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Paramolar tubercle in endodontics: An overview, case report and specimen study



J. Paras Mull, M.K. Manjunath*

Department of Conservative Dentistry and Endodontics, JSS Dental College and Hospital, A Constituent College of JSS University, Sri Shivarathreeshwara Nagara, Mysore 570015, Karnataka, India

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ABSTRACT

Paramolar tubercle is an additional cusp occurring on the buccal surface of a permanent maxillary molar. Due to their overall low occurrence, there is limited information about root anatomy of paramolar tubercles. Periapical radiographs do not always image the root canal associated with the paramolar tubercle. Teeth with paramolar tubercle can promote problems like dental caries, gingivitis, periodontitis, and may pose problems to the clinician in procedures like orthodontic banding and rubber dam placement. Although, small paramolar tubercles may not have pulp tissue, a very large tubercle may contain separate pulp chamber and associated root canal. For successful management of such teeth requiring endodontic or periodontal therapy, advanced radiographic diagnostic aids should be used. In this paper this anatomical variation in maxillary second molar, was studied (i) by clinical examination, radiographic examination using intra-oral radiography and (ii) macroscopic examination, radiographic examination and by clearing technique in vitro.

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1. Introduction

During a routine dental examination, variations in morphological structures of human teeth may be found either on the crown in the form of anomalous cusps, or in an increased number of roots, which in some instances are associated with an anomalous cusp.[1] Variations in the external morphology of a tooth inevitably could also have a variation in the root canal system which represents a challenge to endodontic diagnosis and therapy.[2]

Paramolar tubercle is an additional cusp occurring on the buccal surface of a permanent maxillary molar.[3] It is considered as a cingulum derivative expressed on the buccal surface of the paracone (mesiobuccal cusp) of the upper molars and thought to arise from an accessory enamel knot at the surface.[3,4] This structure is also known Paleontologically as a Parastyle when present in an upper molar and Protostylid when present in lower molar.[5]

Paramolar tubercle occurs in both deciduous and permanent molars, although very rarely encountered on premolars.[4,6] The tubercle occur unilaterally more than bilaterally, with occurrence rates of 0%–0.1% on maxillary first molars, 0.4%–2.8% on maxillary second molars and 0%–4.7% on maxillary third molars.[6–9]

Due to the superimposition, radiographs do not always reveal the true configuration of a paramolar tubercle and its root if present. The paramolar tubercle may pose clinical problem such as dental caries, gingivitis, periodontitis, interfere with orthodontic banding and rubber dam application. Hence, teeth with paramolar tubercle requiring endodontic or periodontal treatment may necessitate advanced radiographic investigation for understanding the complex anatomy of tooth and its relationship with surrounding structure.

* *Corresponding author*. Tel.: +91 9845854977; fax: +91 821 2548352.
E-mail addresses: dr.parasmullj@jssuni.edu.in, drparas.gehlot@gmail.com (J. Paras Mull).

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In this article paramolar tubercle on maxillary second molar, was studied (i) clinically and radiographically using intra-oral radiography in a patient; and (ii) macroscopically and radiographically on an extracted maxillary second molar, by access cavity preparation and clearing technique.

2. Case report

A 25-year-old Indian male was referred for sensitivity in his left maxillary molar since a week. The clinical diagnosis of dentinal hypersensitivity due to cervical abrasion was established in maxillary second premolar and first molar. Routine examination revealed a paramolar tubercle on buccal surface of mesiobuccal cusp of left maxillary second molar (Fig. 1a, b). The tooth was intact without visible evidence of carious or non-carious lesions and an intra-oral periapical radiograph did not reveal any pathosis, and no separate root or pulp chamber in relation to paramolar tubercle (Fig. 1c).

3. Anatomical study

A maxillary second molar with a paramolar tubercle, extracted due to periodontal reason from a South Indian patient was selected for the study. The tooth was stored in 0.2% sodium azide solution until use. Residual soft tissue on the root surface was removed by soaking the teeth in 5% sodium hypochlorite. (Nice Chemicals, India) for 3 h.

