International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 05, 2020
ISSN: 1475-7192

Assessment of root canal morphology of mandibular central incisor in Indian population

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ABSTRACT

Background: *The root canal anatomy of each tooth has certain commonly occurring characteristics as well as numerous atypical ones. The present study was conducted to assess root canal morphology of mandibular central incisors.*

Materials & Methods: *The present invitro study was conducted on 60 extracted mandibular central incisors. Following this, biomechanical preparation was done and tooth sectioning was done. The samples were evaluated using a stereomicroscope under 10X magnification. The number of root canals, the type of canals based on Vertucci's classification.*

Results: *1 canal was seen in 45 (75%) and 2 in 15 (25%) samples. Type I canal was seen in 54%, type III in 35% and type V in 11%. The difference was significant (P< 0.05). The shape of canal at 1 mm was oval seen in 50%, round in 41%, long oval in 9%, at 2 mm, round in 17%, oval in 62%, long oval in 18% and ribbon in 3%, at 3 mm was round in 16%, oval in 42%, long oval in 27% and ribbon shaped in 15%. The difference was significant (P< 0.05).*

Conclusion: *Authors found that most common shape of the canal was oval seen at different levels and type was type I.*

Key words: *Mandibular central incisor, Morphology, Vertucci's*

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Received: 09 Jan 2020 | Revised: 18 Feb 2020 | Accepted: 29 Mar 2020

I. Introduction

The root canal anatomy of each tooth has certain commonly occurring characteristics as well as numerous atypical ones, understanding of which can be the road maps to successful endodontics.[1] The expected root canal anatomy dictates the location of the initial entry of access, it dictates the size of the first files used, and it contributes to a rational approach to solving the problems that arise during therapy.[2] Therefore, a thorough knowledge of the root canal anatomy from access to obturation is essential to give the highest possible chance for success. Current knowledge of pulp space anatomy is based on research findings and individual case reports. Many studies have examined the root canal systems of mandibular incisors.[3]

Several apical foramina, loops, C-shaped canals and accessory canals have been reported in teeth. Single-canal mandibular incisors have a wide range of prevalence in different populations due to anatomical variations.[4] Mandibular anterior teeth mainly have one root and one canal. A small percentage of these teeth may have two roots or two canals. One previous study reported the prevalence of two canals to be 7.6% for central and 4.17% for lateral incisors. Some other root canal morphologies have also been reported.[5] In one reported type, two separate canals extend from the pulp chamber to mid-root where the lingual canal branches into two canals. The three canals join in the apical third and ending one single apical foramen. In another type, one canal extends from the pulp chamber, divides into two canals in the middle third of the root and the two canals join to form one canal again. The canal branches again into three separate canals with distinct apical foramina.[6] The present study was conducted to assess root canal morphology of mandibular central incisors.

II. Materials & Methods

The present invitro study was conducted in the department of Endodontics. It comprised of 60 extracted mandibular central incisors. The study protocol was approved from institutional ethical committee.

In each teeth access cavity preparation was done and canal orifices were located with 10 K-file. Following this, biomechanical preparation was done and tooth sectioning was done. The samples were evaluated using a stereomicroscope under 10X magnification. The number of root canals, the type of canals based on Vertucci's classification which was as follows: Type I: One single canal extending from the pulp chamber; Type II: Two separate canals extend from the pulp chamber and merge into one canal before reaching the apex; Type III: One canal extends from the pulp chamber and branches into two canals, which later merge at the apical foramen; Type IV: Two separate canals extend from the pulp chamber to the apex; Type V: One canal leaves the pulp chamber and divides into two separate canals with distinct apical foramina; Type VI: Two separate canals leave the pulp chamber, merge at the mid-root and then branch again into two separate canals; Type VII: One canal leaves the pulp chamber and branches into two canals, which merge again at the mid-root and then branch again into two separate canals at the apex; Type VIII: Three distinct canals leave the pulp chamber and extend to the apex.

Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

Received: 09 Jan 2020 | Revised: 18 Feb 2020 | Accepted: 29 Mar 2020

III. Results

Table I Number of canal in mandibular central incisors

Number of canal	Number	Percentage
1	45	75
2	15	25

Table I shows that 1 canal was seen in 45 (75%) and 2 in 15 (25%) samples.

Table II Type of canals in mandibular central incisors

Type	Percentage	P value
Type I	54%	0.001
Type II	0	
Type III	35%	
Type IV	0	
Type V	11%	
Type VI	0	
Type VII	0	
Type VIII	0	

Table II, graph I shows that type I canal was seen in 54%, type III in 35% and type V in 11%. The difference was significant ($P< 0.05$).

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Graph I Type of canals in mandibular central incisors

