



Brief communication

Description of the root canal system of mandibular first premolars in a colombian population

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The success of endodontic treatments depends largely on the knowledge of the morphology of the root canal system, allowing accurate location, for proper cleaning and disinfection for the subsequent three-dimensional obturation [1].

Various studies have indicated that mandibular first premolars have a single canal with different anatomical variations [2]. There have been several methods for studying anatomy of root canal, such as sectioning, conventional radiography, radiovisiography, diaphanization, computerized axial tomography and micro-computed tomography (CT). Although micro-CT may offer a simple and reproducible technique showing the finest details, we used the method of diaphanization [3], a reliable technique that is easy to perform.

The purpose of the present study was to examine the root canal system of the mandibular first premolar in a group of Colombians according to Vertucci's classification [4].

1. Materials and methods

A descriptive anatomical study was performed using 401 healthy human mandibular first premolars of young patients. The teeth used in this study were extracted due to orthodontic

reasons. All patients gave their consent to participate in this study. This study was approved by the ethics committee from the University of Santo Tomás, Bogotá, Colombia.

To verify the patency of the canal, we used K-file # 10. Then, the teeth were immersed in sodium hypochlorite 5.25% for 24 h to remove the pulp tissue.

The diaphanization began with decalcification, at room temperature using 5% nitric acid for 4 h. After washing with water, the samples were dehydrated with increasing concentrations of ethanol. The teeth were completely dried with hot air and cleared with methyl salicylate 99.9% for 30 min.

The pre-cleared specimens were then injected with Chinese ink using syringe irrigation with a 27-gauge needle from the pulp chamber, while negative suction was applied to the apical foramen. The canal system was analyzed by a trained operator using an operating binocular microscope with 10X magnification, recording the canal system configuration according to the classification of Vertucci as shown in Fig. 1, and anatomical variations of the root canal system [5] (Fig. 2). No images were captured and no software was used.

2. Results and discussion

Different reports showed that the first premolar has a complex root canal system with multiple anatomical variations, which may be influenced by characteristics such as age, gender, and race. In

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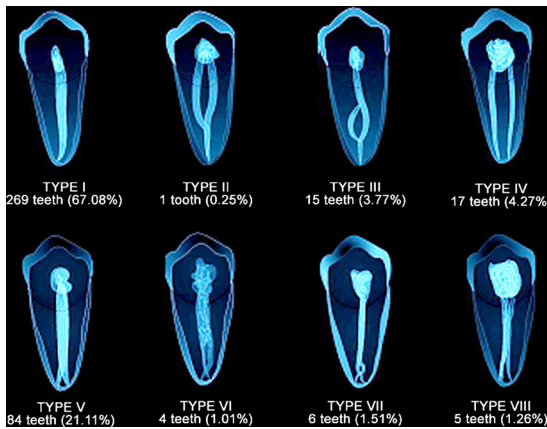


Fig. 1. Root canal pattern distribution of 401 mandibular first premolars according to Vertucci's classification. Type I, a single canal extends from the pulp chamber to the apex. Type II, two separate canals leave the pulp chamber and join short of the apex to form one canal. Type III, one canal leaves the pulp chamber, divides into two within the root, and then merges to exit as one canal. Type IV, two separate and distinct canals extend from the pulp chamber to the apex. Type V, one canal leaves the pulp chamber and divides short of the apex into two separate and distinct canals with separate apical foramina. Type VI, two separate canals leave the pulp chamber, merge in the body of the root, and redivide short of the apex to exit as two distinct canals. Type VII, one canal leaves the pulp chamber, divides and then rejoins within the body of the root, and finally redivides into two distinct canals short of the apex. Type VIII, three separate and distinct canals extend from the pulp chamber to the apex.

