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Research Article

OCCLUSAL MORPHOLOGY OF PERMANENT MANDIBULAR SECOND MOLAR

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A B S T R A C T

Background: The morphology of mandibular second molar has changed from pattern 'y' to '+' during the process of evolution. They can be classified as +4, 4-y, +5, 5-y,+6 and 6-y. Variation in occlusal morphology in different populations have been noted.

Aim: To study different occlusal morphology of permanent mandibular second molars.

Methods: This study comprised of a total of 100 participants selected by random sampling method. Number of cusps and groove patterns of permanent mandibular second molar were examined clinically and photographs of the same were taken.

Results: Overall results of our study showed the 4 cusps form (69%), the "+" pattern (77%) and the occlusal morphology with "+4" pattern (65%) were predominant among the study population. On analyzing the gender, the 4 cusps form, the "+" pattern and the occlusal morphology with "+4" pattern was predominant both in females and males.

Conclusion: The most common occlusal morphology in permanent mandibular second molar in this study was "4 cusp" and "+" groove pattern. It may be concluded that variation in degree of expression and frequency of teeth in dentitions of different populations is different, which may help in forensic identification.

INTRODUCTION

Dental anthropology is the study of the origin and the variations of the human dentition.

It is a useful tool to identify geographic or racial affi nities. Dentoanthropologic structures useful for identifi cation purposes include cusp size, number and location of cusps, occlusal pattern, root confi guration, number and arrangement of teeth, and individual tooth measurements. [2]

The large variations in the morphological features and their form may not be easily altered; thus, a trait of human dentition can be a valuable diagnostic tool for anthropological studies in classifying and characterizing different ethnic group. [1] In anthropological studies, morphological catagories used to describe these variations in occlusal surfaces of the mandibular molars are based on a topology developed by Gregory and Hellman [2].

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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. However it is observed that there are different degrees of expression and frequency of teeth in dentitions of different populations.

The criteria for determing whether the pattern is 'Y' or '+' is the contact of metaconid with the hypoconid. If the contact occurs, the pattern resembles 'Y'; if no contact occurs, the pattern resembles '+'. The occurrence of 'Y' or '+' form is independent of the number of cusps. Thus groove pattern and the cusp number are considered separately because their evolutionary changes are not correlated well phenotypically.[2] The six types of occlusal patterns generally classified are as follows: '+4', '4-Y', '+5', '5-Y', '+6', '6-Y'.

This study was undertaken to find the prevalence of six types of mandibular second molar in the South Indian population

MATERIALS AND METHODS

A total of 100 participants from Saveetha Dental College, Chennai, India were randomly selected. The inclusion and exclusion criteria were as follows:

Inclusion criteria

- Teeth free from occlusal or proximal caries.
- Presence of bilaterally completely erupted permanent mandibular second molars.
- Molars showing clear occlusal outline with all cusps and groove pattern.
- Participant of Indian population.

Exclusion criteria

- Any pathology involving teeth including age-related changes.
- Traumatic injuries of jaws or teeth.
- Participants with cusp grinding, restorations and prosthesis.
- Molars clinically showing hypoplastic features.

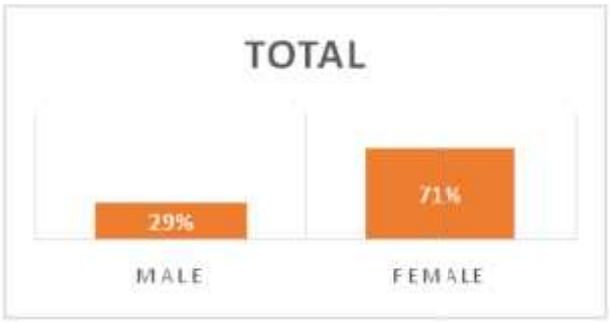
The participant consent form and the participant information details (name, age, gender, occupation, address were collected. Direct oral examination was performed. The examinations were carried out using a dental mouth mirror and dental explorer. A 12 megapixel camera was used for taking the photograph. Photographs of the mandibular arch, right and left permanent mandibular second molar were taken. The number of cusp, groove pattern and occlusal morphologies of both left and right permanent mandibular second molar were noted.

RESULTS

Table 1 and graph 1 shows the gender distribution of the total no. of participants. Out of 100 participants, 29% were males and 71% were females. The number of male participants were less when compared to the female participants.

