Introduction

To achieve the main goal of Root Canal Treatment (RCT), which is to prevent and/or treat apical periodontitis, chemo-mechanical cleansing and shape of the root canal system, as well as three-dimensional obturation, are required. [1] There are several anatomical variances in root canal systems, some of which can greatly enhance the difficulties of endodontic treatments. Prior to beginning treatment, learning the anatomy and morphology of a root canal system can improve the quality of treatment and, as a result, the long-term prognosis of endodontic therapy. [2] 2D radiography, root canal staining, hard tissue slice, micro-CT, and Cone-Beam Computed Tomography (CBCT) scanning were all used to determine root canal configuration. [3] 80% of the mandibular first premolars had a single root, (18%) had two roots, and two percent (2%) had three roots. [4] The present understanding of the morphology of the mandibular first molar root canal space is based on Hess’ work. He used vulcanite casts to recreate the anatomy of the pulp area, and found that 21 teeth (4%) out of 512 had four root canals. [5] Most of the teeth had one root (99.8%). Type I canal configuration (95.4%) was the most prevalent observation. [6] There is no systematic review research related to our topic in Saudi Arabia. The aim of this study was to do a systematic review of the literature on root morphology and root canal configuration in permanent mandibular dentition.

Literature Review

The PRISMA principles were followed, and the PROSPERO database was used to record this systematic review (258869). To reach and identify the published literature related to the anatomy of the root and the root canal configuration of all permanent mandibular teeth in the Saudi population, two independent teams conducted a comprehensive search using Cohen’s kappa agreement for title selection (0.97), abstract selection (0.77), and full-text selection (0.70). Each group was comprised of two analysts who directed a consolidated hunt dependent on distinct and concurred together upon consideration and avoidance rules. On the off chance that any of the groups can’t concede to which article to pick, an outsider (fifth scientist) will settle and concurred together upon consideration and avoidance rules. This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.


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residents, using human extremely durable mandibular teeth and an example size of somewhere around 10 teeth (power). Case reports, case series, or survey studies should be liberated from abnormalities, for example, deciduous teeth test size, non-human teeth, non-Saudi populace, case reports, case series, or audit examines. Root trench life structures or root waterway morphology or root channel design and Kingdom of Saudi Arabia or Saudi Arabia or KSA were used in a methodical writing search using the PubMed web crawler. At the point when the pursuit started in August 2020, there were no time cut-off points or language limitations. Scopus, Web of Science, Embase, Cochrane, and Direct Science were completely looked with similar rules and search approach. A manual inquiry was additionally completed, which included cross-referring to every one of the chose papers’ reference records to guarantee that all applicable articles had been surveyed.

**Data Collection**

The studies were chosen using a “three-step examination.” All relevant literature titles and abstracts were examined in the first step, taking into account the study’s inclusion/exclusion criteria. The whole text of the selected publications was studied, analyzed, and rated in the second step, using the same criteria as before. The third phase involved subjecting the selected relevant studies to a critical appraisal in order to determine the quality of each article. For greater accuracy and convenience, each study was assigned a unique ID number. Information was separated into two groups from each of the clinical and laboratory studies: 1st Matrix: (Ia) Title (IIa) Author (IIIa) Year (IVa) Journal (VA) Institution (VIa) Region. Matrix 2: ( Ib) Author (IIb) Year (IIIb) The method used to study tooth morphology (IVb) Tooth (Vb) Study design (VIb) Sample size (VIIb) Gender (VIIIb) Age (IXb) Outcome (number of roots, number of root canals, and their configurations) Another table was made to organize all of the papers based on their main goals and tooth samples. I C Shaped canal studies; (ii) Maxillary canine; (iii) Maxillary first premolar; (iv) Maxillary second premolar; (v) Maxillary first molar; (vi) Maxillary second molar; (vii) maxillary first molar; (vii) Maxillary Second Molar after that, an excel document with many sheets was produced, each with its own set of categories. Each sheet had multiple columns, beginning with the study ID number, year of publication, year of sample size collection, tooth, number of sample size, gender (male, female, both genders), area (which was divided into five main regions: northern, southern, central, eastern, and western), study design, method of examination (CBCT, lab, clinical), operator number, and gender (male, female, both genders). The results of each investigation were then displayed in the same excel sheet (if mentioned) the number of roots, the number of roots, the number of roots, the number of roots, the number of roots, the number of roots, the number of roots, the canals, vertucci categorization (types 1-8), C-shaped canals, fused roots, merged canals, correlations, bilateral symmetry, gender differences [Figure 1].

