

DENTAL CROWDING AND ITS RELATIONSHIP TO DENTAL MORPHOLOGY IN AN ETHNIC POPULATION

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ABSTRACT

OBJECTIVES: The purpose of this study was to compare and evaluate individual mesiodistal (MD) and buccolingual (BL) tooth sizes as well as the crown proportions in the permanent dentition with moderate, mild and no crowding. **METHOD:** The current study consisted of study models of 90 Assamese subjects aged 12 to 18 years. Subjects were divided into three groups based on the amount of crowding: no crowding (zero discrepancy); mild crowding (0.1 to 5mm of discrepancy) and moderate crowding (> 5mm discrepancy). An electronic digital caliper was used to measure the individual mesio-distal and bucco-lingual tooth width; and arch perimeter was measured by brass wire. **RESULTS:** There was statistically significant difference in the mesio-distal tooth size, bucco-lingual tooth size and in crown proportions in the different groups. **CONCLUSION:** The maxillary central incisors crown proportions; mesiodistal tooth size of maxillary and mandibular second premolar, maxillary lateral incisors; and lastly buccolingual tooth size of both premolars in maxillary arch and mandibular central incisors are largely responsible for the variation that is seen in the dental crowding in the Assamese population.

KEYWORDS: Crowding; crown proportion; mesiodistal (MD); buccolingual (BL)

INTRODUCTION

Nance^[1] described dental crowding as the difference between the space needed in the dental arch and the space available in that arch, that is the space discrepancy. Thus, crowding or spacing can be described as an expression of an altered

tooth tissue ratio or as a dentoalveolar disproportion. Many investigators have examined the relationship of arch size and tooth size with crowding. The observations made in these studies are quite conflicting. Lundstrom^[2] and Fastlicht^[3] found on one hand, a significant relationship of dental crowding with tooth size, whereas Mills^[4] and Howe *et al.*,^[5] found a more significant relationship of dental crowding with arch dimensions. Although previous studies have compared the tooth size between dental arches with or without crowding in some specific ethnic group, so far no such studies have been done on the Assamese population. Thus the current study is undertaken to compare individual mesiodistal (MD) and buccolingual (BL) tooth sizes as well as the crown proportions in permanent dentition with moderate, mild and no crowding. And also to evaluate the effect of mesiodistal (MD) and buccolingual (BL) tooth sizes and crown proportion on dental crowding.

MATERIALS AND METHODS

The study had been conducted on 90 Assamese subjects who were randomly selected from the patients seeking orthodontic treatment in the Department of Orthodontics, Regional Dental College, Guwahati and from local schools. The selection criteria were; 1) Assamese ethnicity, residing in Assam, which was confirmed from family history; 2) Permanent dentition completely erupted except the third molars; 3) Age range between 12 to 18 years; 4) Subjects with no prior orthodontic treatment done. Subjects were divided into three test groups based on the findings obtained as follows:- Group-I: No crowding (zero discrepancy), having 30 subjects (blue coloured model). Group-II: Mild crowding (0.1 to 5 mm of discrepancy), having 30 subjects

Table 1: Comparison of the individual mesiodistal tooth sizes between no, mild and moderate crowding in mandibular arches

Mesiodistal Tooth size (mm)	Lower arch (Mandibular arch)		
	No crowding (n=30) Mean±SD	Mild crowding (n=30) Mean±SD	Moderate crowding (n=30) Mean±SD
1st Molar	10.94 ^a ±0.13	10.93 ^a ±0.16	11.21 ^a ±0.11
2nd Premolar	6.97 ^b ±0.07	7.11 ^{ab} ±0.08	7.28 ^a ±0.08
1st Premolar	7.14 ^b ±0.08	7.23 ^b ±0.08	7.46 ^a ±0.08
Canine	6.99 ^b ±0.09	6.97 ^b ±0.08	7.23 ^a ±0.08
Lateral incisor	6.22 ^a ±0.08	6.21 ^a ±0.07	6.41 ^a ±0.08
Central incisor	5.56 ^a ±0.06	5.65 ^a ±0.06	5.75 ^a ±0.07

Table 2: Comparisons of the individual mesiodistal tooth sizes between no, mild and moderate crowding in maxillary arches

Mesiodistal Tooth size (mm)	Upper arch (Maxillary arch)		
	No crowding (n=30) Mean±SD	Mild crowding (n=30) Mean±SD	Moderate crowding (n=30) Mean±SD
1st Molar	9.99 ^b ±0.10	10.21 ^b ±0.11	10.50 ^a ±0.06
2nd Premolar	6.59 ^b ±0.08	6.78 ^{ab} ±0.09	7.02 ^a ±0.08
1st Premolar	7.06 ^a ±0.09	7.18 ^a ±0.07	7.20 ^a ±0.08
Canine	7.85 ^a ±0.09	7.96 ^a ±0.08	8.06 ^a ±0.07
Lateral incisor	7.02 ^b ±0.12	7.30 ^{ab} ±0.08	7.42 ^a ±0.11
Central incisor	8.90 ^a ±0.12	8.66 ^a ±0.08	8.91 ^a ±0.10

