Journal of Multidisciplinary Dental Research

CASE REPORT

A Rare Case of Morphological Variation in Mandibular Dentition: Fusion and Two Rooted Premolars

Gahana Muthamma[1], Heena[1,*], T P Chandru[2]

[1] *Postgraduate student, Department of Pediatric and Preventive Dentistry, Coorg Institute of Dental Sciences, Virajpet, Kodagu, 571218, Karnataka, India*
[2] *Professor, Department of Pediatric and Preventive Dentistry, Coorg Institute of Dental Sciences, Virajpet, Kodagu, 571218, Karnataka, India*

ARTICLE INFO

Article history:
Received 17.07.2023
Accepted 18.03.2024
Published 20.08.2024

* *Corresponding author.*
Heena
heenaak111@gmail.com

https://doi.org/10.38138/JMDR/v10i2.23

ABSTRACT

The differentiation process of dental lamina and morpho-differentiation of the tooth germ may be the cause of developmental abnormality in terms of number, size, and shape. Management of such anomalies can be more complicated, because they can result in aesthetic problems, malocclusion, and other significant clinical consequences. To present a rare case with developmental anomalies of fusion of the permanent right mandibular central and lateral incisor with unusual anatomy of mandibular first and second premolar with two roots and canals. A 8-year-old male patient reported to the department of Pediatric and Preventive Dentistry for routine dental check-up and after clinical examination a preliminary diagnosis of fusion was made i.r.t 41,42. CBCT examination revealed fusion of mandibular permanent central and lateral incisors and also the presence of two roots in the first and second premolars bilaterally. For fusion the aesthetic management of bifurcation of crown was the suggestion. The two root canals of premolars could be challenging if root canal treatment was required. Although asymptomatic, these dental anomalies of fusion can be of aesthetic concern and management of disengaging the fusion require skillful technique. The two root canals of premolars were caries free and as this variation has been observed in young age the preventive strategy for caries is strongly recommended.

Keywords: Root Morphology; Fusion; Dental anamoly; Permanent dentition

1 INTRODUCTION

Developmental aberration in terms of number, size, and shape may be caused by anomalies in the morpho-differentiation process of the dental lamina and the tooth germ. [(1)] According to where they occur, a tooth's crown, roots, and root canals, morphoanatomic changes in teeth can be classified. [(2)] Both the primary dentition and the permanent dentition can have irregularities or variations in the number, size, and shape of the teeth. [(3)] These developmental abnormalities may be caused by local as well as systemic causes.

A successful root canal procedure requires thorough understanding of the root canal system's anatomy. The degree of root canal complexity varies by race, gender, age, the existence of lateral/accessory canals, additional roots, isthmuses, the position of the teeth at the jaws, and dental abnormalities (dens invaginatus, dens evaginatus, fusion, gemination, dens in dente). When this happens, there are a number of challenges with the root canal procedure. [(4)]

According to Slowey, mandibular premolars are considered to be the most difficult teeth to endodontically treat. [(5)] This is mostly because it might be challenging to distinguish between different anatomical variances in root canal morphology. The architecture of the root canals of mandibular premolars typically does not show a single, uniformly tapering canal; instead, it may show additional canals, anastomosis, and other anomalies. [(6)]

Weine et al., Vertucci, and Gulabivala et al.in the year 1969, 1984 and 2001 respectively have classified and described the root canal system of human permanent teeth and the number of roots can be described by using Table 1 classification. [(7)]

The most used classification system for the root canal configuration is Vertucci's (Figure 1), which has 8 categories such as: Type I (1), Type II (2-1), Type III (1-2-1), Type IV

Table 1: Classification of number of roots

Type 1	One root
Type 2	Two roots
2a.	Bifurcation at coronal third
2b.	Bifurcation at middle third
2c.	Bifurcation at apical third
Type 3	Three roots
3a.	Trifurcation at coronal third
3b.	Trifurcation at middle third
3c.	Trifurcation at apical third
Type 4	More than three roots

(2), Type V (1-2), Type VI (2-1-2), Type VII (1-2-1- 2) and Type VIII (3). [8]

Developmental anomalies in teeth include fusion and gemination. Fusion was described by Pindborg as the joining of two or more independent developing teeth's dentin and/or enamel. [9] Fusion tend to occur in anterior region and the incisors are the teeth most often affected in the permanent dentition and in the primary dentition majority of cases involve anterior mandibular teeth. [9] Fusion can take place between two normal teeth that are next to each other or between a normal tooth and a supernumerary tooth. [10]

This paper is reporting a rare case of dental developmental anomalies in a single patient; the fusion of the permanent right mandibular central and lateral incisor with unusual anatomy of mandibular first and second premolar with two root canals - bilaterally.