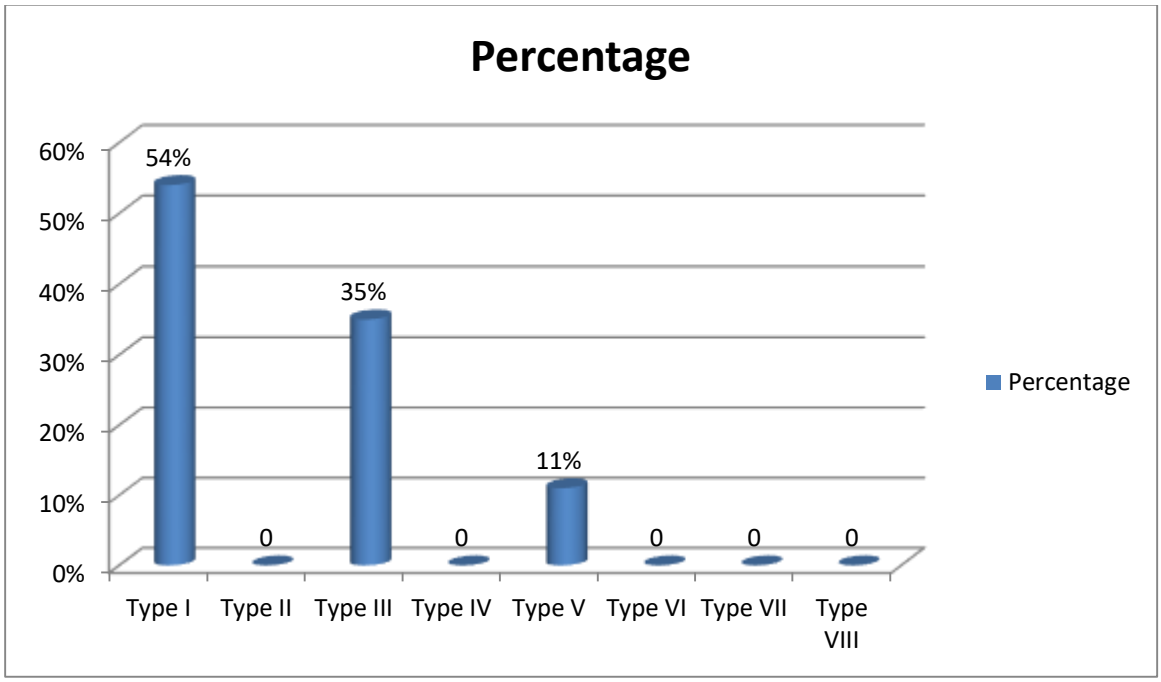

Table III Different shape of the canals at different sections of the root

Shape	At 1 mm	At 2mm	At 3 mm	P value
Round	41%	17%	16%	0.02
Oval	50%	62%	42%	
Long Oval	9%	18%	27%	
Ribbon shape	0%	3%	15%	

Table III shows that shape of canal at 1 mm was oval seen in 50%, round in 41%, long oval in 9%, at 2 mm, round in 17%, oval in 62%, long oval in 18% and ribbon in 3%, at 3 mm was round in 16%, oval in 42%, long oval in 27% and ribbon shaped in 15%. The difference was significant (P< 0.05).

IV. Discussion

A variety of techniques have been used to study root canal morphology including radiographic examination, root sectioning, and staining and clearing techniques.[7] It has been reported that fine details of the root

canal system can be visualized by staining and clearing and this method. The literature on mandibular incisors reveals that 11 to 68% of mandibular incisors possess two canals, although many merge into one canal in the apical 1 to 3 mm of the root.[8] The present study was conducted to assess root canal morphology of mandibular central incisors.

In present study we found that the present study was conducted to assess root canal morphology of mandibular central incisors. Bhat et al[9] evaluated the root canal anatomy and its aberrant morphology in mandibular central incisors. One hundred and twenty extracted human mandibular central incisor teeth were collected. Two different studies have been performed. Sixty teeth were studied through tooth clearing and dye penetration technique. Teeth were decalcified with 5% nitric acid, dehydrated with increasing concentrations of alcohol and rendered clear by immersion in methyl salicylate. Hematoxylin dye was inserted in access cavity and canals. The samples were observed under dental operating microscope. These samples were evaluated for root canal morphology to assess its root canal configuration. Sixty teeth were studied through sectioning of apical 3 mm (1, 2, and 3 mm from the apex) simulating a surgical resection method was followed. The sectioned samples were observed under stereomicroscope for evaluating isthmus and its type.

We found that type I canal was seen in 54%, type III in 35% and type V in 11%. Saati et al[10] examined the root morphology and number of canals in mandibular incisors using cone beam computed tomography (CBCT). Two hundred and seven patients were assessed in terms of their mandibular central and lateral incisors of CBCT. The inclusion criteria were absence of root resorption, coronal restoration or root filling and clarity and optimal resolution of images. According to the Vertucci's classification, number of roots and canals and type of canal were evaluated by two oral and maxillofacial radiologists. All mandibular incisors had one root. Most central (84.5%) and lateral (78.2%) incisors had a single canal (p= 0.065). The majority of central (54.5%) and lateral (56.5%) incisors were Vertucci's type I (p= 0.102). Prevalence of one canal in males: central (84.8%), lateral (77.9%) and in females: central (84.2%), lateral (78.5%) (p= 0.518). Prevalence of Vertucci's type I in males: central (52.3%), lateral (45.3%) and in females: central (56.1%), lateral (64.4%) (p=0.188). The prevalence of two canals was 15.5% (central) and 21.8% (lateral) in mandibular incisors. The Vertucci's type I was the most typical kinds of mandibular incisors.

We found that shape of canal at 1 mm was oval seen in 50%, round in 41%, long oval in 9%, at 2 mm, round in 17%, oval in 62%, long oval in 18% and ribbon in 3%, at 3 mm was round in 16%, oval in 42%, long oval in 27% and ribbon shaped in 15%. Rankine–Wilson and Henry[11] filled the root canals of mandibular anterior teeth with radiopaque material, sectioned them in a horizontal plane, and exposed radiographs. They reported two canals in 40.5% of mandibular incisors.

Mauger et al[12] evaluated the canal morphology at different root levels in 100 mandibular incisors and reported that 98 to 100% of the teeth had one canal in the area 1 to 3 mm from the apex.

Thus, a clear knowledge of the anatomy of root canal systems is an essential prerequisite to carrying out root canal preparation.

V. Conclusion

Authors found that most common shape of the canal was oval seen at different levels and type was type I.

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Received: 09 Jan 2020 | Revised: 18 Feb 2020 | Accepted: 29 Mar 2020