Table 1 Gender distribution

S.No.	Gender	Total
1	Male	29(29%)
2	Female	71(71%)



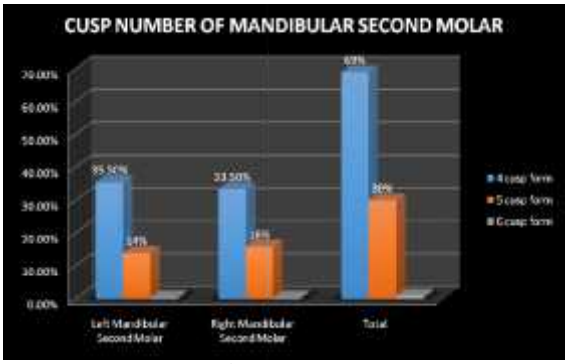
Graph 1 Gender distribution of study population

Table 2 and graph 2 shows the total no. of cusps of permanent mandibular second molar. The 3 different cusps form in both left and right mandibular second molar were tabulated. The 4 cusps form were highest with 69% (138 teeth). The 5 cusps form were about 30% (60 teeth).

Table 2 Number of cusps of permanent mandibular second molar

S.No.	No. of cusps	Left Mandibular Second Molar	Right Mandibular Second Molar	Total
1	4 cusp form	71(35.5%)	67(33.5%)	138(69%)
2	5 cusp form	28(14%)	32(16%)	60(30%)
3	6 cusp form	1(0.5%)	1(0.5%)	2(1%)

And the 6 cusp form were about 1% (2 teeth). So it is concluded that the 4 cusps form (69%) were predominant among the study population.

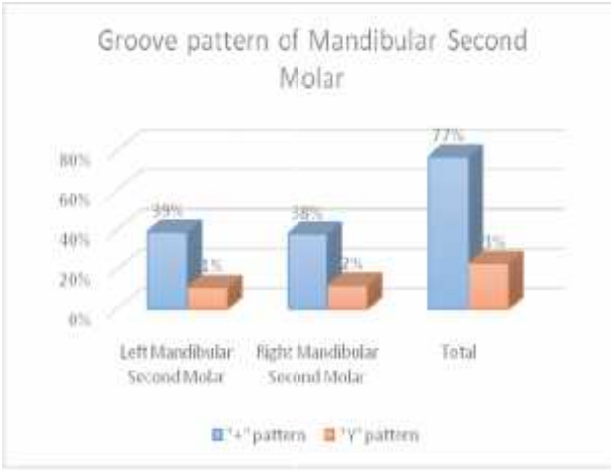


Graph 2 Cusp number of permanent mandibular second molar

Table 3 and graph 3 shows the groove pattern of permanent mandibular second molar. Here the different groove patterns in both left and right mandibular second molar were tabulated. The "+" pattern was prevalent for about 77% (154 teeth) and the "Y" pattern was prevalent for about 23% (46 teeth). So it is shown that the "+" pattern (77%) were predominant among the study population.

Table 3 Groove pattern of permanent mandibular second molar

S.No.	Groove pattern	Left Mandibular Second Molar	Right Mandibular Second Molar	Total
1	"+" pattern	78(39%)	76(38%)	154(77%)



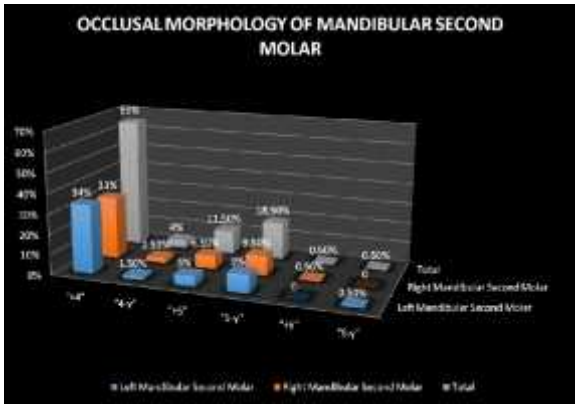
Graph 3 Groove pattern of permanent mandibular second molar

Table 4 and graph 4 shows the occlusal morphology of permanent mandibular second molar. Here the different occlusal morphologies of both the left and right mandibular second molarwere tabulated.

Table 4 Occlusal morphology of permanent mandibular second molar

S.No.	Occlusal morphology	Left Mandibular Second Molar	Right Mandibular Second Molar	Total
1	"+4"	68(34%)	62(31%)	130(65%)
2	"4-y"	3(1.5%)	5(2.5%)	8(4%)
3	"+5"	10(5%)	13(6.5%)	23(11.5%)
4	"5-y"	18(9%)	19(9.5%)	37(18.5%)
5	"+6"	0	1(0.5%)	1(0.5%)
6	"6-y"	1(0.5%)	0	1(0.5%)

From the table, it is noted that the "+4" pattern was prevalent for about 65% (130 teeth) , "4-Y" was prevalent for about 4% (8 teeth) , "+5" pattern was prevalent for about 11.5% (23 teeth) , "5-Y" was prevalent for about 18.5% (37 teeth) , "+6" pattern was prevalent for about 0.5% (1 teeth), "6-Y" pattern was prevalent for about 0.5% (1 teeth). So it is concluded that the occlusal morphology with "+4" pattern (65%) was predominant among the study population.

