

Topographical and Anatomical Features of Teeth Root Canals and Apical Foramen in Georgian Population

Objectives

The aim of our study was investigation and evaluation of: tooth length, number of roots and canals, type of configuration, root canal curvature and degree of curvature in Georgian population.

The study was carried out according to the established plan: laboratory investigation (on the extracted teeth), clinical study (endodontically treated teeth at the clinic). Computed tomography (CT-study) was also included in the final study. Evaluation and comparison of the obtained results was performed in correlation with the international standards. The results of the study revealed interesting data and anatomical characteristics, those replicating the racial signs and differs from the data recorded by the other researchers, became evident.

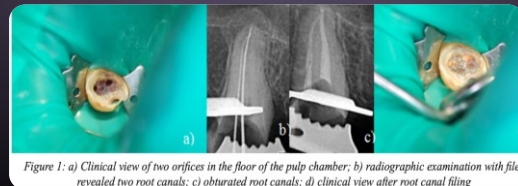
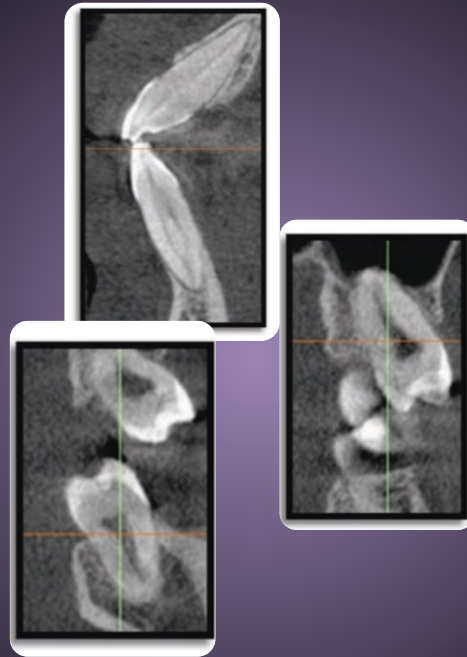


Figure 1: a) Clinical view of two orifices in the floor of the pulp chamber; b) radiographic examination with files revealed two root canals; c) obturated root canals; d) clinical view after root canal filling

Material and Methods

The study was conducted at the Dental Clinic, Training and Research Center “UniDent” from October 2014 to March 2015. CBCT images have been taken using Gendex GXDP-700 3D, (operating at 90 kVp and 7 mA, with an exposure time of 23s and voxel size of 0.2 mm³, with a field of view of 13x9x13 cm, with an estimated dose of about 5mSv, allowing measurements accuracy of 0.2mm)

enabling to get the image simultaneously in three dimensions, increasing the credibility of the assessment of the anatomical features of the teeth roots and root canals.

2753 teeth of 228 patients have been studied by CT. Ages of the patients varied within 25-55 years. Among them 122 men and 106 women. Maxillary teeth - 1394 and mandibular - 1359, respectively.

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Results

The results of the study revealed slightly different and interesting data, the anatomical characteristics those, replicating the racial signs, became evident. Interesting results have been obtained in terms of anatomical deviations of roots and root canal numbers, enabling to provide certain conclusions on racial lines. Studies on the internal and external anatomy of teeth have shown that anatomic variations can occur in all groups of teeth and can be extremely complex.

Table 1. CBCT - Distribution of the studied patients by age, sex and dental groups

Study Groups	Gender Division		Age of the Patients			Teeth Study Groups	Central Incisors	Lateral Incisors	Canines	First Premolar	Second Premolar	First Molar	Second Molar
	Female	Male	25-35	36-45	46-55	Maxillary n=1359	218	171	163	193	185	221	208
n=228	n=122	n=106	34	78	116	Mandibular n=1394	207	219	157	165	181	247	218

Table 2. The Main Morphological Characteristics of the Teeth in Georgian Population - Tooth length, number of roots and channels - cBcT study

