

Dr. Rashed Md. Golam Rabbani
BDS, FCPS
Department of Orthodontics
Dhaka Dental College, Dhaka

Dr. Ahsan Habib
BDS, FCPS
Department of Orthodontics
Dhaka Dental College, Dhaka

Dr. Sohal Mahamud
BDS, FCPS (Part-II Trainee)
Department of Orthodontics
Dhaka Dental College, Dhaka

Dr. Arup Kumar Saha
BDS, MPH
Assistant Professor
Department of Dental Public Health
City Dental College, Dhaka

Dr. A.S.M Rafiul Haque
BDS
Oral and Dental Surgeon, Dhaka

Dr. Md. Shahed Jahan
BDS, MPH
Assistant Professor
Department of Dental Public Health
Update Dental College, Dhaka

Prof. Dr. Md. Zakir Hossain
BDS, PhD
Professor and Head
Department of Orthodontics
Dhaka Dental College, Dhaka

Correspondence to:
Dr. Rashed Md. Golam Rabbani
BDS, FCPS
Department of Orthodontics
Dhaka Dental College, Dhaka
e-mail: rabbani_rashed@yahoo.com

Abstract:

Aims: A descriptive type of cross-sectional study was conducted at the department of Orthodontics & Dentofacial Orthopedics of Dhaka Dental College & Hospital, Dhaka, Bangladesh during January 2010 to December 2012. The aim of the study was to test the hypothesis that there were no differences between adults with class I crowded, class III and class I normal occlusions in respect to width of the maxillary and mandibular arches and gender comparisons.

Materials and Methods: In this study, 82 pairs of study models were selected from the patients and students of the Department of Orthodontics and Dentofacial Orthopedics at Dhaka Dental College and Hospital and were divided into three groups. Twenty seven (27) pairs of dental casts with normal occlusion, 25 pairs with class I crowded and another 30 pairs with class III malocclusions that included almost equal numbers of male and female samples.

Results: Among different arch dimensions, maxillary arch widths were found to have significantly smaller in class I crowded and class III malocclusions compared to normal class I occlusion.

Conclusion: The hypothesis was partially rejected by the findings of the study. It may be suggested that Orthodontist who is aware of these differences in arch dimension will be beneficial to diagnose and make planning of treatment of orthodontic cases more accurately.

Key words: Dental arch, arch width, malocclusions.

Introduction:

Dental arches have historically been described by investigator in simple geometric term such as ellipse, parabola, segments circles joined to straight line or modified spheres. The proposed ideal arrangement of the teeth was described geometrically by Angle as the line of occlusion.¹ Angle postulated that the upper first molars are the key to occlusion and that the upper and lower molars should be related so that the mesiobuccal cusp of the upper molars occludes with the anterior buccal groove of the lower molar. If this molar relationship existed and the teeth are arranged on a

smoothly curving line of occlusion, then the normal occlusion would result. Normal occlusion and class I malocclusion share the same molar relationship but differ in the arrangement of the teeth relative to the line of occlusion. The line of occlusion may or may not be correct in class II and class III malocclusions.² Normal occlusion is commonly defined as "an occlusion within the accepted deviation of the ideal". This definition gives no clear limit to the range of normal occlusion. However, an occlusion which satisfies the requirements of function and aesthetics even though there may be minor irregularities of individual teeth may be

accepted as normal occlusion. In normal occlusion, mandibular teeth are set one inclined plane in advance of the maxillary teeth. The maxillary teeth are set half a cusp buccal to the mandibular teeth. The mesiobuccal cusp of the upper first permanent molar occludes with the anterior buccal groove of the lower first permanent molar. The upper canine permanent canines occlude in the embrasure between the lower permanent canine and first premolar. The lower incisors edges occlude with the middle third of the palatal surface of the upper incisors. This should produce normal overbite and overjet.^{3,4}

General objective: To test the hypothesis that there is no difference between adults with class I crowded, class III malocclusions and class I occlusions in respect to arch widths, width of the maxillary and mandibular arches and gender comparisons.

Specific objectives: To compare the study results with the other similar studies, to establish the origin of transverse discrepancy which will help to forecast a treatment plan and provide guideline for correction.