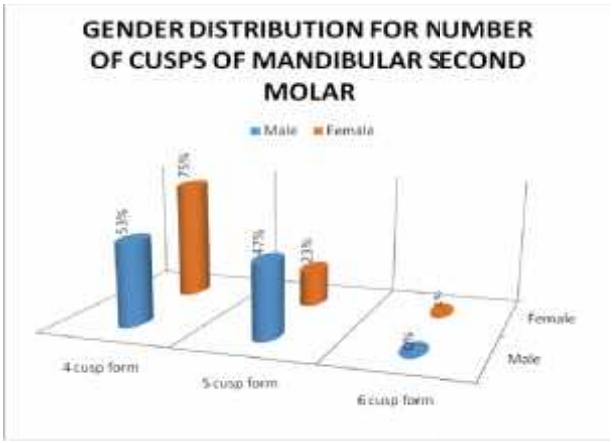


Graph 4 Occlusal morphology of permanent mandibular second molar

Table 5 and graph 5 shows the gender distribution for the no. of cusps of mandibular second molar. Out of the 29 males (58 teeth), the 4 cusps form was prevalent for about 53% (31 teeth), the 5 cusps form was prevalent for about 47% (27 teeth) and the 6 cusps form was absent. Out of the 71 females (142 teeth), the 4 cusps form was prevalent for about 75% (107 teeth), the 5 cusps form was prevalent for about 23% (33 teeth) and the 6 cusps form was for about 1% (2 teeth). So it is shown that the 4 cusps form was predominant both in females and males.

Table 5 Gender distribution for number of cusps of permanent mandibular second molar

S.NO.	Gender	4 cusp form	5 cusp form	6 cusp form
1	Male	31(53%)	27(47%)	0(0%)
2	Female	107(75%)	33(23%)	2(1%)

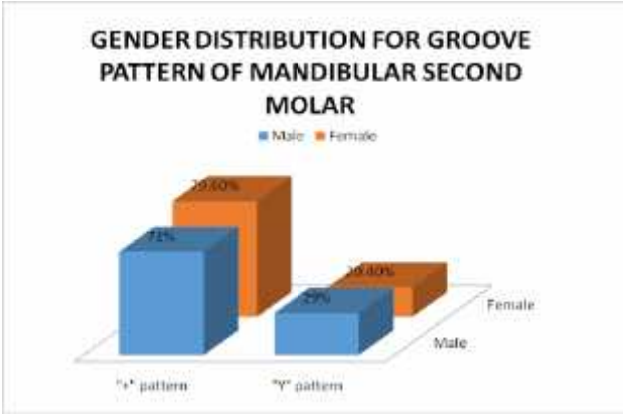


Graph 5 Gender distribution for number of cusps of permanent mandibular second molar

Table 6 and graph 6 shows the gender distribution for the groove pattern of mandibular second molar. Out of the 29 males (58 teeth), the "+" pattern was prevalent for about 71% (41 teeth) and the "Y" pattern was prevalent for about 29% (17 teeth). Out of the 71 females (142 teeth), the "+" pattern was prevalent for about 79.6% (113 teeth) and the "Y" pattern was prevalent for about 20.4% (29 teeth). So it is shown that the "+" pattern was predominant both in females and males.

Table 6 Gender distribution for groove pattern of permanent mandibular second molar

S.No.	Gender	"+" pattern	"Y" pattern
1	Male	41(71%)	17(29%)
2	Female	113(79.6%)	29(20.4%)

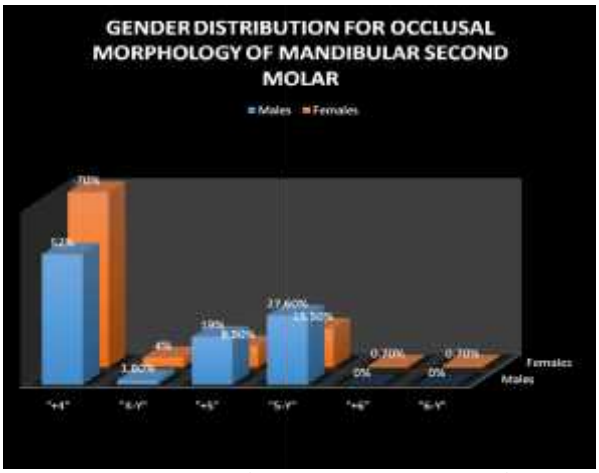


Graph 6 Gender distribution for groove pattern of permanent mandibular second molar

