Prevalence of Occlusal Morphological Patterns of Permanent Mandibular First Molar

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Abstract

Teeth are informative indicators for the study of human populations, serving as markers and the

bases for comparisons of genetic origin. Mandibular first molar is represented as 36 or 46 in the FDI system. The occlusal surfaces of posterior teeth occlude with the opposing occlusal surfaces of posterior teeth. The occlusal morphology differs in each posterior tooth. The occlusal aspect of posterior teeth is developed into cusps (5 or 4 or 6) and grooves (Y or + or X pattern). These cuspal patterns and groove patterns help in forensic identification in cases like gender determination and also to identify the ethnic background of an individual. Variation in degree of expression and frequency of teeth in dentitions of different populations is different which may be helpful for forensic identification. The aim of the study was to determine the prevalence of different occlusal morphological patterns of permanent mandibular first molars. The study included a predominantly South Indian population. Approval was received from the Institutional Review Board. Study was conducted with 100 participants who were randomly selected. The occlusal morphology patterns (number of cusps and groove pattern) of left and right permanent mandibular first molar were assessed from the photographs of the oral cavity and the date was recorded. Results showed that the most prevalent number of cusps in permanent mandibular first molar was 5 cusps (71%) and Most prevalent groove pattern in permanent mandibular first molar was Y pattern. It was also observed that the combination of the 5Y pattern was more prominent in females than in males.

Key Words: *groove pattern, cuspal pattern, permanent mandibular first molar, prevalence.*

Introduction

A dental trait in humans can be a valuable diagnostic tool in anthropological studies for classifying and characterizing different ethnic groups. Many studies have attempted to relate the prevalence of dental morphologies with different factors. Several variations, such as variations in the size, number of cusps, and groove pattern, have been observed in the mandibular molars of diverse populations. [1] 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 within a population.[2,]

Although tooth morphology may be an indicator of genetic distances between populations it should be viewed with caution. Almost all dental anatomy textbooks describe permanent mandibular first molars as 'Y' groove patterns with 5 cusp numbers. However, there may be variations such as the mandibular first molar having 4 cusps and also might have '+' pattern. [3]

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Gregory and Hellman and Hellman described variations in occlusal surfaces of the mandibular molars and developed morphological categories as "5 Y," "5+," "4Y" and "4+." And Takeshi Matsuda has used "6Y," "5Y," "4Y," "6+," "5+," "4+," "6X," "5X," "4X" pattern for mandibular

molars.[4]. The cusps, ridges, and grooves that decorate the crown surface also vary within different species of primates, together with the number and form of tooth roots.[5]

Dental morphological details are valuable for understanding variations among species and add information for phylogenetic and genetic studies. It is useful for collating and distinguishing populations as there are varying degrees of expression of dental features. Analysis of racial differences in dental morphology has led to the opinion that the common origins of people are reflected to a certain degree in their similar phenotypic patterns. [6]

Since only limited data are available on the prevalence of occlusal morphology patterns of mandibular first molars in the south indian population, there seems to be a need to investigate traits in this population. Previously our team had conducted numerous original studies [7-13] and surveys [14-20] over the past five years. Now we are focussing on using this knowledge and exploring the prevalence studies. The idea for this study stemmed from the current interest in forensic identification. The aim of the study was to determine the prevalence of occlusal morphological patterns of permanent mandibular first molar among south indian population.

Materials and Methods

A total of 100 participants were selected randomly. The study included a setting of a varied population predominantly South Indian population. The study was conducted in 2020 and approval was taken from the Institutional Review Board. Participants' name, gender and age were recorded. Total number of cusps and different groove patterns of right and left permanent mandibular first molars were examined from the oral cavity photographs taken.

Inclusion criteria

1. Permanent mandibular first molars free from occlusal caries.

2. Presence of bilaterally completely erupted permanent mandibular first molars.

3. Permanent mandibular first molars showing clear occlusal outline with all cusps and groove pattern.

Exclusion criteria

1. Participants with restorations and prosthesis in the permanent mandibular first molar.

2. Presence of unilateral erupted permanent mandibular first molar.

3. Participants with caries in permanent mandibular first molars.

The collected photographs were separated based on gender. The number of cusps and groove pattern of mandibular first molar was analysed from each photograph. We managed the incomplete or censored data by telephone communications. Statistical test used was descriptive statistics and chi square test. Statistical software used was SPSS software. P value less than 0.05 was considered as statistically significant and the confidence level is 95%.