Materials & Methods:

Study design- Cross sectional type of descriptive study.

Place of study- Department of Orthodontics & Dentofacial Orthopedics of Dhaka Dental College & Hospital, Dhaka, Bangladesh.

Sample selection- Purposively according to selection criteria, 82 pairs of study models of males and females were selected from the patients and students of the Orthodontics & Dentofacial Orthopedics department of Dhaka Dental College & Hospital and were divided into three groups. The first group consisted of 25 pairs of subjects having class I malocclusions (class I skeletal base) with severe dental crowding (>5 mm space deficiency). The second group consisted of 30 pairs of subjects having class III malocclusions and the third group, 27 pairs of subjects having class I/normal occlusion.

Selection criteria:

Inclusion criteria for Class I crowding:

- i. Bilateral Class I canine and molar relationships.
- ii. >2.3 mm mandibular crowding.
- iii. Absence of anterior and posterior open bite.
- iv. No history of previous orthodontic treatment.

Inclusion criteria for Class III group:

- i. Bilateral class III canine and molar relationship.
- ii. Absence of crowding.

Inclusion criteria for Class I group:

- i. Bilateral class I molar and canine relationships.
- ii. >1.5 mm crowding and no >2.4 mm of spacing in the mandibular arch.

Exclusion criteria:

- i. Uncooperative patient.
- ii. Patient with systemic illness.
- iii. Missing tooth other than 3rd molar.
- iv. History of previous orthodontic treatment.
- v. History of trauma.

Study procedure:

Each of the subjects was selected in respect of inclusion and exclusion criteria. A data collection sheet with necessary measurements for each subject was filled.

Measurements:

The measurements were conducted on maxillary and mandibular dental casts of 82 Bangladeshi subjects of both sexes. Twenty five (25) of them were class I crowded, 30 were class III and the rest (26) subjects were in normal occlusion group. Comparison made on inter-canine, inter-first premolar, inter-molar and alveolar widths of both dental arches.

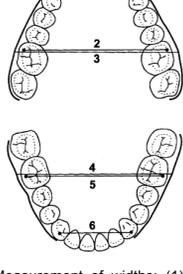


Figure-1: Measurement of widths: (1) maxillary inter-canine, (2) maxillary inter-premolar, (3) maxillary alveolar, (4) mandibular inter-canine, (5) mandibular inter-molar and (6) mandibular inter-premolar.

Maxillary measurements:

- (1) Maxillary inter-canine width- distance between the cusp tips of the right and left maxillary permanent canines.
- (2) Maxillary inter-premolar width- distance between the buccal cusp tips of the right and left maxillary permanent first premolars.
- (3) Maxillary inter-molar width- distance between the mesiobuccal cusp tips of the right and left maxillary permanent first molars.
- (4) Maxillary alveolar width- maxillary alveolar width at the mucogingival junction above the mesiobuccal cusp tips of the first molars.

Mandibular measurements:

- (1) Mandibular inter-canine width- distance between the cusp tips of the right and left mandibular permanent canines.
- (2) Mandibular inter-premolar width- distance between the buccal cusp tips of the right and left mandibular permanent first premolars.
- (3) Mandibular inter-molar width- distance between the mesiobuccal cusp tips of the right and left mandibular permanent first molars.
- (4) Mandibular alveolar width- mandibular alveolar width at the mucogingival junction below the buccal grooves of the first molars.

Table-1: Distribution of respondents by maxillary inter-molar and alveolar width.

| Different arch width | Total (n=82) | | | |
|--------------------------------|-------------------------------------|------------------------------------|---|----------------------------------|
| | Normal occlusion n=27 Mean±SD | Class I crowded n=25 Mean±SD | Class III malocclusion n=30 Mean±SD | P-value Significant =<0.05 |
| Maxillary inter-canine width | 35.0±2.3 | 33.5±3.2 | 34.4±3.0 | 0.568 |
| Maxillary inter-premolar width | 42.4±2.3 | 40.1±3.4 | 41.9±3.8 | 0.462 |
| Maxillary inter-molar width | 52.9±2.9 | 51.3±4.5 | 52.0±4.7 | 0.003* |
| Maxillary alveolar width | 58.4±2.8 | 56.8±3.9 | 57.5±4.5 | 0.001* |

Table-1 shows the maxillary inter-molar and alveolar width differences were statistically significant between normal occlusion, class I crowded and class III malocclusions.