**Scientific assessment**

The Critical Appraisal Skills Program (CASP) tool for systematic reviews and Centre for Evidence-Based Medicine (CEBM) had been used in this systematic review to assess the scientific merit of the full texts. CASP checklist contains 12 questions to help the reader make sense of a systematic review. Each of them will be critically appraised by using (CASP) and (CEBM) by one of the researchers.

**Data Analysis**

The electronic database search yielded 268 studies that were
relevant. After cross-referencing, further seven studies were added. After a full-text analysis and duplicate reduction, 246 of the 275 articles were eliminated. Four clinical (prospective) studies, seven in vitro studies, and twenty-one in vivo research were found.

**Matrix development**

The information mentioned earlier in the technique was gathered from the 17 studies that were included. They’ve been arranged and classified in the table accordingly [Table 1]. This table summarizes the various methods used by the various studies, as well as the features of their sample size and study team.

**Data extraction**

Sample size, tooth number, gender, location, methodology used, root morphology, canal classifications, and number were all gathered from the selected articles. For the second step of this systematic review, all data was entered into an excel sheet and numerically coded.

**Data grouping and filtering**

All data was filtered and double-checked after the traditional data extractions to eliminate any human or systemic errors. Following that, filters were applied to the data sheets, and the data was organized by tooth.

### Table 1: Matrix development.

<table>
<thead>
<tr>
<th>Title</th>
<th>Authors</th>
<th>Years</th>
<th>Journal</th>
<th>Institution</th>
<th>Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root canal morphology of mandibular premolars in a Saudi population using cone beam computed tomography</td>
<td>Alam F, et al.</td>
<td>2020</td>
<td>Pakistan Journal of Medical and Health Sciences</td>
<td>College of Dentistry, Aijouf University</td>
<td>Aijouf</td>
</tr>
<tr>
<td>Evaluation of root canal morphology of mandibular premolars in a Saudi population using cone beam computed tomography: A retrospective study</td>
<td>Alfawaz H, et al.</td>
<td>2019</td>
<td>Saudi Dental Journal</td>
<td>College of Dentistry, King Saud University</td>
<td>Riyadh</td>
</tr>
<tr>
<td>Evaluation of mandibular first permanent molars to determine the incidence of three roots and four canals in Aljouf region of Saudi Arabia</td>
<td>Iqbal A, et al.</td>
<td>2019</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevalence of C-shaped canal system in mandibular first and second molars in a Saudi population assessed via cone beam computed tomography: A retrospective study</td>
<td>Alfawaz H, et al.</td>
<td>2019</td>
<td>Clinical Oral Investigations</td>
<td>College of Dentistry, King Saud University</td>
<td>Riyadh</td>
</tr>
<tr>
<td>Cone-beam computed tomographic evaluation of root canal morphology of mandibular canines in a Saudi subpopulation</td>
<td>Al-Dahman Y, et al.</td>
<td>2017</td>
<td>Saudi Endodontic Journal</td>
<td>College of Dentistry, King Saud University</td>
<td>Riyadh</td>
</tr>
<tr>
<td>Prevalence of three-rooted mandibular permanent first and second molars in the Saudi population</td>
<td>Riyahi AM, et al.</td>
<td>2019</td>
<td>Saudi Dental Journal</td>
<td>College of Dentistry, King Saud University</td>
<td>Riyadh</td>
</tr>
<tr>
<td>Incidence of four canals in root-canal-treated mandibular first molars in a Saudi Arabian subpopulation</td>
<td>Al-Nazhan S, et al.</td>
<td>2012</td>
<td>International Endodontic Journal</td>
<td>King Saud University, College of Dentistry</td>
<td>Riyadh</td>
</tr>
<tr>
<td>Incidence of two canals in extracted mandibular incisors teeth of Saudi Arabian samples</td>
<td>Al-Fouzan, et al.</td>
<td>2020</td>
<td>Saudi Endodontic Journal</td>
<td>National Guard Dental Clinics</td>
<td>Saudi Arabia</td>
</tr>
</tbody>
</table>
The mid-mesial canal prevalence in mandibular molars of a Saudi population: A cone-beam computed tomography study

