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ORIGINAL RESEARCH

Study of Pulp Chamber Morphology of Primary Mandibular Molars using Spiral Computed Tomography

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ABSTRACT

Aim: The purpose of this study was to evaluate the pulp chamber morphology in primary mandibular molars using spiral computed tomography (SCT).

Materials and methods: Sixty extracted primary mandibular molars were scanned using SCT for the (i) distance between the central fissure to furcation, (ii) distance between the central fissure to the floor of the pulp chamber, (iii) height of the pulp chamber (roof-floor), (iv) distance between the floor of the pulp chamber to the furcation. The mean and standard deviation was analyzed using statistical package for the social sciences (SPSS) program.

Results: The results of this study show that the average mean distance from the central fissure to the floor of the pulp chamber is 5.07 mm in first mandibular primary molar and 5.54 mm in second mandibular primary molar.

Conclusion: It can be concluded that the greatest depth to which a bur can go during access opening without perforating the furcation in first primary mandibular molar is 5.07 mm and 5.54 mm in second primary mandibular molar.

Keywords: Furcation, Perforation, Primary mandibular molars, Pulp chamber, Spiral computed tomography.

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INTRODUCTION

The study of root canal morphology is exotic and difficult to classify. The relative simplicity and uniformity of the external surfaces of the roots often masks their internal complexity.[1] Primary teeth exhibit anatomical differences from permanent teeth in terms of size, external and internal morphology. In comparison with permanent teeth, the relatively thin layer of hard mineralized tissue between the external and internal surface leads to rapid involvement of the dental pulp by advancing caries.[2]

One of the complications of pulpectomy is perforating the furcation while gaining access to the pulp chamber of primary molars. The outcome of perforation repair is not a highly predictable procedure. Access preparations are performed by a qualitative method involving the clinician's tactile perception and knowledge of dental anatomy.[3]

Earlier studies have investigated the morphology of teeth using different techniques, including radiography, computed tomography and clearing.[4] As an alternative and refined technique, we made three dimensional observations on the morphology of primary molars using spiral computed tomography scan, which allows the observation of the morphology of the root canals, roots, the appearance of the tooth in every direction and also permits its three-dimensional reconstruction.[5]

A search of literature reveals study on pulp chamber morphology of permanent bicuspids and molars, but lack of studies on pulp chamber morphology of primary molar. It has been reported that root canal morphology varies according to the race.[6] The morphologic measurement of pulp chamber of primary mandibular molar in an Indian population has never been reported. Therefore, the aim of the study was to evaluate the pulp chamber morphology in primary mandibular molars using spiral computed tomography (SCT) in an Indian population.

MATERIALS AND METHODS

A total of 60 extracted human primary mandibular molars were collected and divided into two groups. Group I- 30 mandibular first primary molar, group II- 30 mandibular second primary molar. The extracted teeth were collected from children aged between 9 and 12 years. Mandibular molars included in this study were clinically mobile and

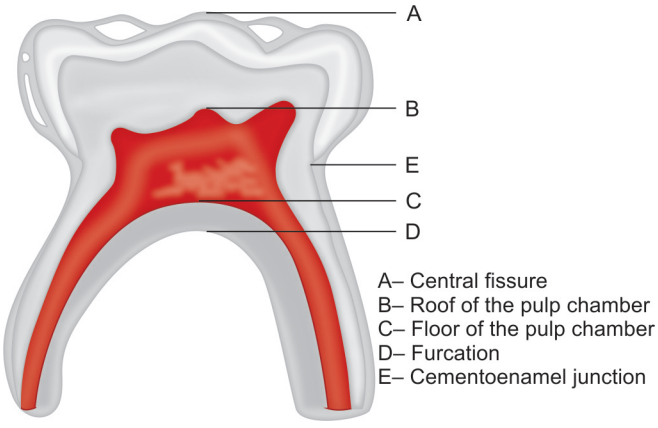


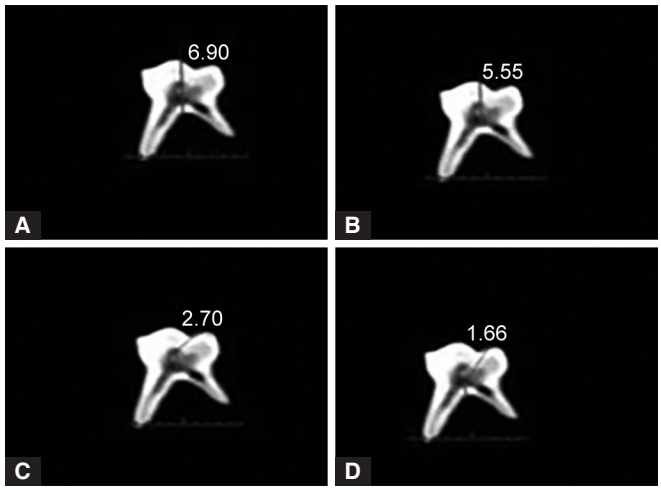
Fig. 1: Diagram showing the reference points taken to determine the pulp chamber

showed root resorption with presence of succedaneous permanent tooth on radiography. Teeth that were badly broken, pulpectomy treated tooth, or restored were excluded. The samples were stored in 10% formalin. Ultrasonic scalers were used to remove any soft tissues present on the root surfaces.