External characteristics showed the presence of paramolar tubercle on mid-buccal aspect of crown, and a single fused buccal and a palatal root (Fig. 2a, b). Macroscopic and radiographic features of the tooth were recorded in mesio-distal and bucco-palatal planes (Fig. 2). Radiograph showed a separate pulp horn under the cusp of the paramolar tubercle (Fig. 2d). A conventional access cavity was prepared (Fig. 3b). Initially the canals were explored with Stainless steel #15-40 K-Files (Mani Inc, Japan) and three canals were located namely mesiobuccal, distobuccal and the palatal. Upon further exploration more buccally, a catch was felt and the access cavity was modified (Clover-leaf like) to locate the orifice of the fourth canal under the paramolar tubercle (Fig. 3c). With the files in all the four canals, radiographs were taken to visualize the inter-relationship between the canals (Fig. 2c, d). The single fused buccal root had three separate canals all exiting as three separate foraminas (Fig. 3d).

In comparison to the radiographic techniques used to study the root canal anatomy in extracted teeth, Omer et al emphasized that clearing technique has considerable value as a

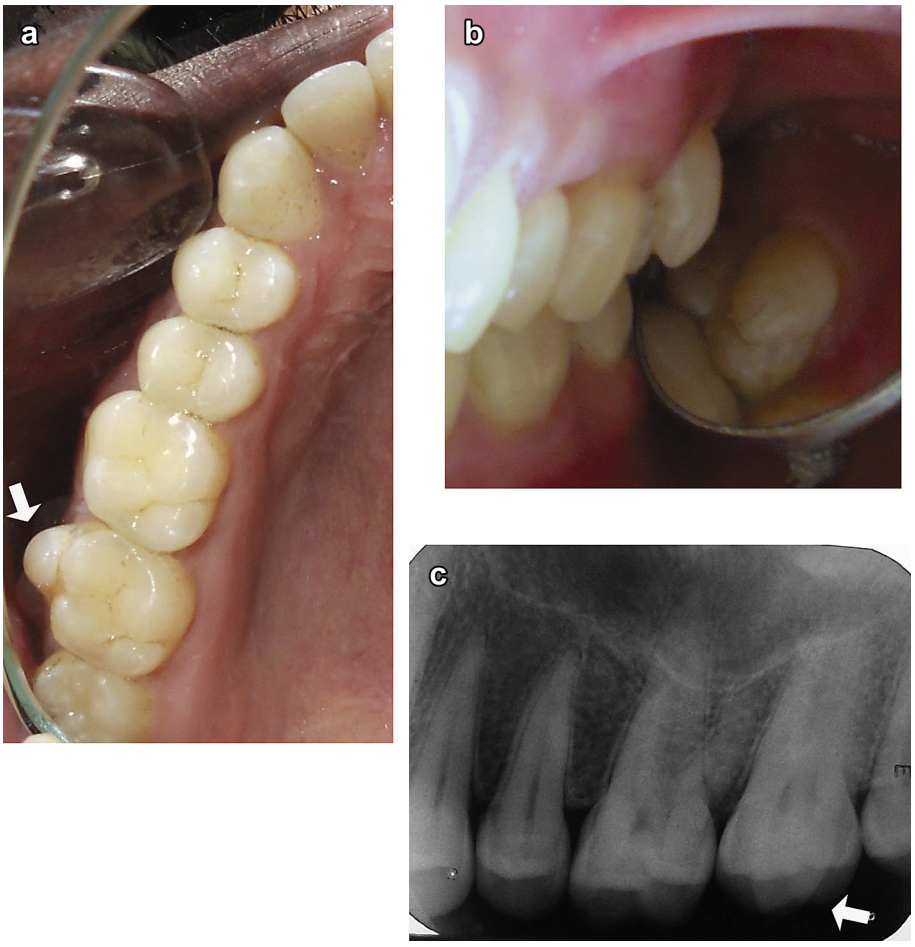


Fig. 1 – Paramolar tubercle on maxillary second molar. (a) Occlusal view (arrow). (b) Buccal view. (c) Periapical radiograph with superimposition of the paramolar tubercle (arrow).

