CASE REPORT
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Variations in Root Morphology of Primary Mandibular First Molars: A Review And Report of two Rare Cases

Mehrsa Paryab [a], Mahsa Mahlegha[b]

[a]Department of Paediatric Dentistry, School of dentistry, Tehran University of Medical Sciences, Tehran, Iran.
[b]Dentist, School of Dentistry, International campus, Tehran University of Medical Sciences, Tehran, Iran.

***Correspondence to Mehrsa Paryab, Email:** m-paryab@tums.ac.ir

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Abstract:

Knowledge about the anatomy and number of roots is imperative for pulp therapy of primary teeth due to the possibility of anatomical variations in morphology or number of roots. The primary mandibular first molars usually have two mesial and distal roots. This study is a simple review of the available literature regarding the root variations of primary teeth and reports two cases of single-rooted and three-rooted primary mandibular first molars to aid dental clinicians in management of such anatomical variations. Treatment was conducted for a primary mandibular first molar with an abnormal root anatomy in the form of presence of one root and one canal in a 5-year-old girl and for a primary mandibular first molar with three separate roots including one lingual root and two buccal roots in a 3-year-old boy. Primary teeth may have anatomical variations, which necessitate precise clinical and radiographic examinations before their pulp therapy to select the best treatment option for them.

Keywords: Molar; Deciduous; Dentition; Tooth Root

Introduction

Dental caries still has a high prevalence worldwide, and the main goal of dental treatments in children is to preserve the primary teeth until the time of eruption of permanent successors to prevent complications such as impaired mastication or dental arch space loss. Due to the fast progression of caries and tooth destruction in primary teeth, many carious primary teeth require pulp therapy. Comprehensive knowledge about the morphology of the pulp chamber and roots is imperative for successful pulp treatment. Studies have assessed the root canal morphology of primary teeth using different methods such as in vitro digital radiography[1], three-dimensional model by dye injection into the root canals, cross-sectioning and clearing techniques[2], and clinical conventional radiography[3]. More recent modalities such as micro-CT provide more precise information about the root canals[4].

Precise micro-CT assessments have revealed numerous variations in root canal morphology of primary teeth due to secondary dentin deposition in root canals and ramifications. Also, the number of canals in cervical part of the root may be different from that in the apical part. For instance, branching of the canals can result in presence of two canals in the cervical region and five canals in the apical region. Due to high variations in branching of primary root canals, the currently available tooth classification systems[4] may not be able to cover all the available anatomical forms of primary root canals.

Aside from the variations in root canal morphology, different numbers of canals and roots may be found in primary teeth. Presence of three canals in one root[5], single-rooted primary maxillary and mandibular first molars[6], three-rooted primary mandibular molars[7], primary molars with taurodontism[8], maxillary molars with fusion of the distobuccal and palatal roots[4], presence of an additional mesiobuccal canal[9], presence of two palatal roots[3], and primary canine teeth with two or three roots[10] have been reported in the literature, although sparsely.

This study aimed to review the available literature regarding the root canal anatomical variations of primary teeth and to report two patients with single-rooted and three-rooted primary mandibular first molars to aid dental clinicians in management of such anatomical variations.

Case

A thorough electronic search was performed using PubMed and Google Scholar. MeSH terms search using keywords and their combinations “Molar, Deciduous, Dentition; Tooth Root” was performed. Additionally, a hand search was made by screening reference lists of relevant articles, reviews, and systematic reviews to identify additional sources.

Case reports:

Case 1: A 5-year-old girl was presented to the dental clinic of Tehran University of Medical Sciences, Tehran, Iran in October 2024 for dental treatment with a non-remarkable medical history and no systemic disease, syndrome, or congenital disease. Clinical observation revealed no sign/symptom in her skin, hair, nails, or extremities.

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Clinical oral examination revealed proximal caries in maxillary and mandibular primary molars. A panoramic radiograph was obtained, and after clinical and radiographic evaluation, the treatment plan was suggested, which included pulp therapy and stainless-steel crown for carious primary molars. More precise assessment of the roots revealed no evidence of inflammatory root resorption or periapical radiolucency. However, the primary right mandibular first molar appeared to have an abnormal root canal anatomy in the form of presence of one root and one canal (Figure 1A. Note: informed consent was obtained from the parents to publish their child's photos or radiographs anonymously).