Results and Discussion

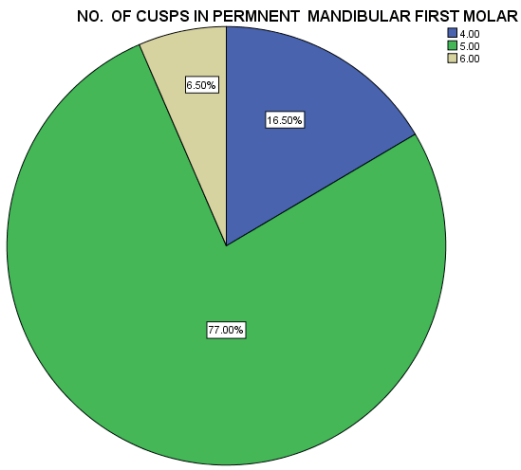

Figure 1 : Pie chart showing distribution of cuspal patterns in permanent mandibular first molar. The most predominant pattern was 5 cusps 77% (green colour), followed by 16.5% 4 cusps (blue colour) and 6.5% 6 cusps (khaki colour)

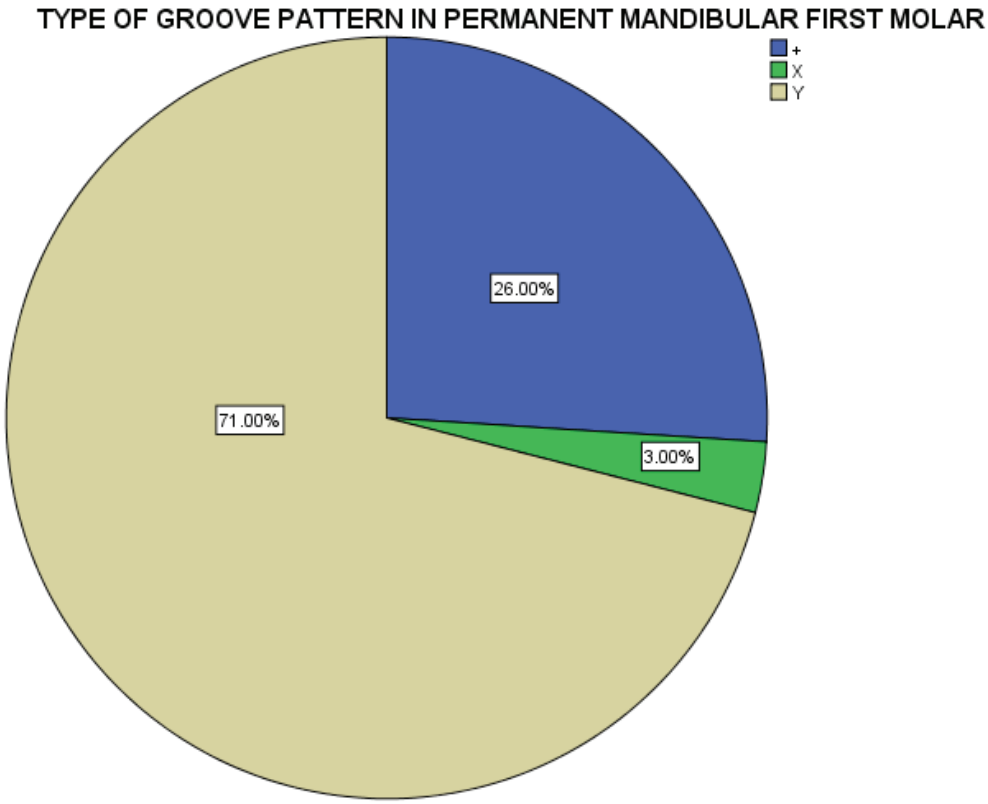

Figure 2 : The pie chart shows the distribution of groove patterns in permanent mandibular first molar. The most predominant pattern was Y pattern 71% (khaki colour), followed by 26% + pattern (blue colour) and 3% X pattern.(green colour)