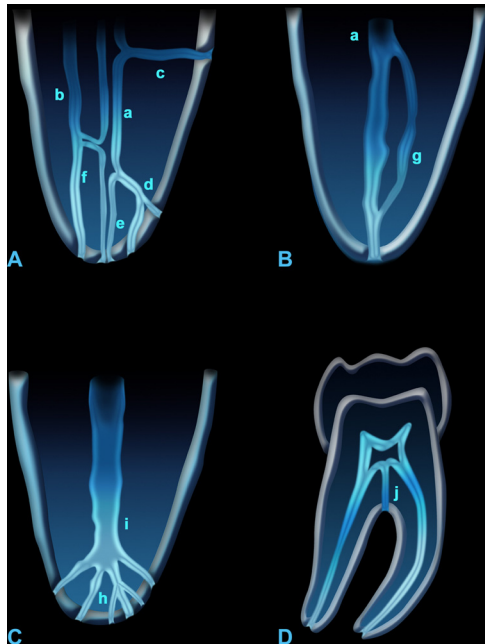


Fig. 2. Ramifications of the root canal. The images A, B, and C represent the classification proposed by Pucci and Reig, on the other hand, the image D represents the classification determined by Kuttler. (a) Principal canal axis passes through the tooth and generally reaches the apex. (b) Collateral canal runs along the root portion, more or less parallel to the principal canal and reaches the apex. (c) Lateral canal connects the principal canal or collateral canal with the periodontal tissue to the level of the middle and cervical thirds. (d) Secondary canal is the canal that is similar to the lateral because it connects the principal or collateral with the periodontal tissue but in the third apical. (e) Accessory canal is that which connects the secondary canal with the periodontal tissue, generally found in the foramen apical. (f) Intercanal is the small canal which connects the two or more main canals without reaching the cement or periodontal tissue. (g) Recurrent canal is that which exists from the main canal, running a varied course, meeting again at that main canal before arriving at the apex. (h) Reticular canals are the union of various small inter-connected canals in reticular form becoming multiple intercanals which can reach the apex. (i) Apical delta consists of multiple endings of the distinct canals which reach the multiple apical foramen, forming a delta with different endings. (j) Cavo interradicular connects the pulp chamber to the periodontal tissue where the molars separate.

the present study, 401 teeth were examined with diaphanization that allowed us to observe the configuration of complex root canal systems in a tridimensional form. To classify the configuration of the root canal system of the mandibular first premolar, we selected the classification of Vertucci [4].

The results demonstrated that the most frequent anatomical configuration was the Type I (269 teeth; 67.08% of 401 teeth). This highest frequency of Type I in the Colombian population is similar to those (72% and 70%) in an Indian population [1] and a Caucasian population [4], respectively. Type V was found in 84 teeth (21.11%). The second frequency of Type V is consistent with the results reported in a Caucasian population (24%). Type IV was found in 17 teeth (4.27%), which is different from other reports, 1.5% by Vertucci and 10% by Velmurugan.

Type III was found in 3.77%, which is similar to that reported by Vertucci (4%) and Velmurugan (3%). Type VII was only 1.51%, and Vertucci and Velmurugan did not report this Type. Type VIII was present in 5 teeth (1.26%). This is similar with those reported by Vertucci (0.5%). Type VI was found in 4 teeth (1.01%). We found only 1 tooth (0.25%) as Type II.

Regarding the anatomical variations, we found that 152 teeth had some anatomic variations. The most frequent was the collateral canals in 106 teeth (69.74%), followed by the apical delta in 34 teeth (22.32%), recurrent canal in 23 teeth (15.13%), intercanal in 23 teeth (15.13%), and less frequently the secondary canal in 13 teeth (8.55%), lateral canal in 11 teeth (7.24%), and reticular canal in 2 teeth (1.32%). Only one tooth showed accessory canal (0.66%), which is consistent with those reported by other authors [1,4].

Bifurcations were observed in 137 tooth cases, which can be divided into the middle third (88 teeth), apical third (35 teeth), and cervical third (14 teeth).

The knowledge that the first premolar in the Colombian population presents many anatomical variations was documented in this study. It compared the results of other studies, which allowed us to conclude and confirm that the mixture of phenotypes led to multiple anatomical variations. In this milieu, the varied anatomy and morphology in mandibular first premolar implies cleaning and shaping will be difficult. The clinician should consider this tooth group as complex and make use of microscopy, the radiography angle, opening, canal location, biomechanical preparations, and sealants.

Acknowledgments

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