Difference in root canal length between Asians and Caucasians

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Abstract

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Aim To investigate whether there is a racial difference in canal length between the Asians and Caucasians.

Methodology Five hundred and fifteen Asian patients who had received root canal treatment at the Yonsei University Hospital, Korea between 1995 and May 2001 and 324 Caucasoid patients who had received root canal treatment at the Graduate Endodontic Clinic at the University of Pennsylvania, US were selected. The clinical endodontic procedures at both clinics were similar. An electronic apex locator (Root-ZXTM; J. Morita Co., Kyoto, Japan) was used to measure the initial working lengths and this was verified by

conventional radiography. The measurements from both Asian and Caucasian teeth were compared using a Student's *t*-test and a Mann–Whitney test.

Results The mean difference in canal length of pooled teeth between the Asian and Caucasian teeth was 1.2 mm, with a range from 0 to 2.5 mm. The greatest difference was in the distobuccal canal (2.5 mm) of maxillary first molar teeth followed by the mesiolingual canal (2.3 mm) of mandibular second molar, the buccal canal (2.1 mm) of the maxillary second premolar, the maxillary first molar and the mandibular second molar.

Conclusion Tooth lengths in Asians were shorter than Caucasians.

Keywords: Asians, canal anatomy, canal length, Caucasians, endodontics.

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Introduction

There is a body of opinion that believes that there are differences in root canal lengths between Asians and western population with the latter having longer teeth. This may be important during apical surgery. Although there were reports on the average tooth lengths in Caucasian people (Eliasson *et al.* 1986, Ingle & Bakland 1994, Weine 1996), no information on the differences in canal lengths between the races is available.

Therefore, the aim of this retrospective study was to compare the average canal lengths of the teeth of Asian and Caucasian races.

Materials and methods

Five hundred and fifteen Asian patients who received a root canal treatment at the Yonsei University Dental Hospital in Korea between 1995 and May 2001 were randomly selected. Three hundred and twenty-four Caucasoid patients who had undergone root canal treatment at the Endodontic Postgraduate Clinic at the University of Pennsylvania were also selected. The clinical procedures for the root canal treatment in both institutions were essentially the same, particularly in the area of canal length determination. Access cavities were made using the standard clinical procedures and occlusal reduction was performed especially in molar teeth. The canal lengths were first measured using an electronic measuring device (Root-ZXTM; J. Morita Co., Kyoto, Japan), and the lengths were then verified by taking conventional radiographs. Any electronic length

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within 1 mm of the radiographic tooth length was regarded as a reliable initial working length. Only the initial working length was used in this study because the working length might change as the canal became enlarged. Teeth with severe dental caries, fixed prosthesis, or those where it was impossible to negotiate the apical region due to calcification or other reasons were excluded. The root canal length of each tooth was measured to the nearest 0.5 mm and each counterpart tooth type in Asians and Caucasians was compared. Student's *t*-tests and Mann–Whitney tests were used for the statistical analysis of the difference in tooth length.

Results

The canal lengths of each tooth type in Asian and Caucasian teeth are given in Tables 1 and 2. The overall differences in the canal lengths between Asians and Caucasian patients ranged from 0 to 2.5 mm, with the average being 1.2 mm.

Table 1 Mean values of canal length (mm) in maxillary teeth

Tooth	Canal	Korean	Caucasian	Difference		
Central incisor		22.0 (90)	23.5 (19)	1.5*		
Lateral incisor		22.0 (40)	22.0 (9)	0		
Canine		24.5 (31)	24.5 (16)	0		
First premolar	Buccal	19.7 (34)	20.3 (20)	0.6		
First premolar	Palatal	19.3 (27)	20.2 (20)	0.9*		
Second premolar	Buccal	19.5 (35)	21.6 (13)	2.1*		
Second premolar	Palatal	19.2 (23)	20.7 (9)	1.5*		
First molar	Mesiobuccal	18.5 (67)	20.0 (31)	1.5*		
First molar	Distobuccal	18.0 (67)	20.5 (31)	2.5*		
First molar	Palatal	19.0 (67)	21.0 (31)	2*		
Second molar	Mesiobuccal	18.2 (30)	19.5 (37)	1.3*		
Second molar	Distobuccal	18.2 (30)	19.7 (37)	1.5*		
Second molar	Palatal	18.2 (30)	20.0 (35)	1.8*		

Values in parentheses indicate number of sample. *Significant (P < 0.05).