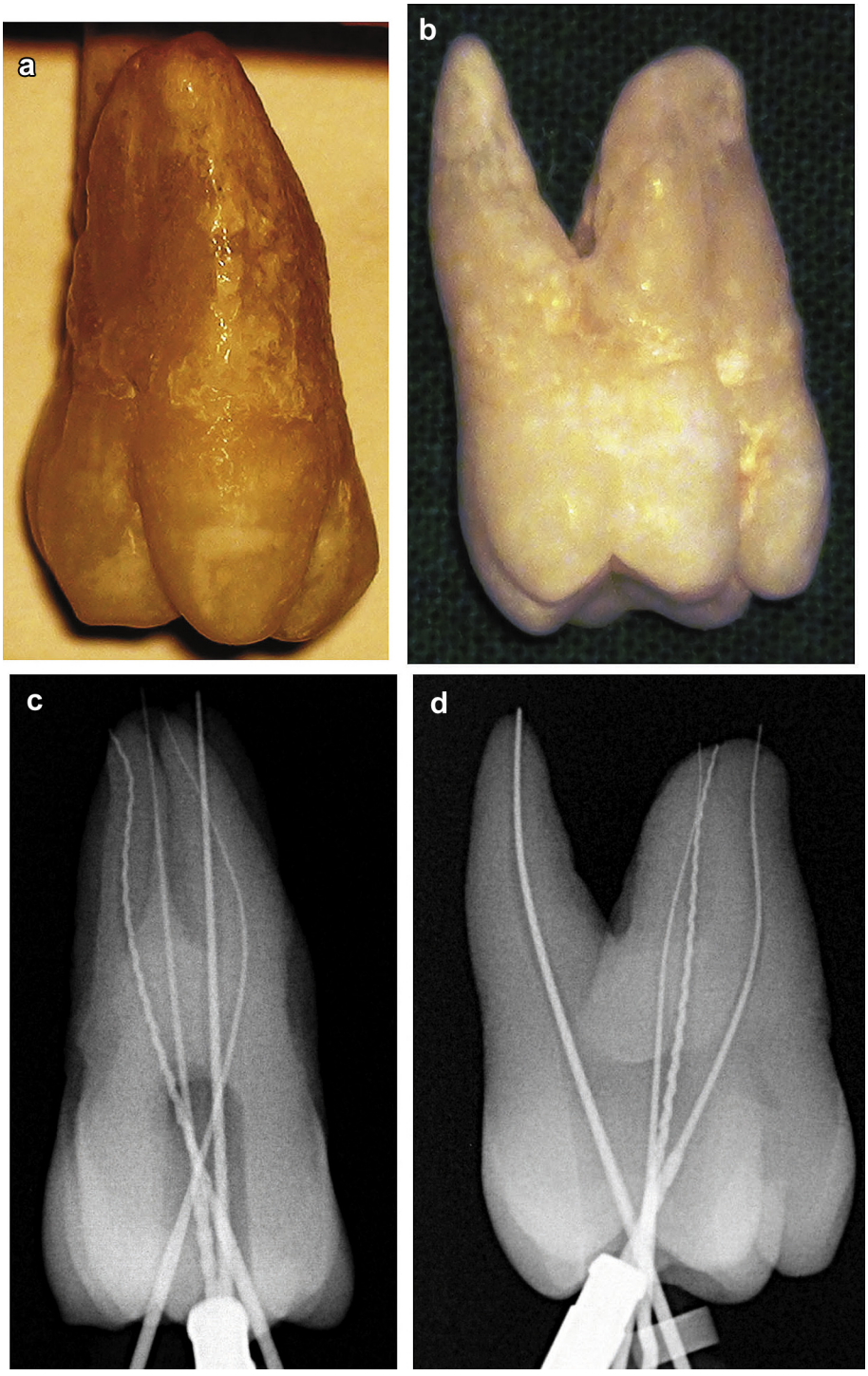


Fig. 2 – Maxillary second molar with paramolar tubercle. (a) Buccal view. (b) Proximal view. (c) Radiographic aspect – Buccal. (d) Radiographic aspect – Proximal.

