Reliability of two methods on measuring root canal curvature

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Purpose: This study was conducted to evaluate the reliability of Schneider's and Weine's methods by comparing the difference of root canal curvatures measured by three examiners.

Materials and Methods: Fifty-one selected premolars were measured by three trained graduates of endodontics respectively with Schneider's and Weine's methods. The results were analyzed with analysis of variance (ANOVA).

Results: Among the three examiners, the data were not significantly different (p>0.05), and linear correlation was found between the two methods (p=0.0001).

Conclusion: The results suggest that both the Schneider's and Weine's methods are reliable to determine the degree of root canal curvatures. **(Int Chin J Dent 2003; 3: 118-121.)**

Clinical Significance: Either the Schneider's or Weine's method is reliable to determine the curvature of root canals.

Key Words: reliability, root canal curvature, Schneider's method, Weine's method.

Introduction

Since Schneider[1] measured root canal angulation primarily, the methods of measurement have been studied for more than thirty years. During this period, several methods have been innovated or modified by the dental practitioners. Among them, Schneider's method and Weine's method[2] are simple and practicable. Especially Schneider's method has already been adopted widely by the endodontists throughout the world. Up to the present, however, the reliability of them has hardly been reported.[3] The purpose of this study was to compare the difference of curvatures measured with these two methods and to examine the reliability of the methods.

Materials and Methods

Selection and Preparation of Specimen

Ninety-seven human premolars with fully formed apices were used in this study. The teeth with previous endodontic therapy were eliminated. All the roots were debrided with hand scalers, washed, and were stored in 10% formalin following extraction. Access openings were made using #700 diamond burs and the canal contents were removed with barbed broaches. Canal length was determined by placing a #15

file into each canal until it was just visible at the apical foramen. Each specimen was embedded into a plastic cuboid container using soften red wax. The sizes of the container are 20x20x22 mm and they are radioparent.

Radiographic Technique

Radiographs were taken by Trophy X-ray machine (France) from the clinical and proximal views. The buccal and the mesial aspect of each tooth was exposed at 70 kVp for 0.28 s. In this study Cygnus Imaging X-Ray2 Video System (USA) was used. The radiographs were printed on the A4 paper with a magnification of 90x66 mm after they were digitalized by the above system.

Measurement of Canal Angulation

Fifty-one curved canals were randomly selected for this study after the straight ones were eliminated. The canal curvatures were determined by three examiners respectively using the techniques described by Schneider or Weine (Figs. 1 and 2). The examiners were all trained graduates of endodontics and the measurement criteria were coordinated.

The Schneider's method (Fig. 1)[1] 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. A third point c was made at the apical foramen and the line was drawn from this point to point b. The angle formed by the intersection of the lines was measured as the canal curvature.

Weine referred to another method for determining the canal curvatures (Fig. 2).[2] A straight line is drawn from the orifice through the coronal portion of the curve and a second line drawn from the apex through the apical portion of the curve. The intersection of the two lines formed the canal angulation. A protractor and 0.5 mm lead pencils are used as tools for measurement.
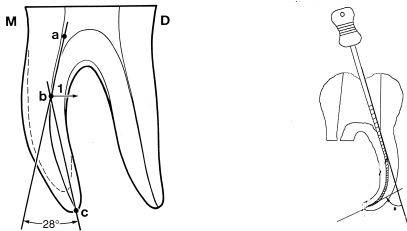

Fig. 1 Schneider's method (left).[1]
Fig. 2 Weine's method (right).[2]

Results

The degree of root canal curvature determined by Schneider's or Weine's methods was summarized in Table 1. Using ANOVA test of SAS v6.04, there were no significant differences (p>0.05) among three examiners although examiner B's result is larger than the ones of examiner A and C. From Table 3, the correlation demonstrated the linear relationship in degree of curvature between the two methods through calculating the Pearson coefficients (P=0.0001).

Table 1. Root canal curvature and linear correlation.

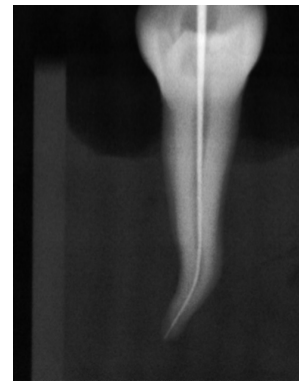| Examiner	Curvature (Schneider's method)			Curvature (Weine's method)			Linear correlation
	Mean	SD	(degree, n=51)	Mean	SD	(degree, n=51)	
A	16.15	5.19		23.91	8.47		r=0.90994 (p=0.0001)
B	17.27	5.01		26.75	10.09		r=0.75726 (p=0.0001)
C	16.19	5.47		23.20	8.78		r=0.80597 (p=0.0001)

F=0.76 and p=0.4694 for the Schneider's method; F=2.16 and p=0.1188 for the Weine's method. SD, Standard deviation.
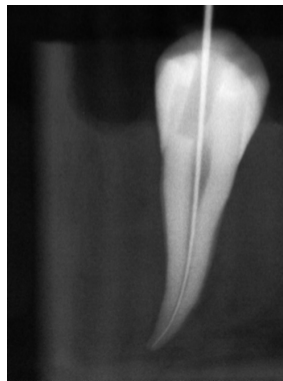
3   4   5

Fig. 3. A: 40.5˚; B: 44˚; C: 39˚.
Fig. 4. 20˚ using Schneider's method, and 37˚ using Weine's method.
Fig. 5. 20˚ using Schneider's method, and 28˚ using Weine's method.

Discussion

The result of this study shows that the error for Schneider's method is less than the one for Weine's method. That was different from our anticipation. During performing in our experiment, we found that in Schneider's method the point b was indeterminate, while in Weine's method there is no requirement to position the point. So it seems the latter is more accurate. But it was opposite to the result of statistics. We considered that in the gradual curved canals the apical line for Weine's method may be more subjective (Fig. 3). Meanwhile the magnification of the radiograph is also an important factor for error. It cannot be ignored. For example in specimen No. 30, examiner A measured 40.5°, examiner B measured 54°, and examiner C's result was only 39°. In addition, the degrees are equal for Schneider's method in some different canals whereas they are different significantly for Weine's methods. We speculated it may be related to the shape and location of the curvatures. And we also realized the apical curvatures were represented better using Weine's method (Figs. 4 and 5). To the same canal, the curvatures measured by Weine's method were about eight degrees larger than determined by Schneider's method through statistics. According to Schneider's classification of curvatures: straight (5° or less), moderate (10-20°), and severe (25-70°), the curvatures more than 18 degrees measured by Weine's method were just regarded as curved

canals.

When we were taking radiographs more than one curve was found in some canals. Obviously they cannot be measured by Schneider's or Weine's method. At the same time, the canals of premolars are larger than molars. The #15 K-file will approximate the actual canal shape but may not conform very well, especially where a canal is large and the file does not remain centered. Thus the curvatures cannot be reflected exactly by the two methods. These aspects should not be neglected in further research.

Conclusion

There is no significant difference in using the same measurement method among operators. Linear correlation has been demonstrated within the two methods in this study. In a word it is reliable for Schneider's or Weine's methods to determine the curvatures.

References

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