Teeth n=2753	Maxillary		Mandibular	
	Tooth length	Canal System	Tooth length	Canal System
Central Incisor	Aver. 23,4 Min 18,2 Max 26,9	100% One root / one canal	Aver. 21,1 Min. 15,8 Max. 22,5	One root / one canal-65,07% One root /two canals 35,9%
Lateral Incisor	Aver. 22,0 Min. 17,4 Max. 25,5	100% One root/one canal	Aver. 21,6 Min.16,9 Max. 23,3	One root / one canal -62,9% One root / two canals 37,03%
Canines	Aver. 27,5 Min. 21,1 Max 31,0	100% One root / one canal	Aver. 23,2 Min. 19,5 Max. 26,4	One root / one canal-70,2% One root / two canals 28,5% Two roots - 1,27%
First Premolar	Aver. 22,5 Min 16,0 Max 24,4	One root -20,6% Two roots - 77,2% Three roots - 2,07% One canal - 11,8% Two canals - 78,08% Three canals - 2,07%	Aver. 22,1 Min. 17,5 Max. 24,2	One root / one canal -62,4% One root / two canals -29,1% Two roots / two canals 7,3% Two roots / three canals -1,21%
Second Premolar	Aver. 22,3 Min. 16,4 Max. 24,9	One root -61,08% Two roots -37,8% Three roots - 1,08% One canal- 29,1% Two canals - 61,0% Three canals- 1,08%	Aver. 22,3 Min. 16,7 Max. 24,2	One root / one canal -56,6% One root / two canals -32,04% Two roots / two canals 7,7% Two roots / three canals -0,56%
First Molar	Aver. 22,6 Min. 17,8 Max. 24,8	Three roots/three canals -17,54% Three roots/four canals -80,6% Five canals - 1,86%	Aver. 22,2 Min. 17,8 Max. 24,6	Two roots / three canals -32,4% Two roots / four canals -60,7% Three roots / four canals - 6,9%
Second Molar	Aver. 21,4 Min. 17,6 Max. 23,8	Three roots/three canals -48,54% Three roots/four canals - 41,6% Two root - two canals -6,26% Five canals - 2,6%	Aver. 22,2 Min. 17,8 Max. 24,6	Two roots / three canals -43,6% Two roots / four canals -48,7% one fused roots/ three root canals -4,84% One fused roots /two root canals 2,4%

Conclusions

Thus, statistic data are not the universal criteria, however, basing on these indicators anthropometrical data of roots and canals vary according to the geographic zones and nationalities. The study of variations in tooth form has interested anatomists (description and comparison), anthropologists, biologists, and dentists.

Moreover, the presence of accessory canals, isthmuses, and apical deltas adds another layer of complexity to the anatomical landscape. A comprehensive understanding of these features is crucial for endodontics, guiding them in navigating the intricate terrain of root canals and ensuring thorough treatment

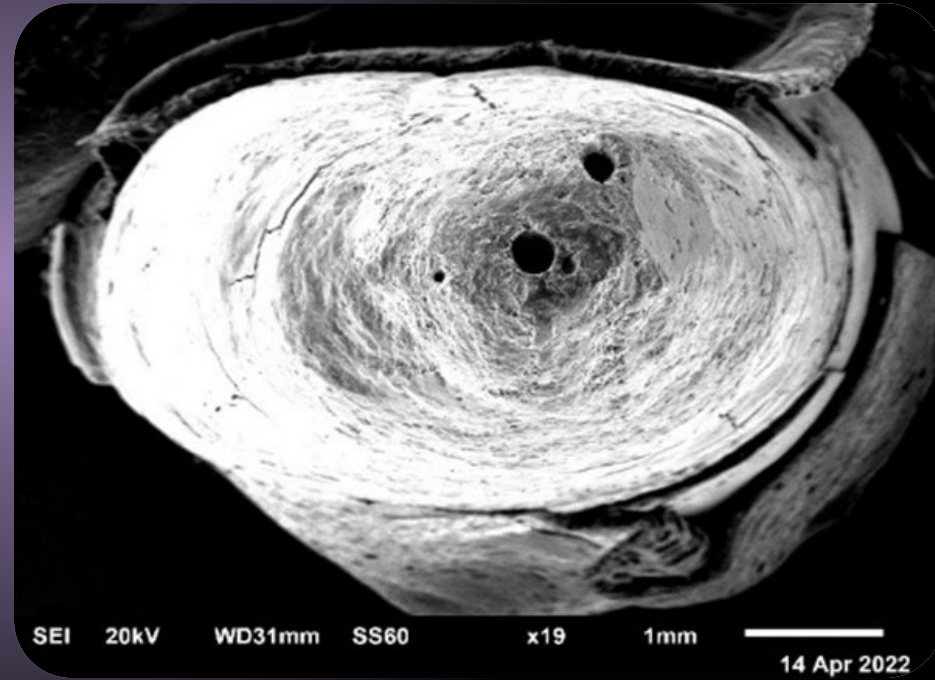
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BACKGROUND

