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Root Canal Morphology of Mandibular Anterior Teeth using Cone Beam Computerized Tomography in Saudi Sub-population.

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Abstract:

Introduction:
The aim of this study was to investigate root canal morphology of mandibular anterior teeth using cone beam computerized tomography (CBCT) in Saudi subpopulation.

Materials and methods:
A total of 298 patients who had examined with CBCT. Including 1,788 mandibular anterior teeth. The examinations were done by using CBCT are number of roots, number of root canals and canal configuration according to Vertucci's classification.

Result:
Among demographic variables, there were 120 males and 178 female, with maximum of age 68 and minimum of age 12. All the incisors show single root. Type I was the most significant type among the examined teeth (86.9%, n=1554). The prevalence of two root canals in lateral incisors (20.3%, n=121) found to be higher than central incisor (16.8% n=100). The major pattern of two root canals system was type II in mandibular incisor (74.9%, n=143), the incidence of other types (III, IV, V and VI) was (37.2%, n=111). According to the result, the presence of two roots in mandibular canines was (0.9%, n=3). Type I pattern was highly prevalent (97.85%, n=583) and two root canals system (2.2%, n=13)

Conclusion:
Two root canals in mandibular anterior teeth have been found in current study with percentage of (13.1%), and type II was the most predominant type in two root canals types.

Keywords: Platelet concentrates, regenerative endodontics, platelet-rich-plasma, concentrated growth factor, pulp regeneration

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Introduction

The complexity of the root canal anatomy has been shown with the advent of many new techniques which can explain the reasons of failing root canal treatments. The presence of accessory canals and bifurcating canals for example that are left untreated can host the microorganisms that are able to re-infect the root canal system. Thus, the knowledge of canals morphology is mandatory for complete root canal debridement of the bacterial population or reduce it to provide environment that make the periapical area capable to heal (1). Also, it is important to know the root canal morphology of lower anterior teeth in order to avoid mishaps (2,3). Although mandibular central incisors considered to be one type of teeth that have verity of the root configuration (4,5). Mandibular central incisors mostly are single root canals (6). Many studies have examined the morphology of the root and canals using different methods. Fischer, used corrosion preparation in which the pulp was removed chemically and Celluloid was forced into the root canal under pressure (7). Hess and Zurcher used Vulcanite Instead of Celluloid (7). Barret used ground suction in which the canal had previously been stained with Eosin (7). Recently CBCT has become available for many dental clinics. It costs reasonably low price and has a lower radiation dose and a higher resolution comparing to the conventional CT (8,9). CBCT have been proved to be a reliable way of 3-dimensional assessment of the root canal system (10). Ting Han, et al has conducted a study on the Chinese subpopulation

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using 3,871 CBCT of mandibular anterior teeth , And they found that The prevalence of 2 canals for the mandibular lateral incisors (27.36%) was significantly higher than that for central incisors (15.71%) and canines (6.27%) (11) .Mustafa Altunsoy, et al also did a study on root canal morphology of anterior teeth in a Turkish Population Using more than 800 CBCT images, And the result was 1 canal with a range of (77-95%) which was the most prevalent in the mandibular anterior teeth, followed by 2 canals with a range of (5.3-18.9%) (12).And Yang Zhengyan, et al has conducted a study on the Chongqing population using about 1,725 CBCT images, the results were that all of the mandibular central incisors had a single root, and two roots for the mandibular lateral incisors and mandibular canines with percentage of 0.3%,0.8% respectively, and the prevalence of multiple canals in the mandibular anterior teeth was (3.8%) for central incisors, (10.6%) for lateral incisors, and (4.2%) for canines (13). Finally, this study aimed to describe the canal configuration of mandibular central and lateral incisors and canines in Saudi population using cone beam computerized tomographic imaging.