Γooth	Canal	Korean	Caucasian	Difference
Central incisor		18.9 (16)	19.9 (8)	1
_ateral incisor		19.7 (11)	19.9 (6)	0.2
Canine		22.5 (20)	23.3 (16)	0.8
First premolar		20.3 (18)	21.1 (12)	0.8
Second premolar		20.0 (31)	21.3 (26)	1.3*
irst molar	Mesiobuccal	19.2 (59)	21.0 (67)	1.8*
First molar	Mesiolingual	19.0 (59)	20.5 (67)	1.5*
irst molar	Distobuccal	19.0 (59)	20.5 (67)	1.5*
irst molar	Distolingual	19.0 (27)	20.5 (40)	1.5*
Second molar	Mesiobuccal	19.0 (33)	21.0 (44)	2*
Second molar	Mesiolingual	18.9 (33)	21.2 (43)	2.3*
Second molar	Distal	18.5 (29)	20.0 (38)	1.5*

The greatest difference was in the distobuccal canal (2.5 mm) of maxillary first molar teeth followed by the mesiolingual canal (2.3 mm) of mandibular second molar teeth, buccal canal (2.1 mm) of maxillary second premolar teeth, maxillary first molar and mandibular second molar teeth.

Discussion

Studies of canal length have been conducted mostly on extracted teeth or radiographs (Eliasson *et al.* 1986, Ingle & Bakland 1994, Weine 1996). Although a large number of specimens are easily available for study, radiographs are not always reliable because they can show considerable deviations depending upon the angles of the X-ray cone (Eggen 1975, Forsberg 1987). Direct measurements on extracted teeth may be the most accurate method, however, it is difficult to obtain a sufficient number of teeth with a sound tooth structure for each tooth type. Furthermore, the anatomical root apex does not always coincide with the canal terminus (Dummer *et al.* 1984, Stein & Corcoran 1992).

For this study, the clinical working lengths from two institutions, one in Korea, one in the USA, were used. The canal lengths were first measured using an electronic measuring device (Root-ZXTM), and the lengths verified using conventional radiography. Teeth with severe dental caries, crowns, or those teeth that could not be negotiated to the apical region due to calcification or other reasons were excluded. The access cavity was made in a usual clinical manner. This procedure may have created the potential for error. Nevertheless, the results of this study demonstrate clearly that there were significant differences in the canal lengths between Caucasians and Asian patients. The Caucasian samples of both the maxillary and

Table 2 Mean values of canal length(mm) in mandibular teeth

values in parentileses indicate number of sample. Digitileant $(r < 0.0)$	Values	in parer	theses in	ndicate	number	of	sample.	*Significant	(P	<	0.0)5)
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mandibular molar teeth had significantly longer roots (P < 0.05) than those of the Asian tooth samples.

This finding is in agreement with an anthropological study (Perzigian 1981), which reported that taller individuals generally have longer teeth than shorter individuals.

Conclusion

In general, the teeth of Caucasians are longer than Asians.

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References

Dummer P, McGinn J, Rees D (1984) The position and topography of the apical canal constriction and apical foramen. *International Endodontic Journal* **17**, 192–8.

- Eggen S (1975) Determining tooth length from radiographs. *Quintessence International* **6**, 69–70.
- Eliasson S, Lavstedt S, Ljungheimer C (1986) Radiographic study of alveolar bone height related to tooth and root length. *Community Dentistry and Oral Epidemiology* **14**, 169–71.
- Forsberg J (1987) Radiographic reproduction of endodontic 'working length' comparing the paralleling and the bisecting-angle techniques. Oral Surgery, Oral Medicine, Oral Pathology 64, 353–60.
- Ingle JI, Bakland LK (1994) *Endodontics*, 4th edn. Philadelphia: Lea & Febiger, pp. 92–226.
- Perzigian AJ (1981) Allometric analysis of dental variation in a human population. *American Journal of Physical Anthropology* 54, 341–5.
- Stein TJ, Corcoran JF (1992) Radiographic 'working length' revisited. Oral Surgery, Oral Medicine, Oral Pathology 74, 796–800.
- Weine FS (1996) *Endodontic Therapy*, 5th edn. St Louis, MO: C.V. Mosby, pp. 239–304.

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