teaching or research tool.[10] Hence to check for any anatomical intricacies between the canals, the specimen was decalcified by immersion in 5% hydrochloric acid (S D Fine-Chem Ltd., Mumbai, India), changed every 24 h for 6 days. The decalcification process was confirmed by taking radiographs at frequent intervals. After decalcification the teeth were washed in tap water overnight and dehydrated in ascending concentration of ethyl alcohol (50%, 70%, 95% and 100%) (S D Fine-Chem Ltd., Mumbai, India). The specimen was cleared by placing in methylsalicylate (Thomas Baker Chemicals Pvt Ltd., Mumbai, India) for 1 h. To visualize the internal anatomy of tooth, under negative pressure applied at the root tip, the canals were injected with water-based dye (Camlin Ltd., India) mixed with the clearing agent. The transparent tooth with the root canals were examined under Dental operating microscope (OPMI pico Dental Microscope, Carl Zeiss, Germany) at 3.4× magnification, which

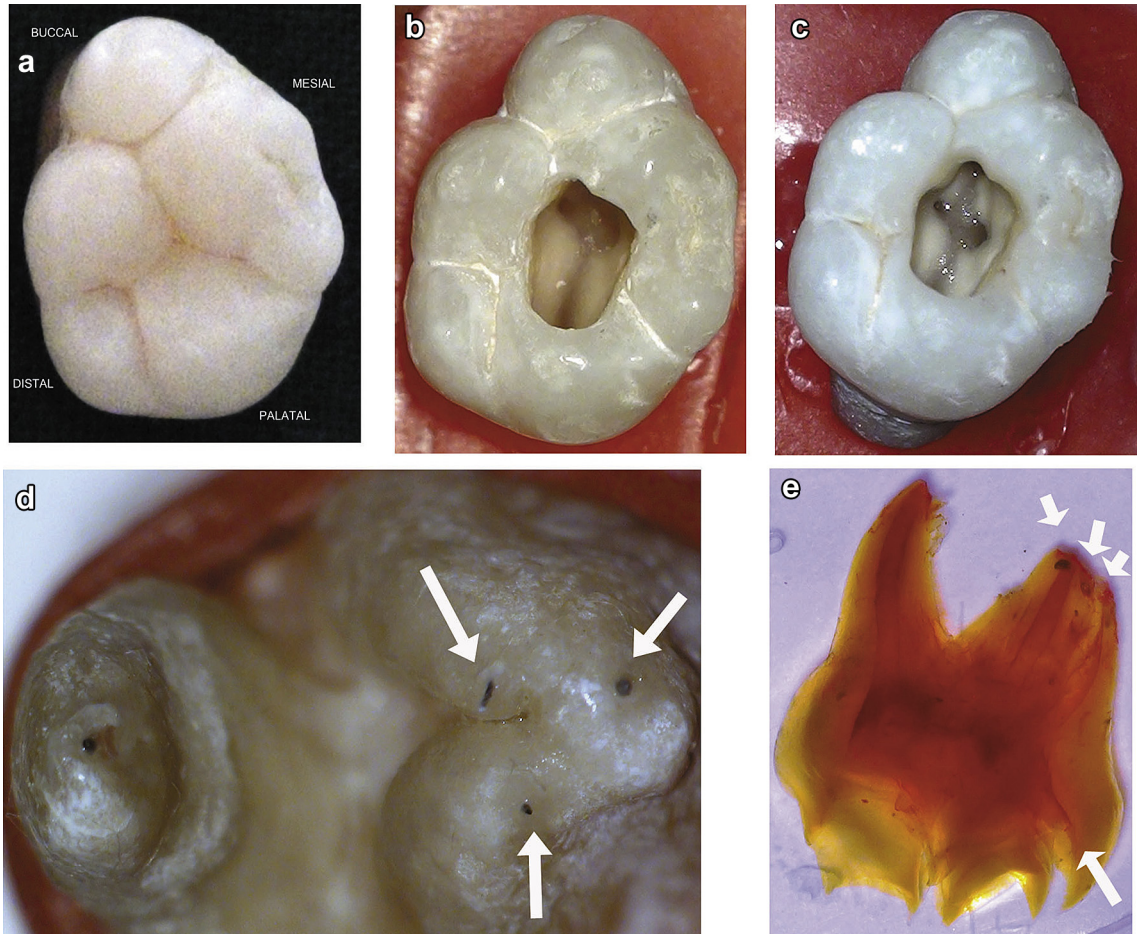


Fig. 3 – (a) Occlusal view. (b) Occlusal view with canal orifice located for three canals. (c) Occlusal view with canal orifice for fourth canal located under the paramolar tubercle buccally. (d) Root-end view showing the exit of all the four canals. (e) Cleared tooth revealing the internal anatomy.

