

Root Canal Morphology of Mandibular First Premolars of Bangladeshi Population

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ABSTRACT

Background: The presence of a single root canal in mandibular first premolar cannot be assumed always. The variability in canal morphology of root canal includes the number & shape of the canal as well as pathways of the canals. **Methods:** In this study, 100 mandibular first premolar teeth were evaluated by clearing technique. Collected teeth were cleaned and merged with 5.25% NaOCl for 48 hours. Then the teeth were decalcified with 5% nitric acid for 72 hours followed by dehydrated sequentially with 80-100% alcohol. After dehydration, Indian Ink was injected into the canal through the previously prepared access cavity. Finally the teeth were made transparent by 98% methylsalicylate and examined. **Results:** Out of 100 mandibular first premolar teeth, 89 were single rooted, 10 with double rooted and only 1 was triple. On evaluation of canal configuration according to Weine classification, mandibular first premolars had 64% type I, 5% type II, 22% type III and 9% type IV. Apical delta was found in case of 8% mandibular first premolar tooth. **Conclusion:** Based on this study, mandibular first premolar teeth of Bangladeshi population have multiple roots and canals and variable canal configurations.

Introduction

The presence of a simple canal cannot be assumed always. The variability in canal configuration of the root canal system includes the number, shape and pathways of the canals. The epithelial sheath of Hertwig is disrupted or folded, supernumerary roots and accessory root canals may be formed during dental development.¹ The objective of endodontic therapy is the restoration of the treated tooth to its proper form and function in the masticatory apparatus in a healthy state. Variations in canal geometry before shaping and cleaning procedures have more influence on the changes that occur during preparation than the

instrumentation techniques themselves.² A study show untreated canal space was present in 42% cases where endodontic retreatment is needed.³ The most recent studies demonstrating anatomic complexities of the root canal system, it has long been established that a root with a tapering canal and a single foramen is the exception rather than the rule.⁴

Among the human permanent dentition, the mandibular premolars may present the greatest difficulty of all teeth to perform successful endodontic treatment.⁵ Also the most variable canal pattern was reported in case of this tooth.⁶ The mandibular first premolar is typically of a

single-rooted tooth,⁷ Two-rooted, three-rooted and four-rooted varieties have also been reported.⁸ Furthermore, the root canal system of the mandibular first premolar is wider buccolingually than mesiodistally. Two pulp horns are present: a large, pointed buccal horn and a small, rounded lingual horn. At the cervical line the root and canal are oval; this shape tends to become round as the canal approaches the middle of the root. If two canals are present; they tend to be round from the pulp chamber to their foramen. In another anatomic variation, a single, broad root canal may bifurcate into two separate root canals. All races and ethnic groups have some degree of dental anatomic variations. Asian populations present one of the widest variations in coronal shape, external root form and internal canal space morphology.⁹

The methods most commonly used in analyzing the root canal morphology are canal staining and tooth clearing, conventional radiographs, digital and contrast medium-enhanced radiographic techniques, radiographic assessment enhanced with contrast media and more recently computed tomographic techniques. In this study, the root and canal numbers, presence or absence of apical delta and canal configuration of mandibular first premolar teeth of Bangladeshi population was evaluated by using canal staining and tooth clearing method.

Materials & Methods

For this in-vitro study, 100 Mandibular first premolar teeth which were extracted for orthodontic treatment at different government and private hospital were collected in 10% formal saline solution. The inclusion criteria were teeth with mature root apex irrespective of age and sex. The exclusion criteria were teeth with open apex, complicated fracture and external root resorption communicating with root canal or grossly damaged teeth where there was chance of procedural error. Then the teeth were bleached with 5.25% sodium hypochlorite solution for 1 hour, after which any remaining soft tissue or calculus were removed by scaling. Then access cavity was prepared for each tooth and the teeth were placed into 5.25% solution of

sodium hypochlorite for 2 days to remove organic tissues from the canal. The old solution was changed with a fresh one at every 24 hours to preserve its activity. Then the teeth were rinsed with running tap water for 4 hours.

The next step was teeth decalcification with 5% nitric acid for 3 days and every 24 hour the old solution was replaced with the fresh solution. Then the teeth were rinsed again with running tap water for 4 hours. Then the dehydration process was done sequentially by 80% alcohol for 24 hours, 90% alcohol for 1 hour and 100% alcohol for 1hour respectively. After drying, Indian ink was injected through the access cavities. After 12 hours, the teeth were emerged into 98% methylsalicylate for 24 hours for clearing purpose. Then the ink dyed root canal systems were evaluated based on Weine's classification.¹⁰

Result

100 Mandibular first premolar teeth were evaluated for number of root and canal, apical delta and canal configurations. The results regarding root and canal number and apical delta has shown in Table 1. Canal configurations of mandibular first premolars have listed in Figure 1. Statistical analysis was done by two proportion Z test where P value was significant at <0.05 at 95% confidence level.