Materials and Methods

In this Retrospective study. 298 Saudi patients who had been examined with cone beam computerized tomographic images (CBCT) at Dental University Hospital (DUH) for Implant and Orthodontic treatment. The data will be collected of cone beam computerized tomographic images (CBCT) from King Saud University (KSU) Dental University hospital (DUH) data base using PLANMECA (ProMax3D Max) device and software PLANMECA (Romexis) Version 4.5.2R. The samples selected according the following criteria: Available CBCT images of mandibular anterior teeth with complete root formation, Absence of root canal treatment, Absence of coronal or post coronal restorations, Absence of root resorption or periapical lesions, High-quality CBCT images (voxel size 200-300μm). The following information collected by two general practitioners and analyzed: determination of roots and canals number of each tooth, root canal configuration and the canal configuration symmetry between the contralateral teeth. Root canal configuration using Vertucci classification:" Type I: A single canal appears from the pulp chamber to the apex. Type II: 2 separate canals leave the pulp chamber but merge into 1 to the exit. Type III: 1 canal leaves the pulp chamber, divides into 2 within the root, and then merges to the exit. Type IV: 2 distinctly separate canals are present from the pulp chamber to the apex. Type V: A single canal leaves the pulp chamber but divides into 2. Type VI: 2 separate canals leave the pulp chamber, join at the midpoint, and then divide again into 2 with 2 separate apical foramina. Type VII: 1 canal leaves the pulp chamber, divides and then rejoins within the root, and finally re-divide into 2 separate canals with 2 separate apical foramina. Type VIII: 3 separate and distinct canals begin from the pulp chamber to the root apex." Statistical analysis: Pilot study held between two general practitioners. Kappa test to evaluate the reliability Inter-examiner agreement evaluated between the two examiner by randomly selecting 50 CBCT images read twice in the first day and a third time after one-week interval to determine the intra-examiner and inter-examiner agreement. The canal configuration correlation with gender, age and tooth position analyzed statistically with Chi-square statistical analysis.

Results

Among demographic variables, there were 120 males and female178, with maximum of age 68 and minimum of age 12. The total number of teeth was 1788. All the incisors show single root. Type I was the most significant type among the examined teeth (86.9%, n=1554). The prevalence of two root canals in lateral incisors (20.3%, n=121) found to be higher than central incisor (16.8% n=100). The major pattern of two root canals system was type II in mandibular incisor (74.9%, n=143), the incidence of other types (III, IV, V and VI) was (37.2%, n=111). According to the result, the presence of two roots in mandibular canines was (0.9%, n=3), one root canal pattern was highly prevalent (97.85%, n=583), and two root canals (2.2%, n=13). Table 1

Table 2 elaborates the prevalence of one and two root canals in male and female. Regarding age, it has been found that the most frequent type was type I (91.3%) and that was greatly seen in patient with 40 years of age and above. Table 3 demonstrates the details of all four age groups.

Tooth	Stat	Type 1	Type II	Type III	Type IV	Type V	Type VI	Type II to Type VI	Total
Left canine	n	292	4		1	1		6	298
	%	98.0	1.3		0.3	0.3		2.0	100
Left lateral	n	230	37	31				68	298
	%	77.2	12.4	10.4				22.8	100
Left central	n	231	40	24	2	1		67	298
	%	77.5	13.4	8.1	0.7	0.3		22.5	100
Right central	n	232	37	23	2	3	1	66	298
	%	77.9	12.4	7.7	0.7	1.0	0.3	22.1	100
Right lateral	n	245	29	23		1		53	298
	%	82.2	9.7	7.7		0.3		17.8	100
Right canine	n	291	4		3			7	306
	%	97.7	1.3		1.0			2.4	100

Table 1 Frequency of single and two root canal system

Gender			Type 1	Type II to type VI	Total
Gender	Male	n	582	138	720
		%	80.8%	19.2%	100.0%
	Female	n	972	96	1068
		%	91.0%	9.0%	100.0%
Total		n	1554	234	1788
		%	86.9%	13.1%	100.0%

Table 2 Distribution of single and two root canal system by gender

Age Group			Type 1	Type II to type VI	Total
Age Group	<= 20	n	243	33	276
		%	88.0%	12.0%	100.0%
	21 - 30	n	564	96	660
		%	85.5%	14.5%	100.0%
	31 - 40	n	396	72	468
		%	84.6%	15.4%	100.0%
	> 40	n	345	33	378
		%	91.3%	8.7%	100.0%
Total		n	1548	234	1782
		%	86.9%	13.1%	100.0%