2 CASE REPORT

A 8-year old male patient reported to the department of Pediatric and Preventive Dentistry for routine dental check-up. The patient's medical history was ordinary; there was no evidence of paternal consanguinity or dental anomalies in the patient's family. There was no trauma history noted. Extraoral and general examinations didn't seem to be helpful.

On clinical examination a wide crown with increased width mesio-distally and one deep groove on the labial and lingual surfaces was found on the patient's adjacent permanent right central incisor. Examination of occlusion exhibited an anterior cross-bite. On the basis of the clinical findings, a preliminary diagnosis of fusion was made i.r.t 41 and 42 (Figures 1 and 2).

Radiographic examination revealed complete fusion of permanent mandibular central and lateral incisors with a single crown and a single root which is an uncommon finding.

A confirmed diagnosis was made using CBCT (Figure 3) which revealed fusion of mandibular permanent central and lateral incisors. The fused teeth were caries free and hence no treatment was carried out on them. The CBCT scan also identified two roots in the first and second premolars - bilaterally (Figures 5 and 6).

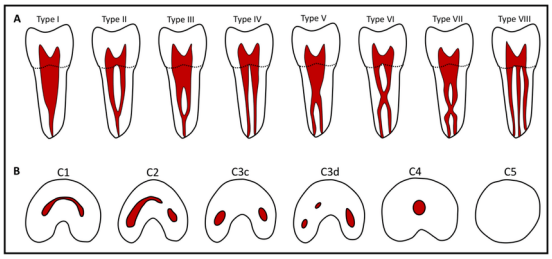

Fig. 1:

Fig. 2:

Fig. 3:

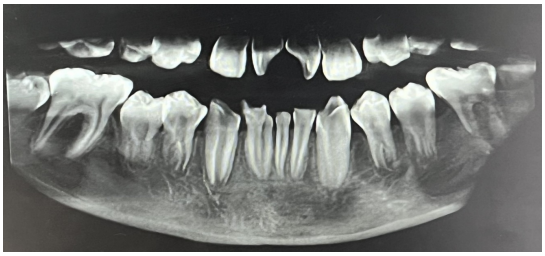

Fig. 4:

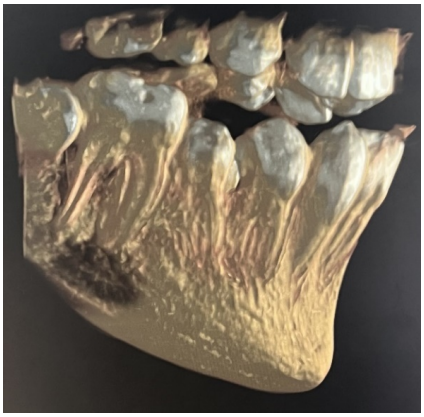

Fig. 5:

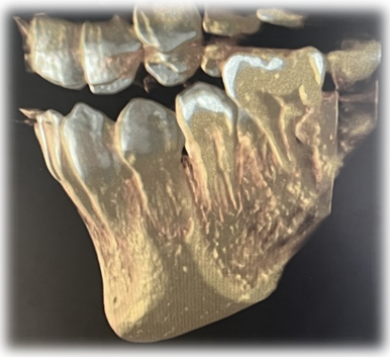

Fig. 6:

3 DISCUSSION

The combination of fusion of mandibular central and lateral incisors along with the presence of extra root in the mandibular first and second premolars and since it is not associated with any known systemic diseases or developmental syndrome makes this case an interesting one.

Despite the large number of cases that have been documented in the literature, the report of fusion and presence of two roots in mandibular first and second premolar was not observed.

The term fusion refers to the dentinal merger of two or more initially separate teeth.

Possible participants include both healthy teeth and extra teeth (mesiodens or supplementary tooth).[11] Two distinct tooth germs united by enamel and dentin (true fusion) and by dentin and/or cementum during the formative stage (late fusion).[12] Concrescence refers to a cementum's late fusing. If fusion starts before the calcification stage, the participating teeth completely fuse, and the crown integrates the enamel, dentin, cementum, and pulp characteristics of both participating teeth. When incomplete fusion occurs, the resulting tooth may have separate crowns, just involve the root, and have the pulp canals fused or separate. When an anomalous tooth is classified as one, fusion exposes a missing tooth. It could be either bilateral or unilateral. In the front mandibular segment, it is more frequent.[13,14]