During the treatment session by a pediatric dentistry specialist, local anesthesia was administered, and access cavity was prepared. Considering the presence of one large orifice and abnormal root canal anatomy, it was decided to perform pulpectomy (similar to single-rooted primary teeth). A periapical radiograph was obtained with one gutta-percha point in the canal to ensure the absence of any accessory canals or resorptions (Figure 1A). The working length was determined followed by root canal cleaning using H files. The root canal was subsequently filled with zinc oxide eugenol paste due to its high durability. The pulp chamber was sealed with reinforced zinc oxide eugenol paste, and the tooth crown was restored with a stainless-steel crown (Figure 1B). At the one-year follow-up, the requested panoramic radiograph (Figure 1C) revealed no evidence of inflammatory or infectious root resorption.

The primary left first molar was caries-free. However, its clinical and radiographic examination at the follow-up session revealed the possibility of ankylosis. The parents were informed about the necessity of follow-ups to evaluate the trend of eruption of permanent successors and monitor the resorption of zinc oxide eugenol paste in the primary right first molar, and possible risk of ankylosis in the primary left first molar.

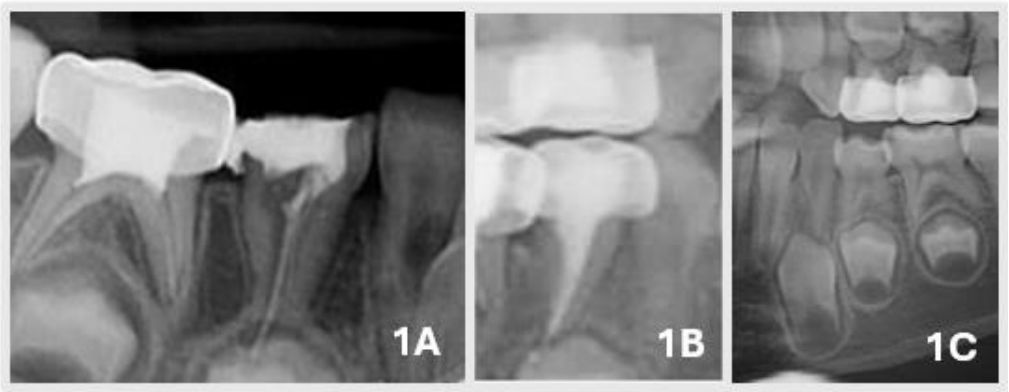

Figure 1: First periapical radiography to determine the root canal length (1A), One year follow-up radiograph (1B), Ankylosis was determined in submerged left mandibular primary first molar (1C).

Case 2: A 3-year-old boy was referred to the dental clinic of Tehran University of Medical Sciences in April 2024 for dental treatment. He had no remarkable medical history, systemic and congenital diseases, or syndrome. Clinical examination revealed carious primary anterior teeth and primary first molars in both the maxilla and mandible. Posterior Periapical Radiographs were prescribed, but the child didn't cooperate. Therefore, a panoramic radiograph was requested (Figure 2A. Note: informed consent was obtained from the parents to publish their child's photos or radiographs anonymously). According to clinical and radiographic examinations, the suggested treatment plan included pulp therapy and stainless-steel crown for carious primary first molars. The primary right mandibular first molar was detected to have an abnormal anatomy in the form of presence of three separate roots including one lingual root and two buccal roots. Due to the young age and lack of cooperation of the child, treatment was performed under general anesthesia. More precise assessment of the roots revealed no evidence of inflammatory root resorption or periapical radiolucency according to an extra Periapical radiograph under General anesthesia (Figure 2A). During the treatment session by the pediatric dentistry specialist, access cavity was prepared, coronal pulp tissue was removed, and pulp chamber was rinsed with saline. After achieving hemostasis (Figure 2B), MTA paste was applied over the pulp tissue at the canal orifice. Next, the pulp chamber was filled with reinforced zinc oxide eugenol paste, and the tooth crown was restored with a stainless-steel crown. In agreement with the root canal anatomy that mimicked that of maxillary molars in terms of number and direction of the roots, the tooth crown was also similar to that of maxillary molars due to lower mesiodistal width, having a triangular shape, and having a more prominent buccal bulge. Therefore, the contralateral maxillary stainless-steel crown (Upper left size 7) was selected for the tooth (Figure 2C). The tooth was clinically asymptomatic at the 6-month follow-up.

