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ANATOMICAL ASSESSMENT OF MAXILLARY FIRST BICUSPID ROOT CANAL MORPHOLOGY USING CONE BEAM COMPUTED TOMOGRAPHY

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ABSTRACT

Background: The objective of this study was to assess Maxillary First Bicuspid Root Canal Morphology 'using Cone Beam Computed Tomography'

Methodology: This was 'Descriptive study' and was carried out in the Radiology department at Rehman College of Dentistry in Peshawar from September 15, 2022 to March 15, 2023. The 'CBCT scans of 120 patients from both sexes aged between 18 to 60 years were analyzed'. The Cone Beam Computed Tomography scan was evaluated for the configuration and number of pulp canals. Their results were analyzed through SPSS (v. 21). A chi square test was performed to see the effect modifiers of canal number stratified by gender. Significance was set at a p-value of 0.05.

Results: Among the '120 Cone Beam Computed Tomography scans (N=120), 69 (57.5%) were females and 51 (42.5%) were males with the mean age of 32.02, the ages ranged from 18-55 years and the standard deviation was 13.45 years'. 'Most of the maxillary first bicuspids had a 2 canal (n=73, 60.83%) followed by 3 canals (n=27, 22.50%)'. C shaped canals (n=11, 9.16%) and single canal teeth (n=2, 1.68%) were rare. The number of canals in genders was not statistically significant.

Conclusion: The most common type of maxillary first bicuspids has two canals followed by three canals. Prevalence of teeth with c shaped canals and single canal teeth is rare.

Keywords: Canals, roots, Bicuspid, morphology, maxilla, cone beam computed tomography,

INTRODUCTION

The successful outcome of endodontic treatment relies heavily on an accurate understanding of the root canal system's complex anatomy. The morphology of root canals presents substantial variations among different tooth types and even within the same tooth type, posing challenges to clinicians aiming for optimal cleaning, shaping, and obturation of the root canal space[1]. Due to their great clinical importance and possible complications, maxillary bicuspids have had significant relevance in endodontic studies owing to their structural diversity[2].

Routine radiographic procedures like periapical and bitewing radiographs have been the main practices in Endodontic diagnosis and treatment planning[3]. Nevertheless, these two-dimensional approaches often fail to capture the complex nature of a volumetric root canal system[4]. This limitation has led to assumptions regarding canal curvatures, overlooking additional canals, and poor treatment results.

The application of Cone Beam Computed Tomography in endodontics, or CBCT, has significantly transformed the manner in which dentists see and understand the anatomy of the root canal. CBCT provides high-resolution volumetric images which permit a precise evaluation of the root canal's anatomy, such as the existence of extra canals, isthmuses, apical deltas, and even intricate shapes of the root [5]. This technology equips endodontists with the necessary information to make better choices regarding treatment approaches, types of instruments, and strategy of negotiation [6].
Maxillary first bicuspids have many anatomical variations that make endodontic treatments difficult because of the presence of multiple canals such as C-shaped canals, lateral canals, and deltas that require successful morphology disinfection and obturation[7]. Earlier studies conducted using CBCT facilitated the visualization of the dentin canal configurations among these teeth, which were previously obscured by the use of conventional radiographs[8]. Other studies done in the west show that single canals in maxillary first bicuspids are the most common (75%). These are followed by two and then three canals[9].

The goal 'of this research was to assist the existing knowledge concerning root canal morphology of maxillary' bicuspids in the context of CBCT imaging. This study seeks to analyze a greater portion of the population from different demographics and attempt to reveal the full range of anatomical differences that exist with this specific tooth type. Understanding the intricate canal configurations and variations in root canal morphology of maxillary bicuspids is crucial for enhancing the precision and success rate of endodontic treatments in these teeth. The objective of this study was to assess Maxillary First Bicuspid Root Canal Morphology using Cone Beam Computed Tomography**.**

METHODOLOGY

The 'descriptive study was conducted in the radiology department of Rehman College of Dentistry after the necessary ethical committee review board approval was obtained'. The study was conducted from 15th August 2022 until 15th February 2023. The CBCT scans of 120 patients, both male and female and above the age of eighteen, were included after consent was obtained.
Patients were enrolled through consecutive sampling. The inclusion criteria eliminated patients with restorations or caries on their maxillary bicuspids and those cbcts with distorted images. 'The radiographs were taken by "Carestream Ger, model 90003D" with 73.9kv for male patients, 69.9kv for female patients, and 10.1mA'.