allowed the observation of separate pulp horn under the paramolar tubercle and three separate root canals in the buccal root, originating from the pulpal floor to apical region and one palatal canal corresponding to the palatal root (Fig. 3e).

4. Discussion

One of the main reasons for failure of root canal therapy is the lack of sufficient knowledge concerning the anatomy of teeth, both internal and external.[11] Historically, Bolk first described an additional cusp occurring on the buccal surfaces of permanent molars and termed it as the paramolar tubercle.[12] According to Turner and Harris the paramolar tubercle arise during the morphogenesis process starting from an "accessory" enamel knot, developed buccal to the presumptive buccal cusp.[13]

The size of the tubercle can vary from a mere prominence on buccal surface to a well-developed lobulated cusp standing independently; well separated by a constriction and having the appearance of a fused supernumerary tooth. The location of tubercle on the buccal surface may vary, and a very large tubercle may also contain pulp tissue.[1,14] Root canals in tubercles are often connected with other canals or they are isolated.[15,16]

There is limited information about the incidence and morphologic character of paramolar roots.[15] Bolk stated that a paramolar tubercle was always united with the anterior buccal cusp (mesiobuccal) of the second and third molars and its roots were attached to mesiobuccal roots.[12] Kustaloglu suggested that the paramolar cusp formation may vary in size, and if large, it may be associated with a separate root.[6] Contrary to Bolk's findings, Ohishi et al reported three cases, with tubercles attached at the middle of the buccal surfaces, and the roots united with the distobuccal roots.[15] Nayak et al recently investigated a case of paramolar tubercle in maxillary second molar using spiral CT and found the tubercle had its own pulp chamber with its root fused to the mesiobuccal and distobuccal roots while its root canal remained independent from the main root canals.[17]

In the specimen study, the tubercle was on mid-buccal aspect of crown (Figs. 2 and 3) and its root fused to the mesiobuccal and distobuccal root to form a single buccal root. Radiographically three separate canals with three separate foramina were noted (Fig. 2d). Hence as mentioned by Ohishi et al this discrepancy between present cases and previous reports suggests the need for further research into the root anatomy of paramolar tubercles.[15]

The presence of paramolar tubercle and additional root presents special problem in endodontics. The treatment difficulties include, difficulty in identifying additional canal on periapical radiographs, placement of rubber dam clamp and modifying access or performing additional separate access cavity for paramolar tubercle.[15] Hence a careful search for additional canal under the buccal wall of the access cavity should be performed in all the cases with paramolar tubercle. If an additional canal is found in the paramolar tubercle, the relationship between the pulp space of the tubercle and that of the tooth must be determine and if the pulp spaces are connected, they are treated at same time.[15] A paramolar structure isolated from the main pulp chamber can be treated independently.[18]

Three-dimensional imaging like Cone beam computed tomography (CBCT) has been suggested as adjuncts to conventional radiography which allows the visualization of the third dimension whilst at the same time eliminating superimpo sitions.[19]

5. Conclusion

The term paramolar tubercle or Bolk's tubercle or paramolar cusp or paramolar structure is used for the cusps of supernumerary nature, occurring on buccal or lingual surfaces of any of the premolars or molars in either jaw. Early diagnosis of these tooth anomalies is an important part of treatment and can improve the prognosis and minimize pulpal and periodontal involvement. Also knowledge of highly variable internal anatomy of human teeth is important for successful endodontic treatment. Clearing technique could be used as a teaching aid to understand the morphologic variations of such teeth. However, advanced imaging technique like Cone beam CT would be more helpful in understanding and detecting anatomical variations and thereby improving treatment outcome in such teeth requiring endodontic or periodontal treatment.

Conflicts of interest

All authors have none to declare.

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