Molarization of the mandibular second premolar in an Indian patient: Report of a rare case

Abstract

Morphological variations can occur in human teeth. When such variations occur, they are more interesting to clinicians, anthropologists, and forensic dentists. Normally, the mandibular second premolar exhibits the two cusp pattern, one buccal cusp, and the other lingual cusps. Occurrence of four cusps in this tooth is rarely reported in the literature. The aim of this article is to present the development of four cusps in the second premolar, resulting in a molar appearance of the tooth and hence, diagnosed as molarization of the premolar.

Key words: Cusp pattern, molarization, morphological variation, premolar

Nagaveni N.B, K.V. Umashankara[1], Radhika N.B[2], Murali Mohan[3]

Department of Pedodontics and Preventive Dentistry, College of Dental Sciences, [1]Department of Oral and Maxillofacial Surgery, Bapuji Dental College and Hospital, Davangere, Karnataka, [2]IDEAS Dental College and Hospital, Gwalior, Madhya Pradesh, [3]General Dental Practitioner, White Line Dental Clinic, Davangere, Karnataka, India

Address for correspondence:
Dr. K.V. Umshankara, Professor, Department of Oral and Maxillofacial Surgery, Bapuji Dental College and Hospital, Davangere, Karnataka, India.
E-mail: kvuanurag@gmail.com

INTRODUCTION

Mandibular second premolars are two in number and present immediately posterior to the mandibular canine and anterior to the molars.[1] When tooth size and morphology are analyzed, a range exists within which a particular tooth will probably be found. The literature dealing with dental morphology describes distinct characteristics that are considered variations within the norm.[2]

The mandibular second premolar assumes two common forms that differ mainly in occlusal design. The first form is the three-cusp type that appears more angular or the square type having three cusps that are distinct, with the buccal cusp being the largest, the mesiolingual cusp being the second largest, and the distolingual cusp being the smallest. Each cusp has well-formed triangular ridge separated by deep developmental groove. These grooves converge in a central pit and form a Y shape on the occlusal surface [Figure 1].[1]

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The second form is the two-cusp type, which appears more rounded from the occlusal aspect. The single lingual cusp development attains equal heights with the three-cusp type. The two-cusp type has no groove but it shows developmental depression distolingually.[1,2]

Mandibular second premolars show an elevated variability of crown morphology, which together with a strong genetic influence, determine their position in the dental arch. Variations include the presence of a single vestibular cusp and tetracusp morphology, in which there is a vestibular cusp and three lingual cusps; the others are missing teeth, presence of macrodontia, hypoplasia, premolar duplication, dens in dente, and peg-shaped teeth.[2]

Developmental anomalies resulting in extra cusps have been reported and are believed to be due to simple localized hyperplasia, folding of the dental epithelium, or crowded pre-eruption conditions. Extra cusps have also been referred to as paramolar tubercles or supernumerary, additional, or accessory cusps.[3]

Apart from these variations that fall within the range of normal, the mandibular second premolars may present another extremely infrequent anomaly, i.e., molarization. In studies of dental anthropology and hominid evolution, descriptions are found (such as that of *Australopithecus robustus*) in which premolars are shaped like molars.[2]

CASE REPORT

A 12-year-old boy reported to the private dental clinic for correction of irregularly placed and ugly looking teeth. On intraoral examination, the patient exhibited complete permanent dentition with Class I molar relation. On careful examination, the mandibular left second premolar exhibited four cusps [Figures 2 and 3]. On the contralateral side, the premolar showed a normal two-cusp pattern and all the other teeth (premolars and molars) also had normal number of cusps. The four cusps were separated by two grooves, and almost looked like a second molar from the occlusal aspect. An impression was taken, poured to make a cast to be named, and each cusp was numbered [Figure 4]. Finally, based on the literature search, the tooth was diagnosed as molarization of the premolar. As only stains and a moderate amount of the calculus were found in this patient, oral prophylaxis was carried out.

DISCUSSION

A wide range of diversity exists in the morphology of the teeth of the mammalia class, which also gives us a tract of evolution of this class.[4] Teeth are particularly used in anthropological research because they have the advantage of preservability (in fossils and forensic records), observability (in the living, skeletons, and fossils), variability (measurement that varies between populations and within a population), and heritability (a strong genetic basis underlying the tooth development and trait expression).[5]

Early in the 20th century, the world renowned paleontologist Gregory said in 1922, "Tooth crown morphology varied hardly at all among the major races of human kind."[6] However, exceptions do exist of which the most common are shovel-shaped incisors, cusp of Carabelli, peg-shaped maxillary lateral incisor, accessory cusp on the maxillary first permanent molar, additional cusp on the mandibular