Aldosimani, et al. 2020  
King Saud University Dental Journal  
Riyadh

Prevalence and characteristics of three-rooted mandibular molars in Saudi population: A retrospective radiographic analysis

Alahmed, et al. 2018  
Journal of Contemporary Dental Practice  
College of Dentistry, Majmaah University  
Al Zulfi

Three-rooted mandibular first molars in a Saudi Arabian population: A CBCT study

Patil, et al. 2019  
Pesquisa Brasileira em Odontopediatria e Clinica Integrada  
College of Dentistry, Jof University  
Aljouf

The Evaluation of Mandibular First Permanent Molars to Determine the Incidence of Three Roots and Four Canals in Aljouf Region of Saudi Arabia

Iraqal, et al. 2019  
The Saudi Dental Journal  
Armed Forces Hospitals  
Asir region

Anatomical analysis of permanent mandibular incisors in a Saudi Arabian population: An in Vivo cone-beam computed tomography study

Algarni, et al. 2019  
Nigerian Journal of Clinical Practice  
College of Dentistry, Jazan University  
Jazan

C-shaped root canals in mandibular second molars in a Saudi Arabian population

Khalid S, et al. 2001  
The International Journal of Medical Research  
King Fahad National Guard Hospital  
Riyadh

The microscopic diagnosis and treatment of a mandibular second premolar with four canals

Khalid S, et al. 2018  
The International endodontic journal  
*  
*

Prevalence of c-shaped root canals in mandibular second molars in a sample population of Saudi Arabia

Laila AB, et al. 2020  
The Pakistan Oral & Dental Journal  
Jeddah, Makkah, and Albaha

Data synergizing

The mean was recalculated using the filtered and selected data for each tooth, based on the selected studies that have a similar design and are homogeneous. After correcting for sample size in each study, the new mean was computed. The new mean and range are shown in separate Tables 2-4 for each tooth in the following section.

Anterior teeth

The number of roots of the mandibular anterior teeth was evaluated by four studies. [6-9] These studies include 2980 mandibular anterior teeth, most of mandibular anterior teeth was one root (86.4%), (13.6%) of anterior teeth were 2 roots.

The number of canals of the mandibular anterior teeth was evaluated by four studies. These studies include 1913 mandibular anterior teeth, most of mandibular anterior teeth was one canal 1736 (90.74%), 198 (10.3%) of mandibular anterior teeth was 2 canals. The frequency of vertucci types was evaluated by two studies [1,3] these study include 1132 mandibular second premolar, the majority of the sample 413 (84.11%) had vertucci type I, 22 (4.48%) was type II, 16 (3.25%) was type III, 24 (4.88%) was type IV, 8 (1.62%) was type V, 1 (0.20%) was type VI, 1 (1.22%) had type VIII, and one tooth had an aberrant root canal morphology. [3,10-12]

Second premolar

The number of roots of the mandibular second premolar was evaluated by four studies [3,11-13] these study include 1475 mandibular second premolar, most of mandibular second premolar was one root 1371 (92.94%), 102 (6.91%) of second premolar was 2 roots, and 2 (0.13%) was three roots. The number of canals of the mandibular second premolar was evaluated by three studies [1,3,13] these studies include 1132 mandibular second premolar, most of mandibular second premolar was one canal 907 (80.12%), 220 (19.43%) of second premolar was 2 canal, 4 (0.35%) was three canals, and 1 (0.08) was four canals. The frequency of vertucci types was evaluated by two studies [1] these study include 722 mandibular second premolar, the majority of the sample 676 (93.62%) had vertucci type I, 15 (2.07%) was type II, 7 (0.96%) was type III, 9 (1.24%) was type IV, 6 (0.83%) was type V, 6 (0.83%) was type VI, and out of the sample, there were 3 (0.41%) teeth had one root, 3 canals, and C-shape configuration.

