Prevalence of Morphological Variations in The Occlusal Aspect of Mandibular Second Premolar

Lekha D[1], Dr. Vikhashini P.M[*2]

[1]Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077.

[*2]Associate Professor, Department of Conservative Dentistry and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai - 600077.

Corresponding Author:

Associate Professor,

Email Id: vikhashinidr@gmail.com

ABSTRACT

Background: Mandibular second premolar is the successor of the deciduous mandibular second molar and is the fifth tooth from the midline. It often occurs in two morphological forms, two cusps and tricuspidata three cusps. Premolars are divided into 2 types namely bicuspid and tricuspid premolars. There are three variant occlusal groove patterns. Y shape pattern is associated with three cusps types and U shape and H shape patterns are associated with two cusps types.

Aim: To determine the prevalence of morphological variations in the occlusal aspect of mandibular second premolar.

Materials and methods: Cross sectional study was carried among 100 participants belonging to the Chennai population. Participants with fully erupted healthy mandibular second premolar on both the left and right side were included in the study. Dat was collected and tabulated in microsoft excel. Data was then exported to SPSS for appropriate statistical analysis.

Results: The most predominant pattern was Y followed by H. On the left mandibular second premolar Y - pattern was predominant, whereas on the right side it was the H pattern.

Conclusion: Within the limitations of the study we can conclude that Y pattern is the most common occlusal groove pattern in mandibular second premolar among Chennai population. Y pattern is most common on the right side and H among the left side. However the results are not in consensus with other population groups. This has opened the eye for a need to understand the interethnic and inter region variability of the occlusal morphology of mandibular second premolar.

Keywords: Mandibular second premolar; occlusal surface; tooth; groove pattern

1. INTRODUCTION

Mandibular second premolar is the successor of the deciduous mandibular second molar and is comparatively larger than the mandibular first premolar. It is the fifth tooth from the midline. Although the buccal cusp of the second premolar is not as noticeable, the mesiodistal measurement of crown and its general outline is indistinguishable to the first premolar[1]. The mandibular 2nd premolar crown mineralizes between 2 and 7 years of age[2]. The pentagonal or trapezoidal shape of the crown is noticeable from the facial aspect[3]. The anatomy of this tooth is particularly unpredictable, as is its eruptive potential and position in the dental arch. The tooth is often missing and hence before the deciduous molar is extracted, the reason for the missing tooth should be evaluated [4].

All premolars develop from four lobes with the exception of the mandibular second premolar which develops from five lobes [3]. This causes the mandibular second premolar to show elevated variability of crown morphology. It often occurs in two morphological forms, bicuspidata and tricuspidata . The three-cusp type appears more angular and square shaped from the occlusal aspect. The two-cusp type is more rounded and oval from the occlusal aspect. In mandibular second premolars, the lingual lobes are more developed making the cusps longer. There are three variant occlusal groove patterns. Y shape pattern

is associated with three cusps types and U shape and H shape patterns are associated with two cusps types [5]. Mandibular second premolars which have two lingual cusps generally show Y cusp pattern. On the other thought , second premolars having one or no lingual cusp generally show H pattern or U pattern [67].

The two cusps form has one large buccal functioning cusp and one small lingual cusp, the buccal inclined plane of which are functional while the lingual inclined planes are non functional. In three cusps form, there is one largest buccal functioning cusp and two lingual cusps, mesiolingual and distolingual [8] . In three-cusp type, mesiolingual cusp is larger than distolingual cusp and the buccal cusp is the largest of all . [1]. Literature shows that 45% of individuals have two cusp form, while 55% have three cusp form. Mandibular second premolar in general is larger than mandibular first premolar but the tricuspid variety is even larger [9] .

The mandibular second premolar may present another extremely infrequent anomaly: molarization . This molar-like morphology of the premolar consists of three buccal cusps and three, two, one, or no lingual cusps. The aetiology of dental anomalies remains largely unclear, but some anomalies in tooth structure, shape, and size result from many factors from disorders during the morphodifferentiation stage of development [10]. Morphological features of the crown, number and position of cusps and the sex of the patient are important in the field of dentistry, as it is known to influence the disease spread and treatment [11].

Research on condylar morphology using orthopantomograms has demonstrated the importance of imaging in detecting anatomical variations in dental structures.[12] Similarly, age estimation studies utilizing radiovisiography have emphasized the role of dental pulp morphology in forensic dentistry.[13] The relationship between periodontal health and temporomandibular disorders further underscores the need for understanding occlusal morphology.[14]

Variations in enamel structure, such as those observed in fluorosis-related caries prevalence, highlight the impact of developmental anomalies on occlusal surfaces.[15] Additionally, ultrasonographic studies on jaw swellings reinforce the role of imaging in diagnosing morphological deviations.[16] Case reports of rare presentations, such as metastatic hepatocellular carcinoma in the maxilla and mandible, further contribute to understanding how systemic conditions influence dental morphology.[17]

Functional aspects of occlusal morphology have also been explored through studies assessing maximum bite force in oral submucous fibrosis patients[18] and complete denture wearers.[19] The study of dental morphological characteristics is important in anthropological research as it can provide information on the phylogenetic relationship between species , as well as variations and diversities in a population . Moreover , knowing common variations in dental anatomy and morphology about each individual tooth can help in performing certain dental treatments and for also comparing the variations between different populations. Therefore, the results of this anatomical study can be used in both research and clinical aspects of dental science. Based on these inspirations, we have planned to do a study to determine the prevalence of morphological variations in the occlusal aspect of mandibular second premolar.