The manufacturer's radiation protocols for diverse age categories and members were followed, which set the values. All scans were performed at 'standard resolution of 0.30 mm voxel and 10.80 s'. Images were read 'using CS Imaging Browser 7.0.20 software'. Estimation of sample size was accomplished using 'G* Power software version 3.1.9.4 with p-value of 0.05, medium-power (0.3) and confidence of 95.1%'. The CBCT scans were studied for number of pulp canals and their configuration. The results were processed through SPSS (version 21). Using the Chi square test, canal number among genders was stratified in order to identify effect modifiers. The set limit of significance was P-value of 0.05.

RESULTS

The analysis was performed on 120 patients' CBCT scans (n=120). The sample consisted of '69 females (57.5%) and 51 males (42.5%) with a mean age of 32.02 years, distributed between 18 to 55 years with a standard deviation of 13.45 years (Table I)'. One hundred percent of the maxillary first

bicuspids had a 2 canal (n=73, 60.83%) configuration and these common features were followed by 3 canals (n=27, 22.50%). C shaped canals (n=11, 9.16%) and single canal teeth (n=2, 1.68%) were uncommon. No gender differences were observed in the number of canals. These findings are presented 'in Table II'.

Table I: Age and Gender distribution

Age	**Gender**
'Range:18-55 years'	Male: 51(42.5%)
'Mean: 32.02 years (± 13.45)'	Female: 69 (57.5%)

Table II: number of canals in maxillary first bicuspid and their gender distribution (n=120)

Number of canals	**male**	**female**	**Total**	**P-value**
one	1(50%)	1(50%)	2(1.68%)	0.121
two	35(47.94%)	38(52.06%)	73(60.83%)	
three	12(44.44%)	15(55.56%)	27(22.50%)	
four	4(57.14%)	3(42.86%)	7(5.83%)	
C shaped	7(63.63%)	4(36.37%)	11(9.16%)	
Total	59(49.16%)	61(50.84%)	120(100%)	

DISCUSSION

The complexity of root canal morphology in maxillary first bicuspids has been a subject of interest and investigation for many years. This tooth type is known for its anatomical variations, which can present challenges to endodontic treatment[10]. The development of novel imaging technologies, including Cone Beam Computed Tomography (CBCT), has provided a deeper insight into the complex root canal systems of the maxillary first bicuspids[11]. The following analysis focuses on the noticed canal configurations in these teeth, their clinical consequences, and the rationale behind clinically correct diagnosis and treatment preparations. For successful root canal therapy to occur, there needs to be an accurate diagnosis, skilled clinicians, attention to detail in treatment, and thorough postoperative care[11].

Achieving these goals presumably enhances the chances of a successful outcome and the preservation of the natural teeth. In endodontic therapy, the essential task entails the identification and obturation of pulp canals in maxillary bicuspids[12]. These teeth have complex system of carved root canals that have a wide range of variations, and their management affects the success and permanence of the treatment13. The identification and obturation of pulp canals in maxillary bicuspids are considered critical aspects of successful endodontic treatment[14]. These steps constitute prevention of infection and aid in the overall healing of the tooth[15]. The common form which we observed maxillary first bicuspids to have is two canals. A particular research conducted in Karachi revealed the existence of two canals in roughly 49.6% of patients examined [16]. Western nations offer a stark contrast as they report a significantly higher occurrence of the single canal type. Regnstrand T et al. found two canals to be 75%[17].

'Although the exact cause of prevalence of two canals is not known but it can be attributed to a combination of developmental factors, evolutionary changes, and genetic variations'[18]. Our study found the three canals in maxillary bicuspid to be 22.50%. c shaped canals and singe canal maxillary first bicuspids were rare. Similar results have been found in studies done nationally and internationally[19]. The presence of three canals in maxillary first bicuspids highlights the intricate and variable nature of root canal anatomy[20]. It's a combination of genetic, developmental, evolutionary, and anatomical factors that can lead to such variations[21]. Understanding these factors is crucial for endodontic practitioners to provide effective and successful treatments in cases with complex root canal configurations.

CONCLUSION

The most common type of maxillary first bicuspids has two canals followed by three canals. Prevalence of teeth with c shaped canals and single canal teeth is rare.

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