First premolar

The number of roots of the mandibular first premolar was evaluated by four studies [1,10-12] these study include 1640 mandibular first premolar, most of mandibular first premolar was one root 1460 (89.02%), 176 (10.73%) of first premolar was 2 roots, and 4 (0.24%) was three roots. The number of canals of the mandibular first premolar was evaluated by three studies. [1,3,4] These studies include 1249 mandibular first premolar, most of mandibular first premolar was one canal 888 (71.09%), 355 (28.42%) of first premolar was 2 canal, 6 (0.48%) was three canals. The frequency of vertucci types was evaluated by two studies. These studies include 491 mandibular first premolar, the majority of the sample 413 (84.11%) had vertucci type I, 22 (4.48%) was type II, 16 (3.25%) was type III, 24 (4.88%) was type IV, 8 (1.62%) was type V, 1 (0.20%) was type VI, 1 (1.22%) had type VIII, and one tooth had an aberrant root canal morphology. [1,3,10-12]
of mandibular first molar was three canals 788 (63.65%), 15 (1.90%) was three roots. 589 (80.3%) of mandibular second molars reported three root canals, 46 (6.27%) was 2 root canals, and 40 (5.45%) was have four root canals, 58 (7.9%) of these teeth display other canals configuration. The frequency of vertucci type IV 266 (39.4%) was the highest in mesial canals followed by vertucci type II 172 (25.5%). In contrast, vertucci type I was the most frequent type in the distal canals 646 (95.6%) and vertucci type IV was not detected in the distal canal. C-shaped root canals in the mandibular second molar was evaluated by three study [2,21,22] and include 1054 mandibular second molar, 110 (10.43%) of these teeth was have of the C-shaped canals.

**Discussion**

All canals must be located, debrided, shaped, disinfected, and obturated for a successful endodontic therapy, and the first crucial step in canal debridement is to identify the canals and a full grasp of the internal anatomy of teeth. The clinician must have sufficient information of the canal design and morphology in order to determine the number of canals in the tooth being treated. Each group of teeth has a different root canal arrangement and anatomy. Additional canals or atypical root canal configuration can occur when many roots are present.

**Anterior teeth**

**Number of roots:** The number of roots of the mandibular anterior teeth was evaluated. [6-9] These studies include 2980 mandibular anterior teeth was evaluated. [6-9] These studies include 2980 mandibular anterior teeth was evaluated.

<table>
<thead>
<tr>
<th>Tooth</th>
<th>Vertucci classification</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
<th>Type VI</th>
<th>Type VII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandibular anterior teeth</td>
<td>N=606 (27%)</td>
<td>N=41</td>
<td>N=1</td>
<td>N=189</td>
<td>N=7</td>
<td>N=25</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mandibular first premolar</td>
<td>N=413 (84.11%)</td>
<td>N=22</td>
<td>N=16</td>
<td>N=24</td>
<td>N=8</td>
<td>N=1</td>
<td>N=6</td>
<td></td>
</tr>
<tr>
<td>Mandibular second premolar</td>
<td>N=676 (93.62%)</td>
<td>N=15</td>
<td>N=7 (2.07%)</td>
<td>N=9 (1.24%)</td>
<td>N=6 (0.83%)</td>
<td>N=6 (0.83%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular first molar</td>
<td>N=17 (1.7%)</td>
<td>N=361</td>
<td>N=13 (3.17%)</td>
<td>N=574 (58.15%)</td>
<td>N=21 (2.1%)</td>
<td>N=1 (0.1%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular second molar</td>
<td>N=42 (6.22%)</td>
<td>N=172</td>
<td>N=110</td>
<td>N=22</td>
<td>N=64 (6.4%)</td>
<td>N=2 (0.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mandibular second molar</td>
<td>N=646 (95.56%)</td>
<td>N=6</td>
<td>N=6 (0.88%)</td>
<td>N=6 (0.88%)</td>
<td>N=18 (2.66%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
mandibular anterior teeth, most of mandibular anterior teeth was one root (85.4%), (0.70%) of anterior teeth were 2 roots. While in Indian subpopulation these studies include 102 and all mandibular anterior teeth had one root 100%

**Number of canals:** The number of canals of the mandibular anterior teeth was evaluated. These studies include 1913 mandibular anterior teeth, most of mandibular anterior teeth was one canal 1736 (90.74%),198 (10.3%) of mandibular anterior teeth was 2 canals. While in Indian sub population the study includes 102 mandibular anterior teeth 83 (81.37%) had one canal and 29 (28.43%).