Scanning Method

The teeth were placed horizontally on a modeling wax sheet and scanned using a Light Speed Plus CT scanner (GE Electricals, Milwaukee, USA). Samples were then analyzed both cross-sectionally and longitudinally with a constant thickness of 0.65 mm/slice and a constant spiral speed of 0.75 and 120 KVP. The records were then moved to an Advantage windows workstation (GE Systems, Milwaukee, WI) image analysis and evaluated for the distance between the central fissure to furcation, the distance between the central fissure to the floor of the pulp chamber, height of the pulp chamber (Roof-floor), distance between the floor of the pulp chamber to the furcation (Fig. 1).

The centermost CT scan slice of each tooth in the longitudinal section was taken and all the measurements were taken from the central fissure for measuring pulp chamber morphology.[5]



Figs 2A to D: Longitudinal sectional SCT view of mandibular first primary molar showing the measurements: (A) central fissure to furcation, (B) central fissure to floor of the pulp chamber, (C) height of the pulp chamber and (D) floor of the pulp chamber to furcation

STATISTICAL ANALYSIS

The mean and standard deviation of pulp chamber measurement was statistical analyzed using SPSS program. Percentage of variance (% variance = standard deviation divided by mean) was calculated for all the measurements.

RESULTS

Morphological Measurement of Pulp Chamber

The descriptive statistics of the pulp chamber measurements for primary first mandibular molar are shown in (Table 1). The mean distance between the central fissure to furcation was 6.93 mm and the average distance between the central fissure to the floor of the pulp chamber was 5.07 mm (Fig. 2).

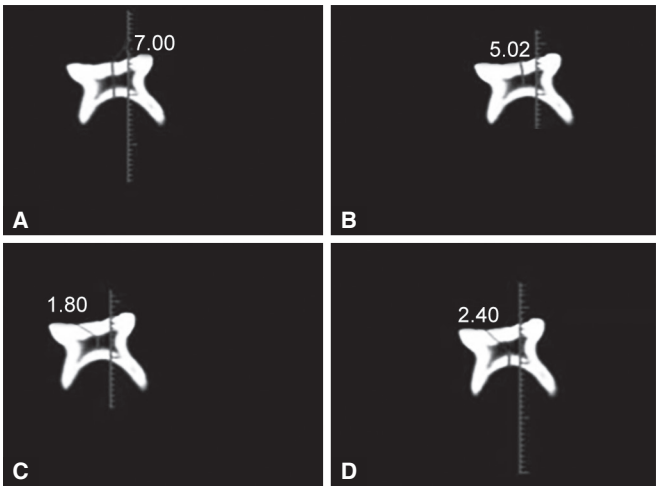
The descriptive statistics of the pulp chamber measurements for primary second mandibular molar are shown in Table 2. The mean distance between the central fissure to furcation was 7.26 mm and the average distance between

Table 1: Mean (mm) measurements for mandibular first primary molar

n = 30	*Distance between the central fissure to furcation*	*Distance between the central fissure to floor of the pulp chamber*	*Height of pulp chamber (roof-floor)*	*Distance between the floor of the pulp chamber to the furcation*
Mean	6.93 (12.5%)	5.07 (37.5%)	1.46 (42.5%)	1.98 (50%)
Standard deviation	0.32	0.76	0.41	0.33
% Variance	4.61	14.99	28.08	16.66

Table 2: Mean (mm) measurements for mandibular second primary molar

n = 30	*Distance between the central fissure to furcation*	*Distance between the central fissure to floor of the pulp chamber*	*Height of pulp chamber (roof-floor)*	*Distance between the floor of the pulp chamber to the furcation*
Mean	7.26 (25%)	5.54 (52.17%)	1.72 (23.25%)	1.88 (18.60%)
Standard deviation	0.51	0.43	0.64	0.60
% Variance	7.02	7.76	37.20	31.91



Figs 3A to D: Longitudinal sectional SCT view of mandibular second primary molar showing the measurements: (A) central fissure to furcation, (B) central fissure to floor of the pulp chamber, (C) height of the pulp chamber and (D) floor of the pulp chamber to furcation

the central fissure to the floor of the pulp chamber was 5.54 mm (Fig. 3).

DISCUSSION

The cavity situated inside the crown portion of a tooth, containing pulp tissue is termed pulp chamber. The key for easy locating of the orifice is to have correct knowledge of the morphology as well as the location of the pulp chamber in relation to the external crown form.[7]

In deciduous tooth the pulp chamber takes up a larger volume of the crown and the enamel is thinner compared to the permanent tooth.[8] A proper access cavity preparation is the first objective procedure done on an endodontically compromised tooth. In primary teeth the furcation is more toward the cervical area so that root trunk is smaller.[9] The incidence of perforation is more common in primary than permanent because of its morphology. Such fault can be avoided if the pulp chamber morphology is understood.

