

## NUMBER AND PATTERN OF ROOT CANALS IN MANDIBULAR INCISORS

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### ABSTRACT

*This descriptive study was conducted to study the variation in number and pattern of root canals in mandibular incisors in a sample of Pakistani population. A Sample of 100 teeth extracted due to periodontal or carious destruction was surveyed through labio-lingual and lateral periapical radiographs. Roots were then sectioned at 1, 2 and 3mm from apex at 20° angulation along the long axis of roots. Sections were observed under stereomicroscope and number and shapes of root canals were recorded. Both observations were combined to classify the root canal patterns according to Vertucci's Classification. Ninety one (91) roots canals were classified at Vertucci's type I. Eight teeth showed double root canals. Two roots had Type V and six had Type III canal configuration. Labio-lingual periapical radiographs were unable to detect the second root canals in any of the teeth with double canals. The need for conducting more research with advanced imaging techniques and larger sample size was highlighted in this study. The limitation of periapical radiographs in locating lingual canals in mandibular incisors was also observed.*

**Key Words:** Vertucci classification, mandibular incisor, root canal, retreatment endodontics.

### INTRODUCTION

The success of endodontic therapy depends upon complete debridement and disinfection of root canal system. Bio-chemo-mechanical root canal therapy is based on accessing all areas in a root canal with mechanical and chemical means. A prior knowledge of the root canal anatomy and its potential to exhibit variations decreases the chances of missing any area of root canal system during treatment.<sup>1</sup> Mandibular incisors are generally perceived as teeth with single root canals but various studies have pointed out the existence of a second lingual canal.<sup>2,3,4</sup> Inability to locate and disinfect this lingual canal is regarded as the reason of persistent periapical inflammation and a cause of failure of many root canal treatments in mandibular incisors. Once this canal was located during the endodontic retreatment of these teeth, resolution of symptoms occurred.<sup>5</sup> The incidence of mandibular incisor teeth with more than one canal has been reported

to range from 11.5% to 50%.<sup>6</sup> Benjamin and Dowson reported that 41% of mandibular central incisors had two root canals.<sup>7</sup> Vertucci classified root canal morphology into eight types and reported that the incidence of multiple canals in mandibular central incisors is up to 27%.<sup>8</sup> Highest incidence (63%) of a second canal in mandibular incisors has been reported in a study in Turkish population.<sup>9</sup> Fourteen additional root canal types were identified in this study. Nine out of these fourteen new canal types were seen in mandibular incisors. There are various case reports that suggest that the failure of root canal treatment in mandibular incisors can be because dentists do not anticipate the presence of a second canal in these teeth and as a result fail to locate and treat it.<sup>10</sup>

Variations in root canal anatomy have been reported among different populations. No published studies on anatomy of root canals in mandibular incisors is available. Our study was conducted to identify the pattern of root canal morphology in mandibular central incisors that were extracted in the Surgery Department of Lahore Medical and Dental College.

### METHODOLOGY

Ours was a descriptive study conducted on hundred extracted teeth with fully formed apices, belonging to patients of age group ten years and above. Immediately after extraction in Department of Oral and Maxillofacial Surgery, teeth were collected for the present study. Age and Gender of each patient was obtained from depart-

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ment record and noted in their respective proforma. Teeth with calcified canals, immature open apices, fractured roots, external root resorptions and broken down roots were discarded. Fresh extracted teeth were immersed in 5.25% NaOCl for 15 minutes. Remaining debris and calculus was removed with ultrasonic scaling and the teeth were dried. Teeth were mounted on the periapical X-ray films (Kodak intraoral E speed, size 2) in a labiolingual direction, which were then positioned parallel to the source with the help of a wooden stand. Object to X-ray distance was maintained at 16mm and films were exposed (70Kvp, 8ma with 3.2 sec exposure time). Teeth were removed from radiographic film and

