



Occlusal morphological variants of permanent mandibular second premolar

Dr Sandhya Jain¹, Dr Monica Chaurasia², Dr Deshraj Jain³

^{1,3}Professor & HOD, ²PG Student

^{1,2}Department of Orthodontics & Dentofacial orthopaedics

³Department of Prosthodontics

***Corresponding Author:**

Dr Monica Chaurasia

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Dental characteristics like tooth morphology, variations in form, size, dental anomalies offer each individual a singular identity.

Aim: The aim of the present study was to determine the prevalence of four and five cusp in permanent mandibular second premolars in an Malwa population.

Methods: A total of 1087 individuals of Malwa population were selected for the study at Government college of dentistry, Indore, Madhya Pradesh, India.

Results: The permanent mandibular second premolars had two cusps in maximum number of cases. Out of 613 females, 456 females (74.3%) had two cusp, 154 females (25.7%) had three cusp, one female had four cusp on left side and one female had five cusp on right side. For males out of 474, 311(65.6%) had two cusp and 163(34.4%) had three cusp. Out of 613 females 493 females had H groove pattern, 71 females had Y groove pattern, 46 had U grooves, 1 female has Modified Y groove pattern in four cusp mandibular second premolar 1 female has Modified H groove pattern in five cusp mandibular second premolar. For males out of 474, 387 males had H grooves, 48 males had Y grooves and 39 males had U groove pattern.

Conclusion: In our study we found that five cusp and four cusp permanent mandibular second premolars do exist. They must be rigorously recorded and further added to the literature. We should keep in mind that the cuspal variations that is seen in numerous population indicates ethnic diversity.

Keywords: Five cusp, four cusp, premolar, modified H grooves, Y grooves

Introduction

Dental characteristics like tooth morphology, variations in form, size and dental anomalies offer each individual a singular identity. Every single tooth possesses a collection of distinctive characteristics known as ‘tooth category characteristics’ that gave the idea of identification. Tooth morphology may be an indicator of genetic disturbances between populations (1). Mandibular second premolar is one in all those permanent teeth with various morphological pattern existing in numerous populations that’s why the data of its sort is extremely necessary from the clinical purpose. The morphology of the mandibular second bicuspid is variable. The ante-mortem dental records for comparison the teeth will facilitate within the determination of age, sex, race/ethnicity, habits, occupations, etc. which may offer additional clues

relating to the identity of the people. The rationale of study for the investigation is to quantify cuspal variation in permanent mandibular second premolar and report the variations in its cuspal numbers and types of grooves within the Malwa population of India.

Material and Methods

The study was conducted from November 2021 to January 2022 in the Department of Orthodontics at Government college of dentistry, Indore, Madhya Pradesh, India, to quantify the cusps and types of grooves in permanent mandibular second premolars. A total of sample size 1087 was examined, out of which 613 were females and 474 were males. The cases with any peculiar features were recalled and examined clinically again to confirm with the findings. The photographs of individuals were taken and data was recorded.

Inclusion criteria

- 1) Permanent mandibular second premolars free from occlusal dental caries.
- 2) Presence of bilaterally erupted permanent mandibular second premolars.
- 3) Absence of any innate abnormalities or medical issues.
- 4) Age within 12 -35 years,
- 5) No previous treatment in their permanent second premolars.
- 6) No systemic diseases.

Exclusion criteria:

- 1) Restorations and corrective within the permanent inframaxillary second bicuspid.
- 2) Any pathology teeth involving teeth as well as age connected changes.
- 3) Traumatic injuries of jaws.

Statistical analysis

The extent of the association between the number of two cusp and three cusp and gender was assessed using chi-square test. The statistical analysis was performed with SPSS version 20 (SPSS, Armonk, NY, USA) and is described in Table 1. The p-value is .001 shows highly significant.

Result

The permanent mandibular second premolars had two cusps in maximum number of cases. Out of 613 females, 456 females (74.3%) had two cusp, 154 females (25.7%) had three cusp, one female had four cusp on left side and one female had five cusp on right side. For males out of 474, 311(65.6%) had two cusp and 163(34.4%) had three cusp. The peculiarity of four and five cusp permanent mandibular second premolars was that it was present in females and were unilaterally present. The four cusp premolar was present on left side but five cusp was present on right side. Figure 1 represents the intra-oral photographs of one case with five cusp mandibular second premolar and Eigure 2 represent intra-oral photographs of one case with four cusp mandibular second premolar. The distribution of types of grooves in permanent mandibular second premolar was also determined. Out of 613 females 493 females had H groove pattern, 71 females had Y groove pattern, 46 had U grooves,1 female has Modified Y groove pattern in four cusp mandibular second premolar 1 female has Modified

H groove pattern in five cusp mandibular second premolar. For males out of 474, 387 males had H grooves, 48 males had Y grooves and 39 males had U groove pattern.

Discussion:

The mandibular second premolar is the fifth permanent tooth from the median line in the mandibular arch, located between the mandibular first premolar and first molar(2). Since the occlusal table is broader and similar to that of posterior teeth, this tooth has a function more like a molar. Mandibular second premolars, though generally are included under bicuspid, are of two types, the 2 cusp and 3 cusp varients (3). The morphology of mandibular second premolar generally shows two cusp with a single root.