Table 3: Comparison of the individual buccolingual tooth sizes between no, mid and moderate crowding in mandibular arches

Buccolingual Tooth size(mm)	Lower arch (Mandibular arch)		
	No crowding (n=30) Mean±SD	Mild crowding (n=30) Mean±SD	Moderate crowding (n=30) Mean±SD
1st Molar	10.62 ^a ±0.09	10.81 ^a ±0.11	10.84 ^a ±0.08
2nd Premolar	8.38 ^a ±0.10	8.70 ^a ±0.09	8.61 ^a ±0.09
1st Premolar	7.70 ^a ±0.09	7.92 ^a ±0.09	7.92 ^a ±0.08
Canine	7.26 ^a ±0.09	7.20 ^a ±0.13	6.74 ^b ±0.13
Lateral incisor	6.39 ^a ±0.08	6.29 ^a ±0.09	6.13 ^a ±0.08
Central incisor	6.15 ^a ±0.09	6.00 ^{ab} ±0.09	5.69 ^b ±0.11

(yellow coloured model). Group-III: Moderate crowding (5.1 mm or more of discrepancy), having 30 subjects (red coloured model). Maxillary and mandibular arches were classified separately. Measurements obtained from the plaster casts included the maximum mesiodistal (Fig. 1) (MD)^[7] and buccolingual (Fig. 2) (BL)^[8] tooth sizes of all permanent teeth except second and third molars. Once both tooth sizes were obtained, MD/BL ratio was calculated for each tooth as a representation of the crown proportion.^[9] Crowding is defined as the

difference in millimeters between the arch perimeter and the mesiodistal tooth size sum.^[10,11] All measurements were made by a single calibrated examiner, by means of a sliding digital caliper to the nearest 0.01 mm. When first and second measurements differ by more than 0.2 mm, the tooth was re-measured and a third measurement was done and registered. The data collected was analyzed statistically. In the present study, the range of age of the subjects was 12 to 18 years, or early adulthood. This was in accordance with the study of Doris *et al.*,^[6] who

Table 4: Comparison of the individual buccolingual tooth sizes between no, mid and moderate crowding in maxillary arches

Buccolingual Tooth size(mm)	Upper arch (Maxillary arch)		
	No crowding (n=30) Mean±SD	Mild crowding (n=30) Mean±SD	Moderate crowding (n=30) Mean±SD
1st Molar	11.15 ^a ±0.12	11.23 ^a ±0.09	11.38 ^a ±0.06
2nd Premolar	9.28 ^b ±0.10	9.48 ^{ab} ±0.09	9.73 ^a ±0.07
1st Premolar	9.36 ^b ±0.10	9.57 ^{ab} ±0.07	9.64 ^a ±0.07
Canine	7.98 ^a ±0.12	7.91 ^a ±0.13	7.31 ^b ±0.17
Lateral incisor	6.72 ^a ±0.12	6.75 ^a ±0.10	6.68 ^a ±0.11
Central incisor	7.60 ^a ±0.12	7.54 ^a ±0.11	7.29 ^a ±0.09

Table 5: Comparison of the individual crown proportions between no, mild and moderate crowding in mandibular arches

Crown proportions (MD/BL%)	Lower arch (Mandibular arch)		
	No crowding (n=30) Mean±SD	Mild crowding (n=30) Mean±SD	Moderate crowding (n=30) Mean±SD
1st Molar	103.04 ^a ±0.90	101.15 ^a ±1.15	103.49 ^a ±0.93
2nd Premolar	83.25 ^a ±0.76	81.78 ^a ±0.83	84.81 ^a ±1.13
1st Premolar	92.96 ^a ±1.08	91.41 ^a ±0.88	94.38 ^a ±1.19
Canine	96.52 ^b ±1.33	97.40 ^b ±1.61	108.30 ^a ±2.02
Lateral incisor	97.54 ^b ±1.38	99.22 ^b ±1.55	105.14 ^a ±1.96
Central incisor	90.89 ^b ±1.45	94.63 ^b ±1.53	102.12 ^a ±2.27

Table 6: Comparison of the individual crown proportions between no, mild and moderate crowding in maxillary arches

Crown proportions (MD/BL%)	Upper arch (Maxillary arch)		
	No crowding (n=30) Mean±SD	Mild crowding (n=30) Mean±SD	Moderate crowding (n=30) Mean±SD
1st Molar	89.76 ^a ±0.93	90.89 ^a ±0.71	92.33 ^a ±0.57
2nd Premolar	71.16 ^a ±0.75	71.55 ^a ±0.93	72.18 ^a ±0.85
1st Premolar	75.51 ^a ±0.59	74.97 ^a ±0.60	74.71 ^a ±0.71
Canine	98.70 ^b ±1.23	101.43 ^b ±2.38	111.79 ^a ±2.49
Lateral incisor	105.24 ^a ±2.34	108.56 ^a ±1.52	112.05 ^a ±2.71
Central incisor	117.80 ^{ab} ±2.18	115.63 ^b ±1.84	122.60 ^a ±1.71

indicated that early permanent dentitions provide the best sample for tooth-size measurements. Early adult dentitions have less mutilation and less attrition in most subjects. Consequently, the effect of these factors on actual mesiodistal tooth widths was minimum.