The knowledge of topography and morphology of the anatomical landmarks located in the apical third of the root is crucial for the successful endodontic treatment. The apical third of the root is the narrowest part of the root which should be processed with the minimal invasive method to create an ideal space for obturation.

OBJECTIVES

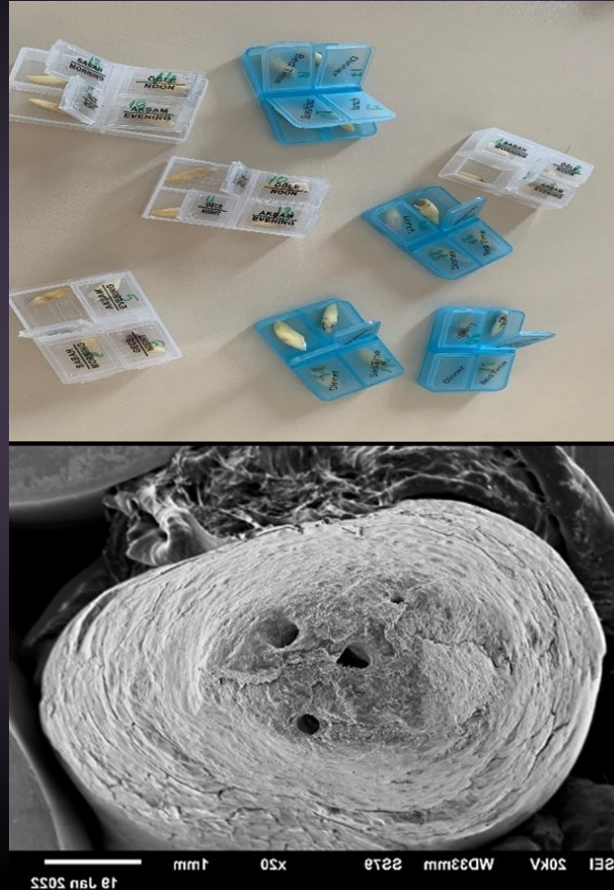
Apical third of the roots has not been conducted in Georgia, therefore there is no map of the apical third variations of the tooth canals of Georgian population. The aim of our study was to investigate the single-rooted teeth's anatomical foramen form, number and topography in Georgian population with a scanning electron microscope.



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Material and Methods

For the study, we have selected 102 single rooted teeth extracted from upper and lower jaws of humans. For the preparation of extracted teeth, we used a protocol based on the general rules of tooth preparation available in the literature. The morphological study of the samples was performed with a JOEL company scanning electron microscope (GSM 6510LV), which is equipped with an English company Oxford Instrument energy dispersive micro-X-ray spectral analyzer, X-Max.



Results

The most common shape of the anatomical foramen in the population of Georgia was round (54.90%) and oval (39.21%). It was found that only one anatomical hole in the upper central incisors was noted in the entire population. In the teeth of all the other groups we studied, we described one or more anatomical foramen. It was also interesting to study deviations of anatomical foramen. The research showed, that most often the anatomical foramen was at the peak of the root apex and having the distal position from it. The degree of deviation in the teeth of the upper and lower jaw was 50.98% in total.

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Conclusions

54.90% of the anatomical tooth root foramens of the population of Georgia have a round shape, 39.21% have an oval shape, and the other shapes are found only in 5.88%. 1 anatomical foramen at the apex of the tooth root in 79.41% of cases, and 2 holes or more in 20.58%. The central opening of the apical foramen was described in 50 teeth (49.02%).

KEYWORDS

Anatomical foramen; apex; deviation; maxillary and mandibular teeth ,root; root canals; CBCT; sem (scanning electron microscope).