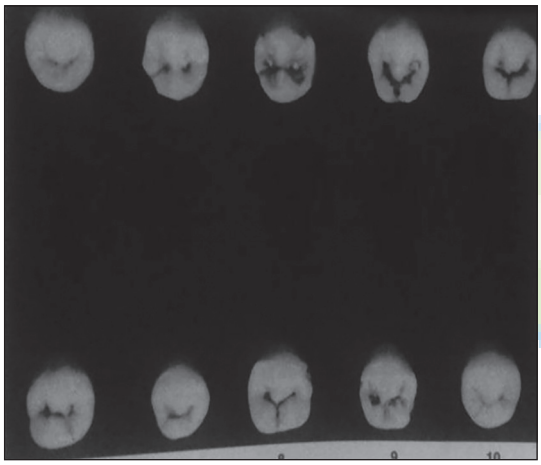

Figure 1: Normal occlusal anatomy of the mandibular second premolar (Courtesy: Ash and Stanley[1])

Figure 2: Photograph showing the mandibular second left premolar with four cusps looking like a molar (molarized premolar)

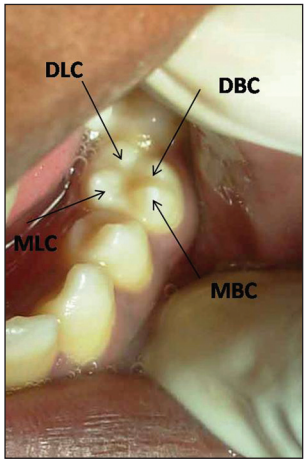

Figure 3: Naming of each cusp in the premolar (MBC = Mesiobuccal cusp, DBC = Distobuccal cusp, DLC = Distolingual cusp, MLC = Mesiolingual cusp)

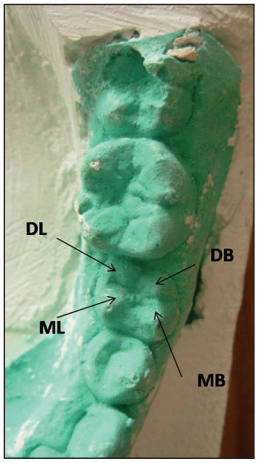

Figure 4: Dental cast showing four cusps in the second premolar (MB = Mesiobuccal, DB = Distobuccal, DL = Distolingual, ML = Mesiolingual)

second premolar giving a total of four cusps to the tooth, and reduced size or absence of a distopalatal cusp on the maxillary second molar.[6,7] The prevalence of these variations is seen more in the maxilla than in the mandible. They can be localized to one tooth, can be generalized to involve all the teeth, or they may be a part of systemic or syndromic disorders.[6]

Lower premolars invariably exhibit single buccal cusps with a well-developed free apex. However, extensive variation occurs in the expression of the lingual cusp. For instance, in contrast to the upper premolar, lingual expression on the lower premolar is more asymmetrical and variable. If an extra lingual cusp occurs, it is usually situated on the ridge extending distally from the primary lingual cusp. The extra lingual cusp is usually smaller and lower on the occlusal plane than the primary lingual cusp. Extra lingual cusps are more common in the lower second premolar.[5]

The etiology for extra cusp formation is unknown. But there are many theories being put forward to explain this trait. Previously, overactivity of the dental lamina was thought to the reason; recently, it is believed that paired box (Pax) and muscle segment homeobox (MSX) genes are responsible for variations in the shape of the teeth.[8] MSX1 that maps to the short arm of chromosome 4 (4p16.1) is critical for the development of specific human teeth, i.e., the second premolars and the third molars. PAX9 mapped to the long arm of chromosome 14 (14q12-q13) is active in the formation of molars as well as mandibular second premolars and incisors.[9]

Embryological evidence suggests that tooth morphogenesis is characterized by transient signaling centers in the epithelium enamel knot.[8] These are nonproliferative transitory epithelial cells that serve a regulatory function by acting as a reservoir of cells for the fast growing enamel organ, and also play a role in the direct folding of the epithelial mesenchymal interface (Butler, 1956).[4] Apart from this, the primary enamel knot regulates the cuspal morphogenesis through expression of up to 20 molecules; the regulation involves factors such as fibroblast growth factors (FGF4 and FGF9), transforming growth factor beta (TGF-β), and bone morphogenic proteins (BMP2, BMP4, and BMP7).[8]

It is assumed that these molecules induce initiation of the secondary enamel knots at the sites of epithelial findings, which mark and coincide with the number and position of the other presumptive cusps during the early bell stage of tooth development.[8] Cusps, apart from the normal ones, form late in development, after the main cusps and are typically small.[5]

Knowledge of common variations occurring in tooth morphology can help in performing dental treatment and can also be used for anthropological research for the identification of a population.[7] The study of dental morphological characteristics and odontometry is important in anthropological research as it can provide information on the phylogenetic relationship within a species as well as variation and diversity within a population. Furthermore, knowing the variations in dental anatomy and morphology about each individual tooth can help in performing dental treatments such as endodontic, restorative, and orthodontic treatments.[10] The present case exhibited a four-cusp pattern on one side. The contralateral premolar had a two-cusp pattern.

The presence of these extra cusps may have dental problems such as caries in the pits or developmental grooves between the accessory cusp and the tooth, and sensitivity or devitalization of the tooth due to fracture or attrition of the protruded portion of the cusp that has pulpal extension.[8] In the case presented here, the grooves were nonretentive and did not show any caries or attrition. So, no treatment was carried out.

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