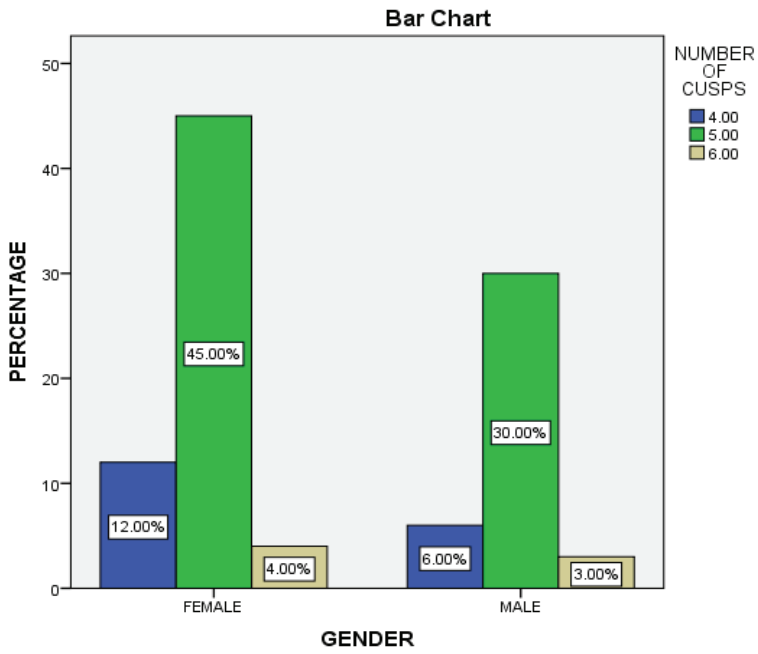

Figure 3 : Bar graph showing association between gender and number of cusps in permanent mandibular first molar. X-axis shows gender and Y-axis shows the percentage of participants. Green denotes 5 cusps, blue denotes 4 cusps and khaki denotes 6 cusps. The most predominant cuspal pattern in both genders was found to be 5 cusp patterns, with females showing slightly higher, but was statistically not significant. Chi square analysis, p=0.853 (p>0.05 indicating statistically not significant).

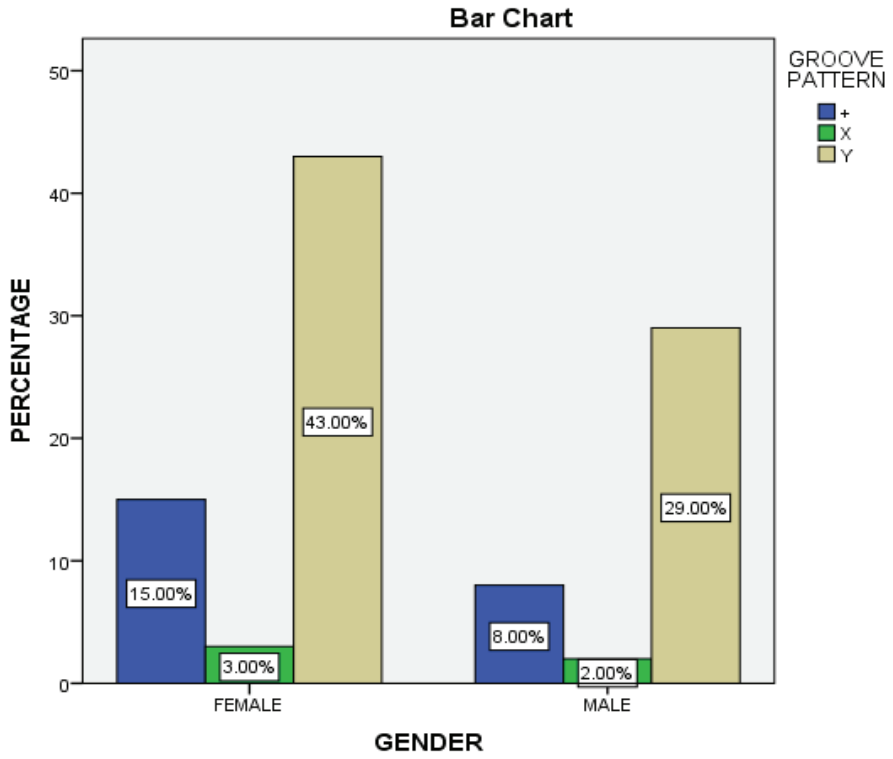

Figure 4 : Bar graph showing association between gender and groove pattern in permanent mandibular first molar. X-axis shows gender and Y-axis shows the percentage of participants. Khaki colour denotes Y pattern, blue denotes +, and green denotes X pattern. The most predominant groove pattern in both genders was found to be Y pattern with females showing slightly higher, but was statistically not significant. Chi square analysis, p=0.894 (p>0.05 indicating statistically not significant)