**Root configuration:** The frequency of vertucci types was evaluated by two studies, these studies include 2980 mandibular anterior teeth. The majority of the sample 806 (27%) had vertucci type I, 41 (1.37%) was type II, 189 (6.3%) was type III, 7 (0.23%) was type IV, 25 (0.83%) was type V, 0 (0%) was type VI. While in Indian subpopulation these studies include 102 mandibular anterior teeth typel canal configuration was the most prevalent 66 (64.71%) type II 24 (23.53%) type III 9(8.82%) type V 3 (2.94).

**First premolar**

**Number of roots:** The number of roots of the mandibular first premolar was evaluated. These studies include 1640 mandibular first premolar, most of mandibular first premolar was one root 1460 (89.02%), 176 (10.73%) of first premolar was 2 roots, and 4 (0.24%) was three roots. while in Gujarati population these studies include 138 mandibular first premolars 134 (97.10%) had one root, 4 (2.89%) was two roots. And in Chinese population the study includes 178 mandibular first premolar, nearly all mandibular first premolars have a single root (177/178). Two roots were found in only 1 (0.6%).

**Number of canals:** The number of canals of the mandibular first premolar was evaluated by three studies. These study include 1249 mandibular first premolar, most of mandibular first premolar was one canal 888 (71.09%), 355 (28.42%) of first premolar was 2 canal, 6 (0.48%) was three canals. while in Gujarati population these studies include 138 mandibular first premolars 122 (88.40%) had one canal and 16 (11.59%) had two canals and in Chinese population the study includes 178 mandibular first premolar, 178 mandibular first premolars, 114 (64.04%) was single canal system, whilst 61 (34.27%) had two canals and 3 (1.69%) had three canals.

**Root configuration:** The frequency of vertucci types was evaluated by two studies, these studies include 491 mandibular first premolar, The majority of the sample 413(84.11%) had vertucci type I, 22 (4.48%) was type II, 16 (3.25%) was type III, 24 (4.88%) was type IV, 8 (1.62%) was type V, 0(0.2%) was type VI, 6 (1.22%) had type VIII, and one tooth had an aberrant root canal morphology. while in Gujarati population these studies include 138 mandibular first premolars, 122 (88.40%) had one canal and 16 (11.59%) had two canals and in Chinese population the study includes 178 mandibular first premolar, the majority of the sample 676 (93.62%) had vertucci type I, 15 (2.07%) was type II, 7 (0.96%) was type III, 9 (1.24%) was type IV, 6 (0.83%) was type V, 6 (0.83%) was type VI, and out of the sample, there were 3 (0.41%) teeth had one root, 3 canals, and C-shape configuration. while in Turkish population these studies include 178 mandibular second premolar, 173 (97.2%) had one canal and 4(2.2%) had two canals, the prevalence of C-shaped canals was 1 (0.6%).

**Second premolar**

**Number of roots:** The number of roots of the mandibular second premolar was evaluated. These studies include 1475 mandibular second premolar, most of mandibular second premolar was one root 1371 (92.94%), 102 (6.91%) of second premolar was 2 roots, and 2 (0.13%) was three roots. while in western Chinese populations these studies include 178 and all mandibular second premolars had one root (100%) and in Korean population the study includes 789 mandibular second premolar, most of mandibular second premolar was one root 784 (99.4), and 5 (0.6%) was two roots.

**Number of canals:** The number of canals of the mandibular second premolar was evaluated. These study include 1132 mandibular second premolar, most of mandibular second premolar was one canal 907 (80.12%), 220 (19.43%) of second premolar was 2 canal, 4 (0.35%) was three canals, and 1 (0.08%) was four canals. while in eastern Chinese populations the study includes 178 mandibular second premolar, 173(97.2%) had one canal and 4(2.2%) had two canals, the prevalence of C-shaped canals was 1 (0.6%).