2. MATERIALS AND METHODS

Study design and study setting
This cross sectional study was conducted among the Chennai population to evaluate the prevalence of morphological variations in the occlusal aspect of mandibular second premolars. The study was initiated after approval from the institutional Scientific review board.

Study population and sampling
The sample size of the study was 100 and simple random sampling was done. The inclusion criteria for the study participants were presence of morphologically sound mandibular right and left second premolar. Exclusion criteria included absence of one or both mandibular second premolar, restored mandibular second premolar, attrited tooth and those with grossly decayed mandibular second premolar.

Data collection
A single calibrated examiner evaluated the patients. Demographic details like age, gender along with the occlusal groove pattern was recorded. Photographs were also taken for documentation and verification. The data were then tabulated using microsoft excel.

Statistical Analysis
The collected data was validated, tabulated and analysed with Statistical Package for Social Sciences for Windows, version 20.0 (SPSS Inc., Chicago, IL, USA) and results were obtained. Categorical variables were expressed in frequency and percentage. Chi-square test was used to test associations between categorical variables. P value < 0.05 was considered statistically significant.

3. RESULTS

The study was conducted among 100 participants. 80% of the participants were females and the mean age was 35.2 years. Y pattern or the 3 cusp pattern was the most common among the participants. On considering the right and left side separately, Y pattern was the most common pattern on the left side and it comprised 46% of the cases. Whereas, H pattern was seen among 38% of the participants and U pattern among 16% on the left side (Figure 1). On the contrary H pattern was the most common among the right side, followed by Y pattern 41% and U pattern 13% (Figure 2). However on comparing the right and left side chi square test did not show any statistical significance with P=0.506 (P>0.05) (Figure 3)
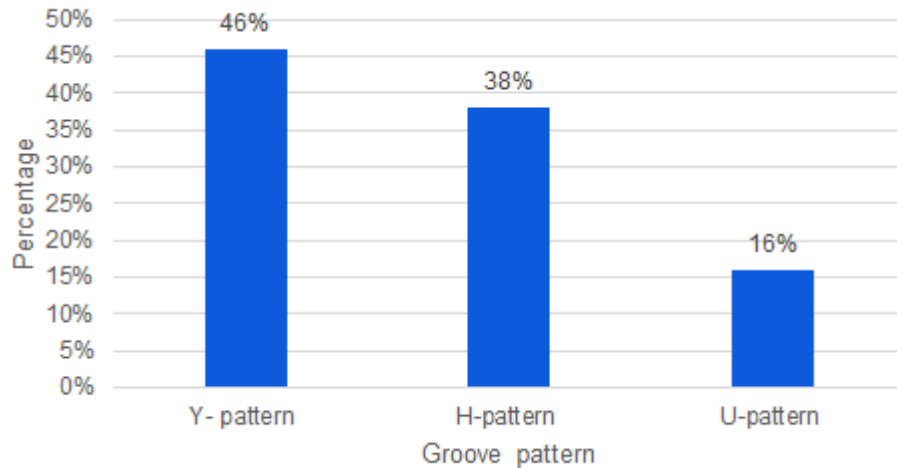
Figure 1: Bar graph representing the percentage distribution of various groove patterns in the left mandibular second premolar. X axis depicts the groove pattern and Y axis the percentage. 46% showing Y pattern, 38% H pattern and 16% showing U pattern.
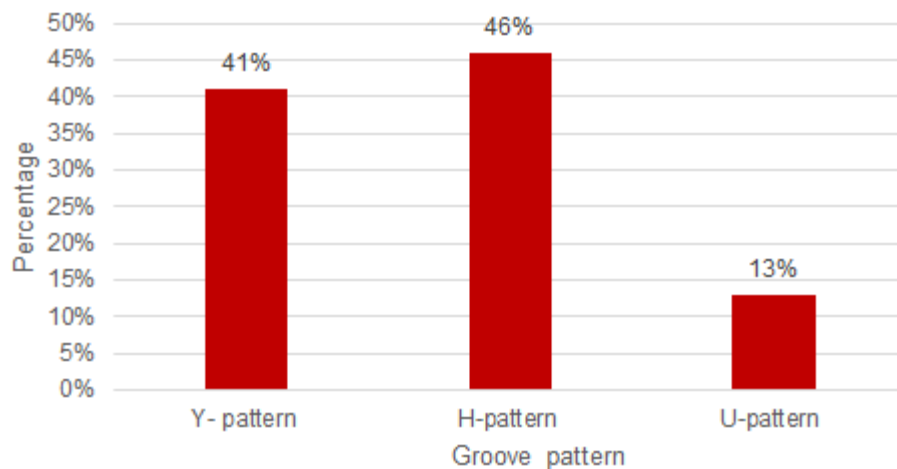
Figure 2: Bar graph representing the percentage distribution of various groove patterns in the right mandibular second premolar. X axis depicts the groove pattern and Y axis the percentage. 41% of the participants showing Y pattern, 46% H pattern and 13% showing U pattern.

