THE MORPHOLOGY OF PERMANENT UPPER FIRST MOLARS EVALUATED BY CONE-BEAM COMPUTED TOMOGRAPHY IN A BRAZILIAN SUBPOPULATION

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ABSTRACT

This study was conducted with the aim of evaluating the variations in the morphology of permanent maxillary first molars, assessed by cone-beam computed tomography in a Brazilian subpopulation. For each tooth, data regarding gender, number of roots and root canals, and root anatomy were analyzed, based on the Vertucci classification (1984). The sample of this cross-sectional study was composed of 111 cone-beam computed tomography scans of patients referred for diagnostic purposes, of both sexes, aged between 18 and 80 years. After applying the exclusion criteria, the final sample consisted of 167 tomographic examinations of upper first molars. After analyzing the images, it was found that all the teeth had three roots, and of these, 85.62% had three canals (n=143) and 14.37% had four canals (n=24). Regarding Vertucci's classification (1984), type I was the most prevalent canal configuration (84%) in the mesio-buccal canals, 5% were classified as type II (n=9), 7% as type III (n=11), 2% as type V (n=3), and 2% as type VI (n=4). There was a low prevalence (1%) of type III classification in the disto-buccal canals, with the remaining (99%) classified as type I. It is concluded that from the cone beam computed tomography images, it was possible to assess the number of roots and the morphology of root canals, elucidating their most frequent variations.

Keywords: Vertucci Classification, cone beam computed tomography, molars, anatomy.

INTRODUCTION

The success of endodontic treatment is related to the correct diagnosis and precise knowledge of the internal anatomy of the root canal. Anatomical variations are considered a challenge for endodontists. Sanitization, shaping, and complete obturation of the root canals are essential factors for a successful endodontic treatment

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(LEE, J. et al. 2011; VERTUCCI FJ. 2015). Knowing the anatomical variations of the root canal is of utmost importance; the absence of this information increases the chances of endodontic failure. Cone beam computed tomography is an essential tool in the evaluation of internal morphology considered the gold standard, analyzing possible changes in shape and number along the axial, sagittal, and coronal axes (ZAJKOWSKI, L. A et al.2020; NIKKERDAR, N.et al.2020). With the aim of assisting in the standardization of these variations Vertucci et al. (1984) classified the morphology of the root canal into eight types, based on the main canal (KAROBARI, M.I. et al. 2021). The objective of the study was to evaluate the variations in the morphology of permanent maxillary first molars, assessed by cone-beam computed tomography in a Brazilian subpopulation.

METHODOLOGY

The present study was approved by the Research Ethics Committee of the Evangelical University of Goiás UniEVANGÉLICA, under opinion no. 3635546, and followed the guidelines established by resolution MS 466/2012. The study sample was composed of 335 cone-beam computed tomography (CBCT) scans, provided by the database of the Dental Imaging Diagnosis Clinic (C.I.R.O) located in the city of Goiânia, Goiás. The tomographic images were acquired using the i-CAT® Imaging System (Hatfield, Pennsylvania, USA) with a voxel size of 0.1 mm, a field of view (FOV) of 6 cm in height by 16 cm in diameter, an exposure time of 40 seconds, a voltage of 120 kVp, and a current of 36.12 mAs. Following the exclusion criteria, the CBCT scans with insufficient quality for interpretation were discarded, such as the presence of artifacts (n=47), edentulous patients (n=10), incomplete rhizogenesis (n=55), absence of the first upper molars (n=8), mandibular scans (n=80), and scans of the temporomandibular joint region (n=24). Thus, the sample included a total of 111 CBCT scans, with 222 teeth being evaluated. The exclusion criteria were applied again, excluding images due to the absence of the upper right first molar (n=15), absence of the upper left first molar (n=25), presence of endodontic filling in the upper right first molar (n=3), endodontic filling in the upper left first molar (n=2), presence of an implant (n=7), and the formation of artifacts in the region that would hinder the evaluation (n=3). Thus, the final sample consisted of 167 upper molars, with 70 being the upper left first

molar and 97 the upper right first molar. The images were analyzed by a radiologist with over ten years of experience and the other researchers, trained and calibrated for this analysis. The interpretation was carried out using the OnDemand3D™ software (Cybermed, Daejeon, Korea) on a computer with the Microsoft Windows 07 Professional SP-2 operating system (Microsoft Corp. Redmond, WA, USA), with an Intel® Core™ 5 Duo 2.86GHz-6300 processor (Intel Corporation, USA), an NVIDIA GeForce 6200 turbo cache video card (NVIDIA Corporation, USA), and an EIZO - S2000 FlexScan monitor, with a resolution of 1600x1200 pixels (EIZO Nanao Corporation Hakusan, Japan). The data were tabulated in a spreadsheet using the Microsoft Office Excel for Windows program (Microsoft Corporation, Washington, USA). The statistical software IBM-SPSS version 19.0 (manufacturer's data) was used for descriptive statistics. For statistical analysis, the simple percentage test was employed.

RESULTS

Regarding sex, of the 24 molars with 4 canals, 54% were from female individuals (n=13) and 45% from male individuals (n=11). Regarding the first upper molars in the sample (n=167), all had 3 roots, and of these, 85.62% had three canals (n=143) and 14.37% had four canals with the presence of a second canal in the mesiovestibular root of the first upper molar (n=24) (Figure 1). Regarding the classification proposed by Vertucci in relation to root morphological types (1984), only variations I, II, III, V, and VI were observed. The mesiovestibular (MV) canals mostly presented type I morphology (84%, n=140), while the others (16%) were classified as II (n=9), III (n=11), V (n=3), VI (n=4) (Figure 2). Regarding the morphology of the disto-vestibular (DV) canals, only one tooth exhibited variation III, while the others (n=166) were classified as type I (Figure 3). The palatal canals presented in their entirety (n=167) the morphology classified as type I. In the case of molars that presented 4 canals (n=24), the mesiobuccopalatal (MBP) canal showed type I morphology in all teeth.

CONCLUSION

Cone beam computed tomography is an accurate and effective tool for evaluating the morphological variations of root canals. The majority of the evaluated

teeth presented three roots and three canals. Regarding Vertucci's classification (1984), type I was the most prevalent canal configuration in the mesio-buccal canals in the evaluated Brazilian subpopulation.

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FIGURES

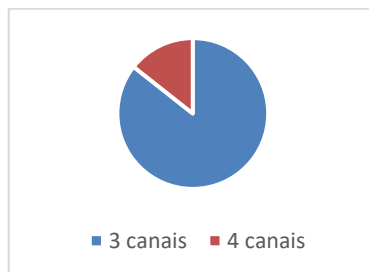Figure 1: Graph of the number of channels found in the sample

■ 3 canais ■ 4 canais

Figure 2: Vertucci Classification applied to the mesio-buccal canals
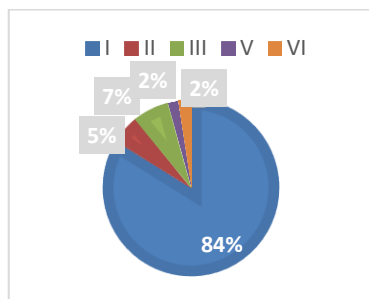

■ I ■ II ■ III ■ V ■ VI

7% 2% 2%
5%
84%

Figure 3: Vertucci Classification applied to the disto-vestibular canals

■ I ■ III

1%
99%