The two epithelial structures' apical growth, which joins at the cervical loop to form a double layer of cells known as Hertwig's epithelial root sheath, starts the process of root development. Genetics controls the pattern of cell proliferation in the root sheath, which determines whether the root will be long or short, wide, or thin, straight or curved, or single or numerous. When opposing portions of the root sheath proliferate both horizontally and vertically, several roots are produced. A new root or many roots are created as horizontal segments combine and spread apically. In mandibular molars and maxillary premolars, the pattern of proliferation also affects whether the roots are distinct or connected.[15]

Because of the complex anatomy of these teeth, studies on the anatomical alterations in mandibular premolars should aid dentists in understanding these teeth before doing root canal therapy. Failure to foresee and recognise the presence of the extra root canals could result in endodontic management failure, which could lead to acute flare-ups during and after the endodontic procedure and retreatment.[16]

For endodontic therapy to be successful, a thorough radiographic assessment, including preoperative radiographs, is crucial.[17] Different techniques, including 2D radiography, root canal staining, hard tissue sectioning, micro-CT, and cone-beam computed tomography (CBCT) scanning, had been used to identify root canal configuration. Axial, sagittal, and coronal sections of the maxillofacial anatomy can be evaluated with CBCT, which also generates high-quality 3D diagnostic pictures free of structural overlapping. A 3D visualization of the root and canal shape, number of canals, and divergence or convergence of the canals are possible. Because of these factors, CBCT has been suggested for the precise assessment of root canal systems.[18,19] Advances in imaging technology and the use of CBCT in dentistry has enabled the clinicians for the better understanding of the canals.

Racial and genetic differences may have an impact on the anatomy and morphology of the root canals.[6] The etiology of dental developmental anomalies (or defects) is complex and can involve multiple causative agents such as local factors (e.g., trauma), genetic influences, or environmental insults (e.g., alcohol or drug exposures during the fetal period, febrile illnesses). In the process of odontogenesis is primarily under the control of the homeobox (HOX) genes (e.g., MSX1, MSX2, SHH, PAX9) which play critical roles in multiple stages of tooth development.[20]

Diverse racial groupings have various canal morphology types.[6] Vertucci et al. report the occurrence of one-root canal in one root in 70% of the mandibular first premolars and 97.5% of the second mandibular premolars (Vertucci

type I). Presence of one root with two-root canals is reported in 1.5% of the mandibular first premolars and 0% in mandibular second premolars (Vertucci type IV).[21] Hussam et al. observed in Saudi population, mandibular first premolars, the most predominant root morphology observed in this study was single-rooted (96.4%), followed by double-rooted (3.1%), and then three rooted (0.5%).[22] There are studies with an incidence of 5.5% for two root canals in the Caucasian and 16.2 and 4.8% in second premolars in the African American group of patients.[21] Rakesh et al. (2013) Indian population showed single roots in 93.5% and single canal in 93.2% of teeth and more than two roots and two canals in 6.4% and 6.8% of the teeth respectively, this might be due to genetic differences related to the racial background of the population.[16] Scott and Turner describe the accessory root of mandibular first premolar as "TOME'S ROOT"[23]. They observed ethnic differences in the root morphology; and, reported the highest incidence (>25%) of accessory roots in the Australian and sub-Saharan African populations. The lowest incidence of Tome's root (0-10%) occurred in the American, Arctic, New Guinea, Jomon, and Western Eurasian populations. Sert and Bayrili[24] also reported sex differences in canal morphology, reporting higher incidence (44%) of accessory roots and canals in females as compared to males (34%).[25]

Double teeth are more common in primary than in the permanent dentition, the prevalence in different series ranging from 0.5% to 2.5% for the primary and 0.0 ~ 0.8% of the general population with no gender prediction for the permanent dentition.[26–28]

For a prompt and accurate diagnosis and to choose the best course of treatment, it is crucial to recognise and identify developmental dental defects. Management of dental anomalies can be more complicated because they can result in failure of root canal procedure, aesthetic problems, malocclusion, and oral disorders.

The current case represents an unusual finding of fusion and an additional root with respect to mandibular premolars. CBCT interpretation revealed complex internal anatomy of the root structure that may require special attention in cases where additional roots are present, and complications can occur during root canal therapy that can cause challenges or difficulty in exploration and negotiation of the root canals due to the inability to continuously follow the root canal curvature, which may result in canal blocking, ledging, transportation, zipping, perforation, and instrumentation.[29] Other difficulties include the increased likelihood of root fracture during exodontia if multi-rooted premolar teeth are rotated during extraction.[30]

4 CONCLUSION

- Although asymptomatic, these dental anomalies can cause clinical issues such as poor aesthetics, occlusal interference, malocclusion, periodontal issues, and greater susceptibility to caries, in addition to the delayed or incomplete eruption of the typical series of teeth.
- Successful treatment can be attained with the use of careful radiographic imaging, treatment planning, and adjustment of the canal preparation procedure.
- Due to the intricate root canal system in mandibular premolars, there is a considerable chance of missing anatomy during root canal procedures.