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Figure 2: First radiograph (2A), Access cavity (2B), Pulp therapy and Stainless-steel crown (2C)

Discussion

Among primary molars, the primary mandibular first molar has a unique coronal and radicular morphology, which is highly different from that of its permanent successor and other primary molars. These teeth have a specific crown morphology and cusp position, and a unique form of root canal branching and anastomosis.

Studies conducted on extracted teeth or CBCT images of Iranian, Turkish, Indian, and Brazilian children have shown that primary mandibular first molars usually have two roots. The mesial root usually has two canals, and the distal root more commonly has one and less commonly two canals[4]. Therefore, considering the variations in canal count of the distal root, it is imperative to take extra care not to miss the fourth canal if present.

Primary mandibular first molars with one root were first reported by Gideon et al (1991)[11]. Some other reports are also available regarding the presence of primary mandibular first molars with one root in non-syndromic children with no systemic underlying condition[12]. However, in Iranian population, Bagherian et al, and Aminabadi et al. did not find any cases of single-rooted primary first molars in their studies [3,4], Bahrololoomi et al.[13] found a case of primary right first molar with one root and one single canal.

It has been stated that the presence of one single root in molar teeth is actually a morphological anomaly that occurs due to fusion of roots or a very deep taurodontism. However, in such cases, one root is present with several canals. The pyramidal Conical form occurs genetically as an autosomal dominant or recessive condition or due to the presence of environmental factors interfering with invagination of the enamel organ or failure in the Hertwig's epithelial root sheath (HERS) breakdown, especially in the squeeze off stage, in which the separation of enamel organ from dental papilla ensures that HERS can form correctly[13]. Regarding the 5-year-old child reported in the present study, the right primary first molar had one root with a large canal, while the left primary first molar showed evidence of ankylosis. It appears that more attention should be paid to eruptive changes such as ankylosis which may occur in addition to numerical anomalies. Also, in non-syndromic cases, simultaneous occurrence of two developmental anomalies such as a single-rooted primary molar along with a primary molar with taurodontism has been reported in literature[13]. As reported in the literature, single-rooted primary molars have been more commonly observed in girls[11], as was the case in the present study.

Increased number of roots is another anomaly observed in primary teeth[14]. Clinical and radiographical findings of primary mandibular first molars with three roots have been reports in studies[15], and the prevalence of three-rooted first primary molar was 0.44% in a study in Mexican population with male: female ratio of 4:1. Also, in vitro studies on extracted teeth with this anomaly are available[4]. In study by bagherian, the first mandibular deciduous molars were all two- rooted [3]. Bagherian et al. reported the presence of two distinct mesial roots in mandibular molars [3].

Increased number of roots is more commonly seen in mandibular Primary first molars and in boys, as was the case in the present study[15]. Also, it is more commonly reported unilaterally and on the right side[15]. In the 3-year-old boy reported in the present study, the primary right mandibular first molar had three roots and the primary left first molar had no anomaly or eruptive problems (such as ankylosis). In conclusion, Primary teeth may have anatomical variations, which necessitate precise clinical examination and radiographic prescription before pulp therapy to select the best treatment option for them.

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Informed Consent Statement: Informed consent was obtained from the parents to publish their child's photos or

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radiographs anonymously and assured that individual data would be kept confidential.

Data Availability Statement: The data obtained during the treatment process are available from the corresponding author upon reasonable request.

Using AI: The authors confirm that this manuscript was written independently and that no generative artificial intelligence tools were used in drafting, writing, or editing of the text.

Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this article.

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