Table 2 Distribution of single and two root canal system by age

Tooth name				Type 1	Type II to type VI	Total	p-value
Central	Location	Right	n	232	66	298	0.001
			%	77.9%	22.1%	100.0%	
		Left	n	264	34	298	
			%	88.6%	11.4%	100.0%	
	Total		n	496	100	596	
			%	83.2%	16.8%	100.0%	
Lateral	Location	Right	n	245	53	298	0.154
			%	82.2%	17.8%	100.0%	
		Left	n	230	68	298	
			%	77.2%	22.8%	100.0%	
	Total		n	475	121	596	
			%	79.7%	20.3%	100.0%	
Canine	Location	Right	n	291	7	298	1
			%	97.7%	2.3%	100.0%	
		Left	n	292	6	298	
			%	98.0%	2.0%	100.0%	
	Total		n	583	13	596	
			%	97.8%	2.2%	100.0%	

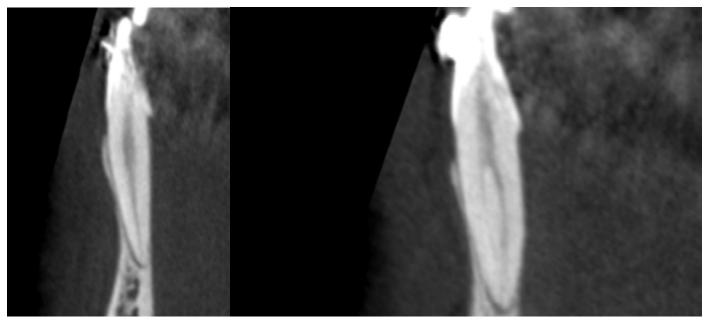**Table 4** Describes the symmetry of the canal morphology between the right and left teeth

Fig. 1 demonstrates Type I in A and TypeII in B canal configuration according to virtucci's classification in pic
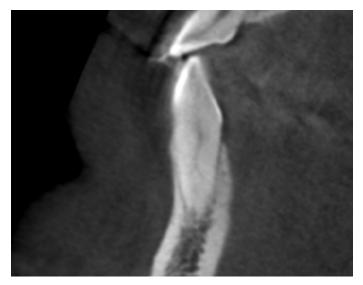

Fig 2 one of the rare cases shows a two rooted canine

Fig 3 demonstrate Type III in pic D canal configuration according to virtucci's classification.

Fig 4 shows one case of asymmetry of the canal configuration between the right and left mandibular central incisor

Discussion

Many studies have examined the the root and canals morphology using different methods. Describing the morphometric aspect of the internal anatomy using CBCT have been proved to be a reliable way of 3-dimensional assessment of the root canal system. A total of 298 patients who had examined with CBCT. Including 596 central incisors, 596 lateral incisors and 596 canines. The prevalence of 2 canals for the mandibular lateral incisors (20.3%) was significantly higher than that for central incisors (16.8%) and canines (2.2%).

The incidence of two root canals in mandibular central incisor in this study is (16.8%) which was lower than Vertucci's study (30 %) and sert et al (67.5%) (5,16). According to Rahimi et al, and Vertucci studies, the lateral incisor shows higher percentage (38.29%), (25%) Alternatively than our study (20.3%) (17,5). The incidence of two canals in mandibular canines in this study was (2.2%), which is lower than many studies such as Vertucci's (22%), Rahimi et al (8.4%) and sert et al (24%) (5, 16,17). The incidence of a second canal in mandibular incisors "central and lateral" in this study was (18.7%), which is relatively similar to Ting Han's study (21.53%) (11).

Male and female were included in this study as a demographic variable, there is a difference between male and female in root canal system, male tend to have two root canals more than female especially in centrals and laterals, and that was statistically approved. Some study support these findings such as, Zitong Lin and Mustafa Altunsoy (14,12). Although other stud-ies have mentioned no difference between male and female such as Guven (15). Regarding age in this study, the prevalence of two root canals decreased with age and it was statistically significant in central incisor of patients above 40 years of age, this could be attributed to tendency of the pulp to calcify with time.

The incidence of symmetry between contralateral teeth was also recorded in current study, we have found un-symmetry in the root canal morphology, and that was seen greatly in central incisor. So this emphasize the knowledge of root canal morphology.

Conclusion

In short, two root canals in mandibular anterior teeth have been found in current study with percentage of (13,1%), and type II was the most predominant pattern of Vertucci classification in mandibular incisor. Among gender and male, two root canals were higher in male than female, and one root canal is highly recorded in 40 years of age and above. Overall, CBCT has been proved as reliable and valid method to assess the root canal morphology.

Acknowledgements

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