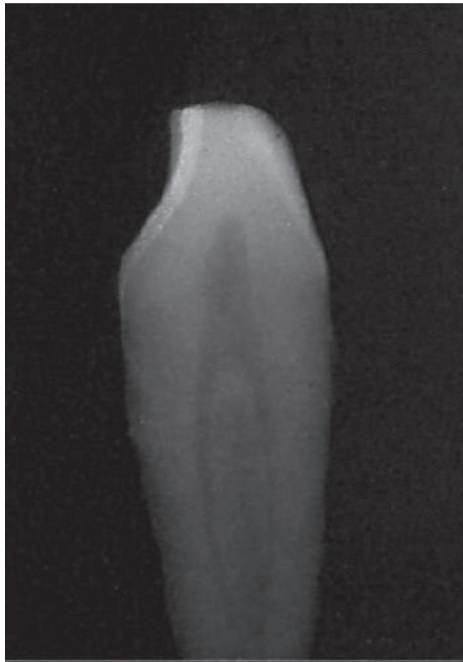


Fig 1: Lateral Periapical Radiograph showing a labial and a lingual root canal



Fig 2: Stereomicroscope image of a Root Section at 1 mm from apex, exhibiting single round root canal

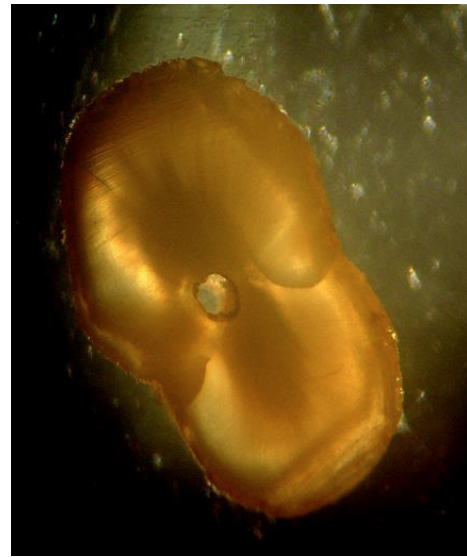


Fig 3: Stereomicroscope image of a Root Section at 2 mm from apex, exhibiting single round root canal



Fig 4: Stereomicroscope image of a Root Section at 3 mm from apex, exhibiting two root canal



Fig 5: Stereomicroscope image of a Root Section at 3 mm from apex, exhibiting single round root canal re-mounted in a mesio-distal direction. Film were again exposed keeping the object source distance at 16mm. All radiographs were developed, fixed and dried with the manual method and mounted on the hand held stand. Radiographs were evaluated by two consultants in the

TABLE 1: NUMBER OF ROOT CANALS SEEN IN STEREOMICROSCOPE

Stereomicroscope observation (B)	1 Canal		1 Canals		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1 mm from Apex B (i)	97	97.0%	3	3.0%	100	100.0%
2 mm from Apex B (ii)	91	91.0%	9	9.0%	100	100.0%
3 mm from Apex B (iii)	91	91.0%	9	9.0%	100	100.0%

TABLE 2: FINAL VERTUCCI'S CLASSIFICATION OF CANAL TYPES

Canal Classification	Frequency	Percentage
Type I	91	91.0
Type III	6	6.0
Type V	2	3.0
Total	100	100.0