**Root configuration:** The frequency of vertucci types was evaluated by two study, these studies include 722 mandibular second premolar, The majority of the sample 676 (93.62%) had vertucci type I, 15 (2.07%) was type II, 7 (0.96%) was type III, 9 (1.24%) was type IV, 6 (0.83%) was type V, 6 (0.83%) was type VI, and out of the sample, there were 3 (0.41%) teeth had one root, 3 canals, and C-shape configuration. while in Turkish population these studies include 549 mandibular second premolar, type I canal configuration was the most prevalent (98.9%) and only one teeth had type II canal configuration. The type V canal configuration was observed in three cases. Type IV, VII, and VIII canal configurations were not found in all teeth and in western Chinese population the study includes 178 mandibular second premolar, the majority of the sample was type I 173 (97.2%), 1(0.55%) was type II, 3(1.7%) was type V, 1(0.55) was C shaped canal.

**First molar**

**Number of roots:** The number of roots of the mandibular first molar was evaluated by eight studies. These studies include 2854 mandibular first molars; most of the mandibular first molars had 2 roots 2736 (95.86%), and 118 (4.1%) had three roots. While in the vietnamese subpopulation which included 332 mandibular first molars, there were 291(87.6%) molars with two roots and 41(12.3%) molars with three roots. While in Jordanian population which included 330 mandibular first molars, most of them 314 (95.2%) had two separate roots, and 3 (0.9%) had two fused roots, three separate roots were found in 13 (3.9%) molars. While in Taiwan’s Chinese population which included 183 mandibular first molars, most of them 141(77%) had two roots, and 6 (3%) had one root, three roots were found in 36 (20%) molars.
Number of canals: The number of canals of the mandibular first molar was evaluated by four studies \[1,5,15,19\]. These studies include 1238 mandibular first molar, most of mandibular first molar was three canals 788 (63.65%), 15 (1.21%) of first molar was two canal, 435 (35.13%) was four canals. While in the Vietnamese subpopulation \[29\] which included 332 mandibular first molars, Most of them had three canals 221 (66.6%), and there were 15 (4.5%) molars with two canals, and 96 (28.9%) molars had four canals. While in Jordanian population \[30\] which included 330 mandibular first molars, Most of them had three canals 159 (48.2%), and there were 2 (0.6%) molars with two canals, and 151 (45.8%) molars had four canals, and five canals were found in 18 (5.5%) molars. While in Taiwan’s Chinese population \[31\] which included 183 mandibular first molars most of them had three canals 93 (51%), and there were 6 (3%) molars with two canals, and 84 (46%) molars had four canals.