DATA ANALYSIS

Mean, standard deviation, statistical significance of mesiodistal, buccolingual tooth sizes and crown proportions values for each of the groups

are evaluated. ANOVA test was used to analyze the data and the level of significance was at 0.05.

RESULTS

1) The crown proportions of maxillary central incisors had statistically significant difference in all the three groups of crowding ($p < 0.05$) but for maxillary lateral incisor, the difference was not statistically significant. The difference of crown proportions of the maxillary canines and mandibular anteriors were statistically significant

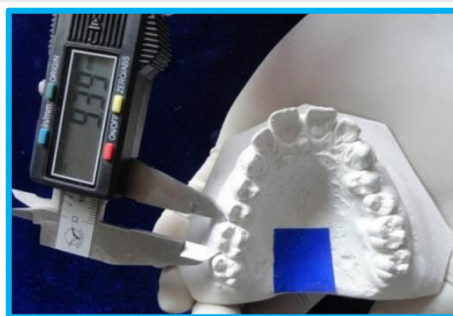


Fig. 1

The difference of crown proportions of the maxillary canines and mandibular anteriors were statistically significant in correlation with no crowding and moderate crowding groups. 2) The mesiodistal tooth size of the maxillary and mandibular 2nd premolar, maxillary lateral incisors had statistically significant difference in three groups of crowding ($p < 0.05$) but maxillary 1st molar, mandibular 1st premolar and canines had statistically significant difference in correlation with only no crowding and moderate crowding groups ($p < 0.05$) 3) The buccolingual tooth size of 1st premolar and 2nd premolar in maxillary arch and mandibular central incisors had statistically significant difference in three groups of crowding ($p < 0.05$) but mandibular and maxillary canines had statistically significant difference in correlation with only no crowding and moderate crowding groups ($p < 0.05$).

DISCUSSION

The crown proportions of only maxillary central incisors had statistically significant difference in all the three groups of crowding ($p < 0.05$) This shows that the maxillary central incisors crown proportions are largely responsible for the variation that is seen in the dental crowding in the Assamese population. The study of Eduardo Bernabe *et al.*,^[12] reported that there is relationship between crown proportion and crowding. The above study states that increase in the incisor crown proportion increases the degree of crowding. The findings of above study are similar to the result obtained in the present study for degree of crowding in relation to all maxillary and mandibular anterior teeth except maxillary lateral incisor. Studies done by Keene A *et al.*,^[13] Smith RJ *et al.*,^[14] Punekey *et al.*,^[15] reported a lack of association between the crown proportions and incisor crowding. The findings of above studies are similar to the result obtained in the

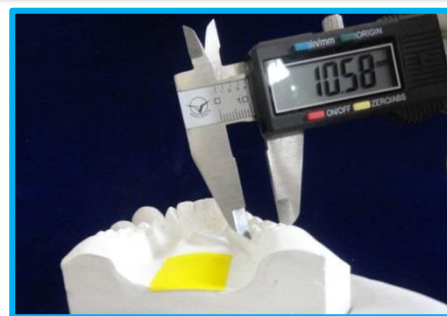


Fig. 2

present study in relation to maxillary lateral incisor crown proportion. Fastlicht,^[3] Lundstrom,^[16] and Doris *et al.*,^[6] conducted a study to conclude whether the mean values of mesiodistal tooth size was significantly greater in crowded arches compared with the normal dentition group. This finding led to the conclusion that large crown dimensions are associated with crowded arches than with less or no crowding. The findings of above studies similar to the result obtained in the present study for degree of crowding in relation to mesiodistal tooth sizes of canines and both premolars in the mandibular arch while lateral incisor, canine, both premolars and first molar in the maxillary arch. In this present study it was found that the maxillary canines had little variation in mesiodistal tooth size in the three groups of crowding ($p > 0.05$, Table 2). This is in accordance with the studies of Lundstrom^[16] and Horowitz *et al.*^[17] The buccolingual tooth size of most of the teeth except mandibular central incisor, mandibular and maxillary canine and maxillary premolars; was found not to influence the dental crowding because there was no statistically significant difference in all the three groups of crowding in the Assamese population.

CONCLUSION

To summarise, the maxillary central incisors crown proportions; mesiodistal tooth size of maxillary and mandibular second premolar, maxillary lateral incisors; and lastly buccolingual tooth size of both premolars in maxillary arch and mandibular central incisors are largely responsible for the variation that is seen in the dental crowding in the Assamese population. It must be kept in mind that dental morphology (tooth sizes and crown proportions) is only one of the several factors that may be involved in the etiology of dental crowding. Certainly, other nonodontometric factors interact, which has not

nonodontometric factors interact, which has not been considered in the present study

CONFLICT OF INTEREST & SOURCE OF FUNDING

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