Thus, a preventive strategy would be recommended to avoid the challenges during endodontic procedure of these teeth. Therefore, comprehensive knowledge of normal anatomy and common variations, careful interpretation of angled radiographs, use of 3D imaging, appropriate cavity preparation, and a thorough exploration of the interior of the tooth, ideally under magnification, followed by adequate cleaning, shaping, and obturation is crucial in endodontic success of tooth/teeth with the variations in root canal anatomy and morphology.

REFERENCES

1) More CB, Tailor MN. Tooth fusion, a rare dental anomaly: analysis of six cases. *International Journal of Oral & Maxillofacial Pathology*. 2013;4(1):50–53. Available from: http://dx.doi.org/10.13140/2.1.3714.1128.
2) Duncan WK, Helpin ML. Bilateral fusion and gemination: a literature analysis and case report," Oral Surgery, Oral Medicine. *Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology*. 1987;64(1):82–87. Available from: https://doi.org/10.1016/0030-4220(87)90121-6.
3) Mukhopadhyay S, Mitra S. Anomalies in primary dentition: Their distribution and correlation with permanent dentition. *Journal of Natural Science, Biology and Medicine*. 2014;5(1):139–143. Available from: https://doi.org/10.4103/0976-9668.127313.
4) Guven EP. Root Canal Morphology and Anatomy . In: Akarslan Z, Bourzgui F, editors. Human Teeth - Key Skills and Clinical Illustrations. IntechOpen. 2019. Available from: https://www.intechopen.com/chapters/67419.
5) Slowey RR. Root canal anatomy. road map to successful endodontics. *Dental Clinics of North America*. 1979;23(4):555–573. Available from: https://pubmed.ncbi.nlm.nih.gov/294389/.
6) Hajihassani N, Roohi N, Madadi K, Bakhshi M, Tofangchiha M. Evaluation of Root Canal Morphology of Mandibular First and Second Premolars Using Cone Beam Computed Tomography in a Defined Group of Dental Patients in Iran. *Scientifica*. 2017;2017:1–7. Available from: https://doi.org/10.1155/2017/1504341.
7) Sonarkar S, Purba R, Badole G, Makade C. Unusual root canal morphology of mandibular second premolar: A case series and review. *Journal of Dental Research and Review*. 2017;4:107–113. Available from: http://dx.doi.org/10.4103/jdrr.jdrr_64_17.
8) Karobari MI, Parveen A, Mirza MB, Makandar SD, Ghani NRNA, Noorani TY, et al. Root and Root Canal Morphology Classification Systems. *International Journal of Dentistry*. 2021;2021:1–6. Available from: https://doi.org/10.1155/2021/6682189.
9) Açıkel H, İbiş S, Tunç EŞ. Şen Tunç E. Primary Fused Teeth and Findings in Permanent Dentition. *Medical Principles and Practice*. 2018;27(2):129–132. Available from: https://doi.org/10.1159/000487322.
10) Peyrano A, Zmener O. Endodontic management of mandibular lateral incisor fused with supernumerary tooth. *Endodontics and dental traumatology*. 1995;11(4):196–198. Available from: https://doi.org/10.1111/j.1600-9657.1995.tb00487.x.
11) Shapira J, Kochavi D, Harary D, Chosack A. A two-step separation technique for fused teeth: clinical report. *Pediatric*