Canals configurations: The frequency of vertucci types was evaluated by three studies, \[1,19\] these studies include 987 mandibular first molar, The majority of the sample 736 (74.56%) had vertucci (distal root) type I, 17 (1.7%) was vertucci (mesial root) type I, 361 (36.57%) was vertucci (mesial root) type II, 54 (5.47%) was vertucci (distal root) type II, 13 (1.3%) was vertucci (mesial root) type III, 110 (11.1%) was vertucci (distal root) type III, 574 (58.15%) was vertucci (mesial root) type IV, 22 (2.22%) was vertucci (distal root) type IV, 64 (6.4%) was vertucci (distal root) type V, 21 (2%) was vertucci (mesial root) type V, 1 (0.1%) was vertucci (mesial root) type VI, 2 (0.2%) was vertucci (distal root) type VI, and out of the sample, from other two studies \[2\] there was only one C-shaped mandibular first molar observed (0.19%) in study no 4, and in the study no 5 there were 9 (1.3%) mid-mesial canals at the mandibular first molar. While in the Vietnamese subpopulation which included subtotal two rooted mandibular first molar (n=291), The majority of the sample 235(80.8%) had vertucci (distal root) type I, 16 (5.5%) was vertucci (mesial root) type I, 89 (30.6%) was vertucci (mesial root) type II, 15 (5.2%) was vertucci (distal root) type II, 6 (2.1%) was vertucci (mesial root) type III, 16 (5.5%) was vertucci (distal root) type III, 177 (60.8%) was vertucci (mesial root) type IV, 19 (6.5%) was vertucci (distal root) type IV, 5 (1.7%) was vertucci (distal root) type V, 0 (0%) was vertucci (mesial root) type V, 3 (1.0%) was vertucci (mesial root) type VI, 1 (0.3%) was vertucci (distal root) type VI. While in Jordanian population \[30\] which included 317 two rooted mandibular first molars, The majority of the sample 168 (50.9%) had vertucci (distal root) type I, and also 168 (50.9%) was vertucci (mesial root) type IV, 2 (0.6%) was vertucci (mesial root) type I, 113 (34.2%) was vertucci (mesial root) type II, 56 (17%) was vertucci (distal root) type II, 2 (0.6%) was vertucci (mesial root) type III, 15 (4.5%) was vertucci (distal root) type III, 30 (9.1%) was vertucci (distal root) type IV, 36 (10.9%) was vertucci (distal root) type V, 3 (0.9%) was vertucci (mesial root) type V, 9 (2.7%) was vertucci (mesial root) type VI, 4 (1.2%) was vertucci (distal root) type VI, 0 (0.0%) was vertucci (mesial root) type VII, 2 (0.6%) was vertucci (distal root) type VII, 10 (0.3%) was vertucci (mesial root) type VIII, 0 (0.0%) was vertucci (distal root) type VIII. While in Taiwan’s Chinese population \[31\] which included 183 mandibular first molars, The majority of the sample 101(55%) was vertucci (mesial root) type IV, 99 (54%) had vertucci (distal root) type I, 6 (3%) was vertucci (mesial root) type I, 54 (30%) was vertucci (mesial root) type II, 23 (12%) was vertucci (distal root) type I, 5 (2%) was vertucci (mesial root) type III, 12 (7%) was vertucci (distal root) type III, 46 (25%) was vertucci (distal root) type IV, 3 (2%) was vertucci (distal root) type V, 3 (2%) was vertucci (mesial root) type V, 3 (2%) was vertucci (mesial root) type VI, 0 (0.0%) was vertucci (distal root) type VI, 1 (1%) was vertucci (mesial root) type VII, 0 (0.0%) was vertucci (distal root) type VII, 10 (5%) was vertucci (mesial root) type VIII, 0 (0.0%) was vertucci (distal root) type VIII.

Second molar

Number of canals: The mandibular second molar has been evaluated in 2 studies in this papers, \[11,19\] most of mandibular second molar was two roots 657 (89.63%), 62 (8.45%) of second molar was one root, and 14 (1.9%) was three roots. While in Turkish individuals, the most of the mandibular second molars (85.4%) had two separate roots, whereas 1.29% had one root. Thirty-two patients (3.45%) were detected to have a three-rooted and only eight molars had four roots. And in Iranian population, of 100 examined teeth, 6% had one root, 89% had two roots, 2% had three roots and 3% had C-shaped roots.

Number of root canals: In this paper, 589 (80.35%) of mandibular second molars reported three root canals, 46 (6.27%) was 2 root canals, and 40 (5.45%) was have four root canals, 58 (7.9%) of these teeth display other canals configuration. While in Turkish individuals, 72.8% of the mandibular second molars had three canals, 22.8% had two canals, and no had five canals. And in Iranian population, 3% had single canal, 6% two canals, 54% three canals, 34% four canals, whilst 3% had C-shaped roots.

Canal configuration: In this paper, the frequency of vertucci type IV 266 (39.4%) was the highest in mesial canals followed by vertucci type II 172 (25.5%). In contrast, vertucci type I was the most frequent type in the distal canals 646 (95.6%) and vertucci type IV was not detected in the distal canal. while in Turkish individuals, The most common were type IV (34.8% in female, 39.8% in male) and type II (36.4% in female, 35.4% in male). Of the distal roots, 94.4% (in females) and 95.8% (in males) had one canal. There were no teeth with three mesial or distal canals. In the three or four rooted molars, all disto-lingual roots (100%) possessed type I canal configuration. And in Iranian population, based on the vertucci classification, the most prevalent canal configuration in the mesial root was type II and in the distal root was type I.

Conclusion

The dentist should be familiar with the most prevalent root and root canal morphology in their area. This understanding is essential for a successful therapy. The data for this systematic study came from various locations of Saudi Arabia, and it comprised an investigation of 9682 mandibular teeth. The findings of this study’s Saudi population are comparable to those of worldwide morphological studies. Any morphological alterations that may occur in the anterior teeth were infrequent. On the other hand, the number of roots and canals in some teeth varied by a large amount.
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References