This article presents one case with four cusp and one with five cusp permanent mandibular second premolar. No similar and opposite findings related to four and five cusp premolars were found within the literature. In our study, the foremost predominant variety of cusps was 2 cusp and 3 cusp but we found one case with four cusp and one case with five cusp premolar. The cuspal morphology of three cusp premolar has one large buccal cusp and two lingual cusp.

Considering the buccal aspect, a five cusp mandibular second premolar has 3 buccal cusp i.e, a large buccal cusp and small mesiobuccal and distobuccal cusp. Lingually, 2 lingual cusp, one large mesiolingual cusp and a small distolingual cusp is present. The mesiobuccal and distobuccal grooves extends to the buccal surface and divides the buccal surface into three cusp .The cusp ridges and marginal ridge limit the occlusal surface of the mandibular second premolar. In five-cusp type, mesiobuccal groove, distobuccal groove and a lingual groove exist. There is one small supplementary grooves arising from mesial pit giving a “Modified H pattern” groove appearance.

In Figure 3 the various cusp in five cusp premolar is denoted as

- 1- Buccal cusp
- 2- Mesiolingual cusp
- 3- Distolingual cusp
- 4- Mesiobuccal cusp

5- Distobuccal cusp

The buccal aspect of four cusp mandibular second premolar has a large mesiobuccal and small distobuccal cusp separated by groove. The lingual aspect has mesiolingual and distolingual cusp. So four cusp mandibular second premolar gives a "Modified Y pattern" groove as the supplemental grooves are attached to Y pattern groove.

In Figure 4 the various cusp in four cusp premolar is denoted as

- 1- Mesiobuccal cusp
- 2- Mesiolingual cusp
- 3- Distolingual cusp
- 4- Distobuccal cusp

Previous studies have shown predominance of 2 cusp pattern. In one study, Sunil *et al* determined the prevalence of 2 cusp mandibular second premolars is 52.8% in Kerala population, South India.(3) and similar findings were seen in study by Priyadharshini *et al* showed 56% of 2 cusp patterns.(4).

Regarding the groove patterns, the predominant groove pattern in our study was Y groove with 43.5%. Asrar *et al* showed a higher prevalence of Y groove and Sunil. S & Gopakumar. D study in Kerala population showed U groove pattern and Y groove pattern (45.27%). The study done by Ash & Nelson study reported a higher prevalence of Y shaped groove.

The etiology for extra cusp formation is unknown. There are various theories that explain the presence of extra cusp trait. Previously, overactivity of the dental lamina was thought to be 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.(5) 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. (5) Embryological evidence suggests that tooth morphogenesis is characterized by transient signaling centers in the epithelium enamel knot.(5). These are non-proliferative 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). 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). (5)

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. (5)

Conclusion:

Mandibular second premolar is one in all those permanent teeth with various morphological options existing in numerous population. The study of dental morphological characteristics and odontometry is very important because it will offer information on the biological process relationship between species as well as variations and diversities inside a population and common variations in dental features.

In our study we found that five cusp and four cusp permanent mandibular second premolars do exist. They must be rigorously recorded and further added to the literature. We should keep in mind that the cuspal variations that is seen in numerous population indicates ethnic diversity.

References:

1. Nayak R, Kotrashetti V, Nayak A, Patil V, Kulkarni M, Somannavar P, *et al*. Maxillary and Mandibular First Premolars Showing Three-Cusp Pattern: An Unusual Presentation. *Case Rep Dent*. 2013;2013:1–4.
2. Nelson SJ, Ash MM, Ash MM. *Wheeler's dental anatomy, physiology, and occlusion*. 9th ed. St. Louis, Mo: Saunders/Elsevier; 2010. 346 p.
3. Sunil S, Gopakumar D. Prevalence of the Two Variants of Mandibular Second Premolars in Kerala Population. *Int J Odontostomatol*. 2012;6(3):375–7.
4. Saveetha Dental College, Chennai - 600077, Tamil Nadu, India, M P, K. R D, Department of Oral and maxillofacial Pathology, Saveetha Dental

College, Chennai -600077, Tamil Nadu. Prevalence of two variants of permanent mandibular second premolars. Int J Curr Adv Res. 2017 Apr 28;6(4):3541-4.

5. Svsg N. Central Accessory Cusp – Unique Site. J Pediatr Neonatal Care [Internet]. 2015 Aug 4 [cited 2022 Feb 3];2(4). Available from: <https://medcraveonline.com/JPNC/central-accessory-cusp-ndash-unique-site.html>

Figure 1 with five cusp second premolar on right side



Figure 2 showing four cusp premolar on left side



Table 1 shows association between the number of cusps and gender

Number of cusps /Gender	2 cusp	3 cusp
Females (613)	456(74.3%)	154 (25.7%)
Males (474)	311(65.6%)	163(34.4%)
p-value	.0013	

Figure 3 with various cusp in five cusp premolar

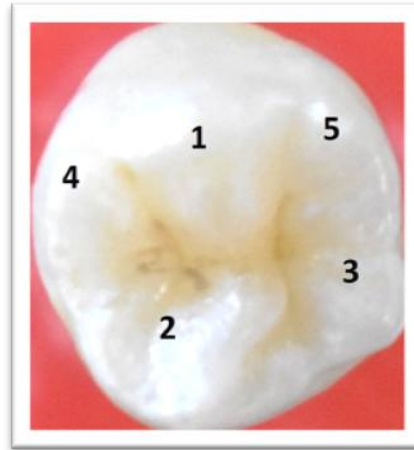


Figure 4 showing various cusp in four cusp premolar