Dentistry. 1983;5(4):270–272. Available from: https://www.aapd.org/globalassets/media/publications/archives/shapira-05-04.pdf.
12) Tannenbaum KA, Alling EE. Anomalous tooth development: Case report of gemination and twinning. *Oral Surgery, Oral Medicine, Oral Pathology*. 1963;16(7):883–887. Available from: https://doi.org/10.1016/0030-4220(63)90326-8.
13) Chalakkal P, Thomas AM. Bilateral fusion of mandibular primary teeth. *Journal of Indian Society of Pedodontics and Preventive Dentistry*. 2009;27(2):108–110. Available from: http://dx.doi.org/10.4103/0970-4388.55336.
14) Tarasingh P, Balaji K. Gemination primary teeth. A report of two clinical cases. . *Annals and Essence of Dentistry*. 2010;II(2):48–51. Available from: https://www.longdom.org/articles/gemination-in-primary-teeth--a-report-of-two-clinical-cases.pdf.
15) Walton RE. Principles and Practice of Endodontics. 2002;p. 1–600. Available from: https://anhihs.com/up/Principles%20and%20%20practice%20of%20endodontic%202002.compressed.pdf.
16) Bansal D, Mahajan M. Morphological variations in the root canal system of mandibular premolars in the population of Uttarakhand. *International Journal of Applied Dental Sciences*. 2016;2(4):68–71. Available from: https://www.oraljournal.com/pdf/2016/vol2issue4/PartB/2-4-14.pdf.
17) Thanaruengrong P, Kulvitit S, Navachinda M, Charoenlarp P. Prevalence of complex root canal morphology in the mandibular first and second premolars in Thai population: CBCT analysis. *BMC Oral Health*. 2021;21:1–12. Available from: https://doi.org/10.1186/s12903-021-01822-7.
18) Bulut DG, Kose E, Ozcan G, Sekerci AE, Canger EM, Sisman Y. Evaluation of root morphology and root canal configuration of premolars in the Turkish individuals using cone beam computed tomography. *European Journal of Dentistry*. 2015;9(4):551–557. Available from: https://doi.org/10.4103/1305-7456.172624.
19) Arroyo-Bote S. Use of cbct in the endodontic management of a second mandibular premolar with three roots: Clinical case. *Journal of Clinical and Experimental Dentistry*. 2022;14(1):107–113. Available from: http://www.medicinaoral.com/medoralfree01/aop/58612.pdf.
20) MacKenzie A, Ferguson MW, Sharpe PT. Expression patterns of the homeobox gene, Hox-8, in the mouse embryo suggest a role in specifying tooth initiation and shape. *Development*. 1992;115(2):403–420. Available from: https://dx.doi.org/10.1242/dev.115.2.403.
21) Georgiev K, Pecheva A. Deviant morphology of the root canal system in mandibular premolars: clinical cases. *Folia Medica*. 2022;64(1):176–180. Available from: https://dx.doi.org/10.3897/folmed.64.e58877.
22) Alfawaz H, Alqedairi A, Al-Dahman YH, Al-Jebaly AS, Alnassar FA, Alsubait S, et al. Evaluation of root canal morphology of mandibular premolars in a Saudi population using cone beam computed tomography: A retrospective study. *Saudi Dental Journal*. 2019;31(1):137–142. Available from: https://doi.org/10.1016/j.sdentj.2018.10.005.
23) Scott GR, Turner CG. The Anthropology of Modern Human Teeth. 2nd ed. Cambridge, USA. Cambridge University Press. 2018. Available from: https://doi.org/10.1017/9781316795859.
24) Sert S, Bayirli GS. Evaluation of the Root Canal Configurations of the Mandibular and Maxillary Permanent Teeth by Gender in the Turkish Population. *Journal of Endodontics*. 2004;30(6):391–398. Available from: https://dx.doi.org/10.1097/00004770-200406000-00004.
25) Kararia N, Chaudhary A, Vandana Kararia. Mandibular left first premolar with two roots: A morphological oddity. *Contemporary Clinical Dentistry*. 2012;3(2):234–236. Available from: https://dx.doi.org/10.4103/0976-237x.96840.
26) Schuurs AH, van Loveren C. Double teeth: Review of the literature. *ASDC journal of dentistry for children*. 2000;67(5):313–325. Available from: https://pubmed.ncbi.nlm.nih.gov/11068663/.
27) Buenviaje TM, Rapp R. Dental anomalies in children: A clinical and radiographic survey. *ASDC journal of dentistry for children*. 1984;51(1):42–46. Available from: https://pubmed.ncbi.nlm.nih.gov/6583219/.
28) Salem G. Prevalence of selected dental anomalies in Saudi children from Gizan region. *Community Dentistry and Oral Epidemiology*. 1989;17(3):162–163. Available from: https://dx.doi.org/10.1111/j.1600-0528.1989.tb00014.x.
29) Kakkar P, Singh A. Mandibular first premolar with three roots: a case report. *Iranian Endodontic Journal*. 2012;7(4):207–210. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3487526/.
30) Jain H, Ballal NV. Endodontic Management of Aberrant Root Canal Anatomy in Premolars - A Report of Two Cases. *Journal of Dental Problems and Solutions*. 2016;3(1):008–011. Available from: https://dx.doi.org/10.17352/2394-8418.000025.