Lekha D, Dr. Vikhashini P.M
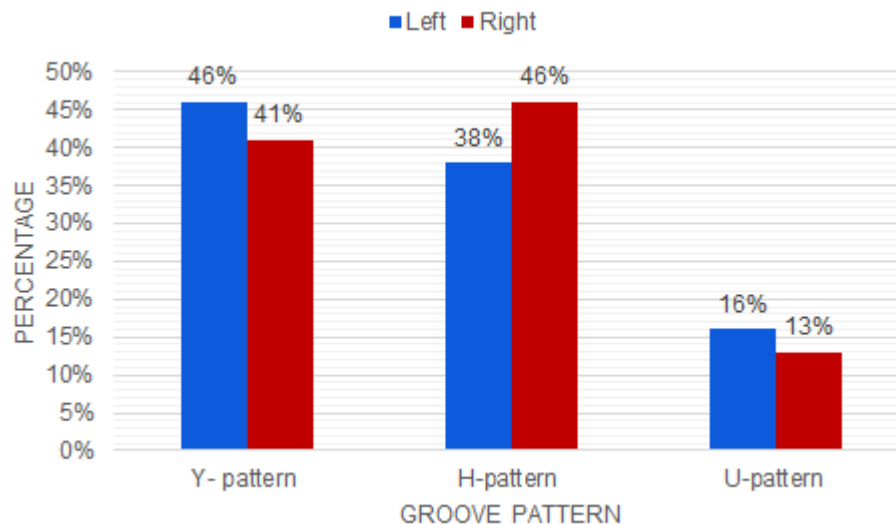
Figure 3: Bar graph showing the comparison of groove pattern between right and left mandibular second premolar. X axis depicts the groove pattern and Y axis the percentage. Y pattern was more common on the left side (46%) and H pattern on the right side (46%). However, the chi square test did not show any statistical analysis with p=0.506 (p>0.05).

4. DISCUSSION

Mandibular second premolar are well known for their numerous morphological variations. The common one being variations in the morphology of the crowns, number of roots and root canals[20]. The various reasons given for these variations include genetic, hormonal imbalance, local trauma etc[21]. The morphological changes have also been found to be more in certain ethnic groups than the other. Mandibular second premolar has always been a mystery for the dentist, as it imposes difficulty in treatment and prognosis. In the current study the prevalence of morphological variations in the occlusal aspect of mandibular premolar was evaluated among the Chennai population.

The result showed a predominance of Y pattern among the general population. This was in accordance with the result obtained by Suni et al in a study conducted among the Kerala population, where the predominant pattern was also Y. Whereas in the same study U pattern was the most common among the teeth with 1 or no lingual cusp [1]. This is in contrast with our study where the H pattern was more predominant than the U pattern among the 1 or no lingual cusp tooth. In another study by Yoo et al among the Korean population, the predominant pattern in 1or no lingual cusp is the U pattern which was also not in consensus with our study [6]. Study Ahmed et showed that the predominant pattern was the U pattern which encompassed 54% of the participants, which was in contrast to all the studies where Y was considered as the most common pattern [10]. His study was carried out among pakistani population.

On comparing with the results of other studies it could be hypothesized that there could be an interethnic and inter region variability in the morphology of the second premolar. This could be attributed to the genetic and environmental factors. Such studies on the occlusal morphological variations can provide information on the phylogenetic relationship between species and diversity between different populations. The study can be extended to involve a larger population and comparison between various population groups can also be carried out to check for the differences and similarities.

Since the study was done in a very small population The results may not be accurate and may vary if done in a larger population. The future scope of this study would be to include the genetic basis inorder to understand the mechanism behind the variations.

5. CONCLUSION

Within the limitations of the study we can conclude that Y pattern is the most common occlusal groove pattern in mandibular second premolar among Chennai population. Y pattern is most common on the right side and H among the left side. However the results are not in consensus with other population groups. This has opened the eye for a need to understand the interethnic and inter region variability of the occlusal morphology of mandibular second premolar.

6. ACKNOWLEDGEMENT

7. CONFLICT OF INTEREST

The authors declare no potential conflict of interest

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