Table 7 and graph 7 shows the gender distribution for the occlusal morphology of permanent mandibular second molar. Out of the 29 males (58 teeth), the "+4" pattern was prevalent for about 52% (30 teeth), the "4-Y" pattern was prevalent for about 1.8% (1 teeth), the "+5" pattern was prevalent for about 19% (11 teeth), the "5-Y" pattern was prevalent for about 27.6% (16 teeth), and the "+6" pattern and the "6-Y" pattern both was prevalent for about 0% (0 teeth). Out of the 71 females (142 teeth), the "+4" pattern was prevalent for about 70% (100 teeth), the "4-Y" pattern was prevalent for about 4% (6 teeth), the "+5" pattern was prevalent for about 8.5% (12 teeth), the "5-Y" pattern was prevalent for about 15.5% (22 teeth), and the "+6" pattern and the "6-Y" pattern both was prevalent for about 0.7% (0 teeth). So it is shown that the "+4" pattern was predominant both in females and males.

Table 7 Gender distribution for occlusal morphology of permanent mandibular second molar

S.No	Gender	"+4"	"4-Y"	"+5"	"5-Y"	"+6"	"6-Y"
1	Males	30(52%)	1(1.8%)	11(19%)	16(27.6%)	0(0%)	0(0%)
2	Females	100(70%)	6(4%)	12(8.5%)	22(15.5%)	1(0.7%)	1(0.7%)



Graph 7 Gender distribution for the occlusal morphology of permanent mandibular second molar.

Overall results of our study showed the 4 cusps form (69%), the "+" pattern (77%) and the occlusal morphology with "+4" pattern (65%) were predominant among the study population. On analyzing the gender, the 4 cusps form, the "+" pattern and the occlusal morphology with "+4" pattern was predominant both in females and males.

DISCUSSION

Dental anthropology is the study of the origin and the variations of the human dentition. [13] It is a useful tool to identify geographic or racial affi nities. Dentoanthropologic structures useful for identifi cation purposes include cusp size, number and location of cusps, occlusal pattern, root confi guration, number and arrangement of teeth, and individual toothmeasurements.

Few dental anthropological studies have investigated the association between these dental features and crown traits in humans using quantitative methods. [2] In this type of studies, some researchers used intraoral examination, some studied dental casts, and some used both methods. Intraoral examination has the advantages of accurate recording, proper identification of teeth, and follow-up of patients when needed. It ensures racial and sexual identification. A sample of extracted teeth would be less than ideal. [2] In this study, intraoral examination was conducted.

In our study, the predominant number of cusps in permanent mandibular second molar was found to be 4 cusp pattern (69%). This was found to be in accordance with the studies done by Mosharraf *et al* and Guo *et al*. But the other studies like Hasund and Bang showed 4 cusp and 5 cusp both to be predominant and Hellman *et al* showed 5 cusp pattern to be predominant. [2, 3, 4, 5]

In our study, the predominant groove pattern in permanent mandibular second molar was found to be '+' (77%). This was found to be in accordance with the studies done by Mosharraf *et al* and Guo *et al*. But the other studies like Hasund and Bang showed '+' and Hellman showed 'Y' to be predominant. [2, 3, 4, 5]

In our study, the predominant occlusal morphology in the permanent mandibular second molar was found to be '+4' (65%). This was found to be in accordance with the studies done by Mosharraf *et al* and Guo *et al*. But the other studies like Hasund and Bang showed '+4' and '+5' both to be predominant and Hellman showed '5-Y' to be predominant. [2, 3, 4, 5]

On analyzing the gender, the 4 cusps form, the "+" pattern and the occlusal morphology with "+4" pattern was predominant both in females and males in our study.

CONCLUSION

In this study, the most frequent occlusal configuration was four-cusp form (69%) and the predominant groove pattern was "+" shape (77%). The most frequent occlusal morphology was the "+4" form (65%). This high percentage of groove pattern with "+" shape and low percentage of primitive "Y" pattern in this study show a high evolutionary trend persisting in Indian population. This study also showed that the "+4" occlusal morphology was more prevalent among the females than the males. This research can be used for the anthropological researches and the clinical aspects of the dental sciences. [2]

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