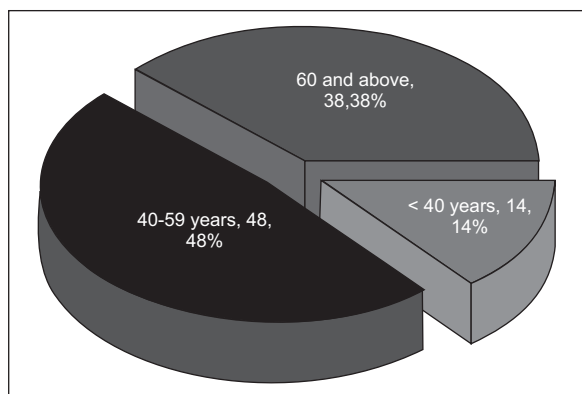


Fig 6: Age distribution of sample population

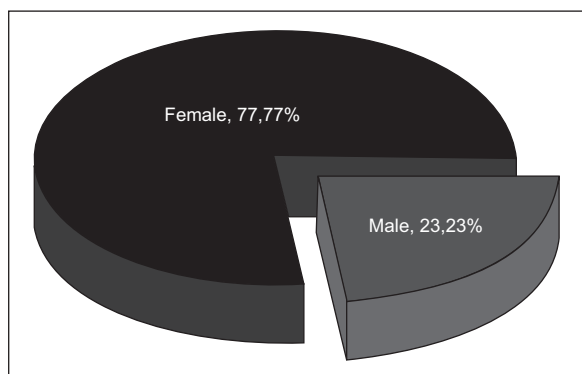


Fig 7: Gender distribution of sample population

Operative Department, with the help of a magnifying lens and an x-ray viewer. The number and pattern of root canals for both teeth was recorded in the proforma. Any difference in observation was referred to a third senior faculty member and his opinion was regarded as final. Each extracted tooth was then sectioned at 1mm, 2mm and 3mm from the apex by using stainless steel discs mounted with a mandrel on a micromotor hand piece. Angle of sections was kept 20° with the long axis of the root. Cut sections were placed in 5.25% sodium

hypochlorite for another 15 minutes to remove any organic debris. Canal openings were cleaned with an endodontic file no 10 to remove any tissue that may be blocking canals. Cross sections were viewed under a stereo microscope using a 16X10 magnification and a field size of 13mm. Number and shape of root canals was recorded. After combining the data of two radiographic and one stereomicroscopic observation, root canals were classified according to Vertucci's classification. Data was entered and analyzed using SPSS version 19.0. Descriptive statistics were used and frequencies of two root canals in mandibular incisors were calculated. P value 0.05 was considered to be of statistical significance.

**RESULTS**

One hundred mandibular incisors were included in the study. 91 had a Vertucci's type I classification. Out of the 91 Type I root canals, seventy belonged to male patients and only 21 belonged to female patients. Eight teeth showed double root canals. Out of those eight teeth two teeth had Type V and six teeth had Type III canal configuration. None of the double root canals could be identified in the labio-lingual periapical radiographs.

**DISCUSSION**

Root canal anatomy variations exist among populations. Number and pattern of root canals in mandibular central incisors was recorded in this study. Frequencies of root canals on labiolingual and mesiodistal radiograph were calculated as well as the number of root canals seen at three cross-sections at 1mm, 2mm and 3mm from the apex. Ninety-two teeth had Vertucci's type I canal morphology. This is in accordance with studies by Walker et al in Chinese population.<sup>11</sup> They found that 83% teeth included in their study had Type I canals. Greatest incidence of 42% two root canals was found by Rankine and Henry<sup>12</sup> whereas Benjamin and Dowsin<sup>7</sup> found that 40% of central incisors had double root canals. Most of the above mentioned studies were conducted in western populations. When same teeth were studied for double root canals in Asian populations only 4.16% of Iranian<sup>6</sup> and 4%<sup>13</sup> of Indian population samples had two root canals in these teeth thus stressing the idea that anatomy variations do exist in different



populations, however; Asian populations may have a lesser incidence of multiple root canals in mandibular incisors.

Type V is not a common canal type for mandibular incisors. None of the published studies described the existence of a Type V canal.<sup>14</sup> It was only the Iranian<sup>6</sup> population study that exhibited a Type V canals. Our study revealed that 3% of the sample teeth had Type V canal configuration which is in contrast to most of the studies conducted on these teeth. It was further found out in our study that, when periapical X-rays with conventional endodontic angulations were exposed none of the double root canals could be obvious but it was only the lateral view which could establish the existence of a second canal. True configurations of the canal were apparent only after the roots were sectioned horizontally. Most of the studies which revealed the canal configurations were conducted on extracted teeth. It makes the knowledge of root anatomy of teeth in a population more important so that the endodontist can begin treating the teeth with a better understanding of what to expect. New techniques like CBCT scan fairly depict root canal anatomy.

## CONCLUSION

Notwithstanding the limitations of this study it can be concluded that mandibular incisors with more than one root canals do exist in Pakistani population. The possibility of presence of additional root canals should be kept in mind when treating such teeth. Further studies with larger sample size are indicated. In case of a failed root canal treatment CBCT investigation should be considered to rule out a missed root canal. These studies will help Pakistani dentist establish a data base of various canal types found in our population.

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## CONTRIBUTION BY AUTHORS

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| <b>1 Fariha Naz:</b>               | Helped in article writing. |
| <b>2 Saima Razaq Khan Sadozai:</b> | Principal author.          |
| <b>3 Rafique Chatha:</b>           | Helped in discussion.      |