Different methods have been used to investigate the pulp chamber using radiographs and sliced specimens. The radiographs produce only two-dimensional image of three dimensional objects and can lead to superimposition.[10] The sliced specimen technique is destructive and causes material loss in preparation; it is difficult to achieve the accurate morphological measurements. The tooth is composed of unique tissues with distinct radiographic densities and it lends itself to assessment by tomographic techniques. CT is a nondestructive method, which allows for observation and analysis from any angle.[11] Hence in our study we used spiral computed tomography for evaluating pulp chamber.

In our study, the mean distance between the central fissure to furcation was found to be 6.93 mm in first primary mandibular molars, 7.26 mm in second primary mandibular molars. The average mean distance from the central fissure to the floor of the pulp chamber is 5.07 mm in first mandibular primary molar and 5.54 mm in second mandibular primary molar. Vijayakumar et al calculated the average distance between the central fissure to the floor in primary maxillary molars and reported it is 5.02 mm in first maxillary molar and 5.32 mm in second maxillary molar.[12] Edwin et al[13] observed that both primary first and second mandibular molars had small variations in root canal anatomy.

Endodontic treatments of permanent teeth are well described in the literature; little is known about the pulp chamber measurements of the mandibular primary molars. The main concern in primary teeth is any change in the pulp chamber morphology due to physiological resorption process. Ernot et al[14] reported pulp chamber status not altered due to resorption process, odontoclasts are usually found inside the pulp until root resorption is close to completion and not before the resorption level has reached approximately below cementoenamel junction. Hence, the reported measurements in our study give us a guideline for a quantitative approach to endodontic molar access of primary mandibular molars.

CONCLUSION

From our study, reported pulp chamber measurements give us a significant clinical finding for developing an access method without perforation in an Indian population. This knowledge of pulp chamber morphology should be incorporated with an evaluation of preoperative radiographs and intraoperative tactile perception during endodontic access preparations.

CLINICAL SIGNIFICANCE

Affixing a mark on a bur 5 mm from the cutting tip will facilitate the dentist to drill into the middle of the pulp chamber of primary mandibular molars without fear of perforation. Knowing this landmark will clinically enable the clinicians to find the floor and hence the canals more easily with much less chance of perforation into the furcation.

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REFERENCES

1. Gulabivala K, Aung TH, Alavi A, Y-L NG. Root and canal morphology of Burmese mandibular molars. Int Endod J 2001;34(5):359-370.
2. Aminabadi AN, Ramin Farahani RMZ, Esrafil Gajan B. Study of root canal accessibility in human primary molars. J Oral Sci 2008;50(1):69-74.

3. Deutsch SA, Musikant BL. Morphological measurements of anatomic landmarks in human maxillary and mandibular molar pulp chambers. J Endod 2004;30(6):388-390.
4. Bagherian A, Kalhori KAM, Sadeghi M, Mirhosseini F, Parisay I. An in vitro study of root and canal morphology of human deciduous molars in an Iranian population. J Oral Sci 2010;52(3):397-403.
5. Reuben J, Velmurugan N, Kandaswamy D. The evaluation of root canal morphology of the mandibular first molar in an indian population using spiral computed tomography scan: an in vitro study. J Endod 2008;34(2):212-215.
6. Sert S, Bayirli GS. Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. J Endod 2004;30(6):391-398.
7. Daniel JG. Advanced endodontics for clinicians: applied tooth morphology. J and J Publishers; 1998. p. 40.
8. Ash MM, Nelson SJ. Wheelers dental anatomy, physiology and occlusion. 8th ed. Philadelphia: Elsevier Science; 2003.
9. Tandon S. Textbook of Pedodontics. 2nd ed. Paras Medical Publisher. p. 305.
10. Robinson S, Czerny C, Gahleitner A, Bernhert T, Kainberger FM. Dental CT evaluation of mandibular first premolar root configurations and canal variations. Oral Surg Oral Med Oral Path Oral Radiol Endod 2002;93(3):328-332.
11. Nielsen BR, Alyassin AM, Peters DD, Carners DL, Lancester J. Micro-computed tomography: an advanced system for detailed endodontic. J Endod 1995;21(11):561-568.
12. Vijayakumar R, Selvakumar H, Swaminathan K, Thomas E, Ganesh R, Palanimuthu S. Root canal morphology of human primary maxillary molars in Indian population using spiral computed tomography scan: an in vitro study. SRM J Res Dent Sci 2013;4(4):139-142.
13. Edwin D, Hibbard, Ralph L. Morphology of root canal of the primary molar teeth. J Dental Child 1957;24:250-257.
14. Ernot C, Ernot N, Aktug M. Histological investigation of physiological resorbing primary teeth using Ag-NoR staining method. Int J Paediatr Dent 2002;12(3):207-214.