0.02)
Outer canal width	group1	0.32 (±0.06)	0.34 (±0.07)	0.32 (±0.04)	0.33 (±0.02)	0.27 (±0.03)	0.20 (±0.06)	0.24 (±0.04)
	group2	0.20 (±0.02)	0.26 (±0.02)	0.29 (±0.03)	0.32 (±0.02)	0.32 (±0.03)	0.31 (±0.04)	0.36 (±0.03)
	group3	0.16 (±0.02)	0.22 (±0.01)	0.28 (±0.02)	0.32 (±0.01)	0.32 (±0.02)	0.29 (±0.03)	0.33 (±0.02)
Inner canal width	group1	0.15 (±0.04)	0.21 (±0.06)	0.30 (±0.04)	0.42 (±0.03)	0.50 (±0.05)	0.52 (±0.06)	0.48 (±0.05)
	group2	0.12 (±0.03)	0.14 (±0.02)	0.15 (±0.03)	0.19 (±0.02)	0.28 (±0.03)	0.38 (±0.04)	0.41 (±0.04)
	group3	0.11 (±0.01)	0.13 (±0.01)	0.14 (±0.02)	0.17 (±0.01)	0.24 (±0.02)	0.33 (±0.03)	0.34 (±0.03)
Amount of transportation	group1	0.17 (±0.03)	0.13 (±0.02)	0.02 (±0.01)	-0.09 (±0.02)	-0.23 (±0.03)	-0.32 (±0.04)	-0.24 (±0.03)
	group2	0.08 (±0.02)	0.12 (±0.02)	0.14 (±0.02)	0.13 (±0.02)	0.04 (±0.01)	-0.07 (±0.01)	-0.05 (±0.01)
	group3	0.05 (±0.01)	0.09 (±0.02)	0.14 (±0.02)	0.15 (±0.02)	0.08 (±0.02)	-0.04 (±0.01)	-0.01 (±0.01)

Minus value indicates that original axis of canal was transported to inner side of curvature after canal preparation.

the canal to the inner side of the curvature at the coronal part, maximally (0.32mm) at the apical 6 mm.

Ⅳ. DISCUSSION

The use of clear casting resin blocks appears to be not only valid substitution for root canals in natural teeth[6], but of great help in improving our under standing of the behaviour of endodontic instruments in root canals. The double exposure method provided enlarged images of root canals, which could be eluci dated and accurately quantified. The method provid ed a clear view of the areas that were enlarged or remained unchanged after instrumentation.

From this study, it was found that ProFiles in a crown down manner and 'Two File' technique caused taper widening of canal space to the inner side of the curvature, taper but somewhat more widening at apical 4mm to 5mm to the outer side of the curvature, and taper widening in total canal width. The inner and outer outline of the curved canal was a smooth curve. The original axis of the curved canal was transported somewhat to the outer side of the curvature at the apical area, but the amount was not great.

K Flexofile caused taper effect but somewhat more widening at apical 5mm to 6mm to the inner side of

the curvature. It caused more widening at the apical area than at the coronal area and maximum widen ing at the apical 2mm to the outer side of the curva ture. It created a nontapered shape with respect to the total canal width and greater widening than ProFiles; the maximum widening was observed at the apical 4mm to 5mm. The inner and outer outline of the prepared canal was not a smooth curve. The original axis of a curved canal was transported to the outer side of the curvature at the apical area and greatly to the inner side of the curvature at the coro nal area.

Kavanagh and Lumley[7] and Bryant et al[8] found that the use of ProFile instruments was effective and produced good canal shapes. Other studies[9,10] partly supported their observations. The results of the pre sent study were consistent and support these previ ous findings in that ProFile instruments used in a rotary fashion performed significantly better than the hand instruments. In this study ProFiles in 'Two File' technique also showed results as good as ProFiles in a crown down manner.

Further research is needed to evaluate the physical properties of nickel titanium instruments to deter mine whether they can be safely used in a rotary fashion.

Ⅴ. CONCLUSION

The purpose of this study was to evaluate the abili ty of a new 'Two File' technique to shape simulated curved canals in clear resin blocks. A total of 36 sim ulated curved canals on resin blocks were instru mented by means of the step back technique, crown down technique, and 'Two File' technique. With the mounting device, which can reproduce the same posi tion of the resin blocks and the camera, the unpre pared and prepared canals were accurately compared by means of a double exposure photographic tech nuque. The analysis of variance test was used for the statistical analysis of data obtained.

The results were as follows :

1. The canals prepared with the K Flexofiles showed nontapered widening and significantly greater transportation than those prepared with the step back tehchnique ($p < 0.05$).
2. The canals prepared by means of crown down technique showed taper widening and significantly lesser transportation than those prepared with K Flexofiles ($p < 0.05$)
3. The canals prepared by means of 'Two File' tech nique showed taper widening and significantly lesser transportation than those prepared with K Flexofiles ($p < 0.05$). There were no significant dif ference between the two results by the two engine driven techniques ($p < 0.05$)

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