Table 1: Root and canal morphology of mandibular first premolar teeth

n	Number of root			Number of canal				AD
	1	2	3	1	2	3	>3	
100	89	10	1	64	32	3	1	8

n : Number of Teeth

AD: Apical Delta

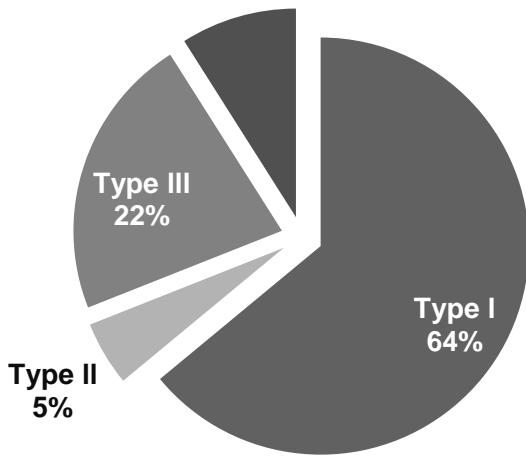


Figure 1: Pie chart shows the types of canal configuration of mandibular first premolar teeth



Figure 2: Canal configuration (Weine's) of mandibular first premolar

Discussion

Radiograph is commonly evaluated for canal evaluation before endodontic treatment. But canal diversion or sudden disappearance of radiolucent canal could not be observed always on the radiograph.¹¹ Many previous studies indicated several methods such as cross section^{12,13} radiography¹⁴ direct observation with microscope¹⁵ decalcification and clearing,^{9,15-20} 3D reconstruction,²¹ computed tomography,^{22,23} for the assessment of root canal configuration. Among them the clearing technique is considered as one of the most effective method for the investigations of canals, shape and courses of the canals in three dimensional views.

The newer and most effective method is the modified canal staining and clearing technique.²⁴

Weine¹⁰ categorized the root canal systems in any root into four simple and directly clinically oriented classifications. Vertucci²⁵ utilizing cleared teeth which had their pulp cavities stained with hematoxylin dye & found a much more complex canal system and identified eight pulp space configurations. In the present study, Among 100 mandibular first premolar teeth; regarding number of root, 89% were single, 10% were double and only 1 were triple; however number of root is variable among the previous studies. In vivo studies, single rooted mandibular first premolar had found 95.5%²⁶ and 85%.²⁷ In vitro studies; 100% single rooted mandibular first premolar have found in some studies^{16,28,29} whereas another study found 90.6% with single root, 6.4% with 2 root, and 2.8% with more than two roots.⁸ Two rooted first mandibular premolar was found 16.2% in African American and 5.5% Caucasian population in vivo study by taking radiograph.³⁰

Regarding canal number and configuration of this study, only 64% teeth has single canal whereas remaining 36% teeth have more than one canal that is type II –IV. Studies regarding mandibular first premolar indicate high percentage of more than single canal.^{8,11,16,17,27-30} The results of those studies show more or less similar to the result of this study regarding single canal of mandibular first premolar tooth. But this study have shown more frequent type III canal configuration (22%) where other studis showed more number of type IV canal than type III. Regarding apical delta, this study has shown 8% apical delt Postmorterm ovarian changes in Bangladesh reported differe 6%¹³ apical de premolar teeth.

Based on this study together with the previous, canal configuration of mandibular first premolar teeth may be related to race or population of different countries. There is variation in related to number of root among African and Caucasian.³⁰ Also there are some variation about number of root and canal of mandibular premolar among the Asian countries.^{9,11,17,20,26,31,32}

Vertucci³³ described some factors regarding endodontic procedure and root canal morphology. When there is only one canal that is in case of type I, it is usually located in the center of the access preparation. If oval in shape must be thoroughly explored with apically precurved small K file to determine if more than one canal is present. If two separate orifice are closer to each other, the greater the chance that two canals join at some point within the body of the root that is type II Weine's configuration. When one canal separates into two (Type IV Weine's configuration), the division is buccal and lingual with the lingual canal generally splitting from the main canal at a sharp angle. Slowey⁵ recommends that type of canal configuration as a lower case 'h' letter and this necessitates a modification in access toward the lingual in order to achieve unobstructed passage of instruments into lingual canal. In this study, any anatomical structure that branched off from the main canal more than 3 mm from the apex was considered as another main canal.

Conclusion

Based on the present study, it can be concluded that mandibular first premolar teeth of Bangladeshi population have multiple roots and canals as well as variable canal configurations.

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