Table1 : Comparison of our study with the previous literature :

	Most prevalent cusp pattern	Most prevalent groove pattern	Most Prevalent no. of cusps in 36	Most Prevalent no. of cusps in 46	Most Prevalent groove pattern in 36	Most Prevalent groove pattern in 46	Most Prevalent no. of cusps in males	Most Prevalent no. of cusps in females	Most Prevalent groove pattern in males	Most Prevalent groove pattern in females
Present study	5	Y	5	5	Y	Y	5	5	Y	Y
Sneha et al	5	+	-	-	-	-	5	5	Y	+
Dholia Et al	5	Y	5	5	Y	Y	5	5	Y	Y
Guo Et al	5	Y	-	-	-	-	-	-	-	-
Hasund Et al	5	Y	-	-	-	-	-	-	-	-

The most prevalent number of cusps in the present study was 5 cusps (77%) (Figure 1). Our study was in accordance to the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent number of cusps in the mandibular first molar was 5 cusps.(Table 1) This indicates that the most prevalent cuspal pattern in different populations was the 5 cusp pattern.

The most prevalent groove pattern in the present study was Y pattern (71%) (Figure 2). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent groove pattern in the mandibular first molar was Y pattern .(Table 1). But the study by Sneha et al showed that the most prevalent groove pattern was + pattern. (62%), which was not in accordance with our study. This indicates that the groove pattern could be different in different populations

The most prevalent number of cusps in 36 in our study was 5 cusps(74%) . Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent number of cusps in 36 was 5 cusps (Table 1) . This indicates that the most prevalent number of cusps in 36 among different populations was the 5 cusp pattern.

The most prevalent number of cusps in 46 in our study is 5 cusps (78%). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent number of cusps in 46 was 5 cusps (Table 1). This indicates that the most prevalent number of cusps in 46 among different populations was 5 cusps.

The Most prevalent groove pattern in 36 in our study is Y pattern (73%). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent groove pattern in 36 is Y pattern(Table 1). This indicates that the most prevalent groove pattern in 36 among different populations was Y pattern.

The Most prevalent groove pattern in 46 in our study is Y pattern (71%). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent groove pattern in 46 was Y pattern(Table 1). This indicates that the most prevalent groove pattern in 46 among different populations was Y pattern.

Most prevalent number of cusps in males in our study is 5 cusps (71%). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent number of cusps in males was 5 cusps(Table 1). This indicates that the most prevalent number of cusps in males among different populations was 5 cusps.

Most prevalent number of cusps in females in our study is 5 cusps (79.5%). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent number of cusps in females was 5 cusps(Table 1). This indicates that the most prevalent number of cusps in females among different populations was 5 cusps.

Most prevalent groove pattern in males in our study is the Y pattern (66.7%) Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent groove pattern in males was Y pattern(Table 1). This indicates that the most prevalent groove pattern in males among different populations was Y pattern.

Most prevalent groove pattern in females in our study is Y pattern (73%). Our study was in accordance with the previous studies like Sneha et al, Dholia et al, Hasund et al and Guo et al [21 - 23] which showed that the most prevalent groove pattern in females is Y pattern(Table 1). But the study by Sneha et al disagree showing that the most prevalent groove pattern in females is + pattern (48%). This indicates that the most prevalent groove pattern in females could be different among different populations .

Comparison between gender in our study, showed that both genders showed the most prevalent cusp as 5 cusps and most prevalent groove pattern to be Y pattern (figure 3, 4). This showed that there were no gender differences on cuspal and groove patterns in our study.

The limitations of the study include less sample size

and homogenous population. This study expects a larger population in further studies for better understanding of the prevalence pattern of mandibular first molars, as it can be a source for forensic identification.

Conclusion

From the study, it was observed that the most common occlusal morphology in permanent mandibular first molar is 5 cusps and Y groove pattern. It was also observed that the combination of the "5Y" pattern was slightly more in females than in males. Thus it is concluded that more studies on different populations is needed to see variation in degree of expression pattern,which may be helpful for forensic identification.

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Conflict of Interest

The author declares that there were no conflict of interest in the present study

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Ethical Clearance: It is taken from "Saveetha Institute Human Ethical Committee" (Ethical Approval Number- SDC/SIHEC/2020/DIASDATA/0619-0320)

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