Data collection and processing:

Dental casts' measurements were performed by a digital dial caliper to the nearest 0.01 mm. All measurements of all subjects were carried out again four weeks later by the same operator to evaluate measurements error. Almost all the measurements were same, where differed, averages were taken. After collection, the obtained data was checked, verified and edited. These were entered in a personal computer using the SPSS (statically package for social science) software. Entered data were cleaned, edited and appropriate statistical tests were done depending on the distribution of data.

Data analysis:

All data analyzed through standard statistical methods by using SPSS /STATA 10 software. The statistical tests used for analyses of data were 't' test and 'f' test where the level of significance was considered as <0.05 (p <0.05).

Results:

This study was a cross sectional study conducted among the dental casts of 82 patients and students of the department of Orthodontics & Dentofacial Orthopedics, Dhaka Dental College & Hospital. The occlusions of these subjects were class I crowded, class III malocclusions and class I normal occlusions.

Figure-1: Distribution of respondents by the comparison of maxillary measurements.

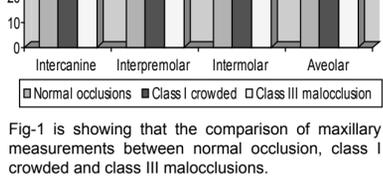


Fig-1 is showing that the comparison of maxillary measurements between normal occlusion, class I crowded and class III malocclusions.

Discussion:

This cross-sectional study was conducted in the department of Orthodontics & Dentofacial Orthopedics at Dhaka Dental College & Hospital. This study was carried out to compare the arch width of Bangladeshi subjects with class I crowded, class III and normal occlusion.³ Samples of the study were selected on the basis of inclusion and exclusion criteria. This study consisted of using 82 pairs of casts with permanent dentition divided into three groups, 27 pairs of dental casts with normal occlusion (13 males and 14 females), 25 pairs of dental casts with Class I crowded (13 males and 12 females) and another 30 pairs of dental casts with Class III malocclusion (16 males and 14 females). The comparison was made between the inter-canine, inter-premolar, inter-molar and alveolar width of both dental arches. The casts were selected from archives of Dhaka Dental College & Hospital. The minimum age of the subjects chosen for this study based on evidence reporting no significant change in the first molar and canine arch widths after 13 in females and 16 in males.⁵⁻⁸ The result of this study revealed that in the maxilla, no significant differences were observed in inter-canine arch width in all three groups. In class I crowded group, the inter-premolar, inter-molar and alveolar arch widths were significantly smaller than class I normal occlusion. In comparison between normal occlusion and class III malocclusion, maxillary alveolar width in class III

Table-2: Comparison of maxillary measurements between normal occlusions, class I crowded and class III malocclusions among male and female samples.

| Different arch width | Normal occlusions | | Class I crowded | | Class III malocclusion | |
|--------------------------------|-------------------------|---------------------------|-------------------------|---------------------------|-------------------------|---------------------------|
| | Male n=13 Mean±SD | Female n=14 Mean±SD | Male n=13 Mean±SD | Female n=12 Mean±SD | Male n=16 Mean±SD | Female n=14 Mean±SD |
| Maxillary inter-canine width | 35.9±2.0 | 34.2±2.3 | 34.2±3.8 | 32.8±2.2 | 35.7±2.9 | 32.8±2.1* |
| Maxillary inter-premolar width | 43.4±1.8 | 41.4±2.4 | 42.4±2.7 | 37.74±2.4* | 43.5±3.9 | 40.1±2.9 |
| Maxillary inter-molar width | 54.4±2.5 | 51.6±2.8 | 52.8±3.2 | 47.7±4.3* | 53.8±3.6 | 50.0±5.1 |
| Maxillary alveolar width | 59.8±2.5 | 57.2±2.5 | 57.2±3.6 | 54.2±2.2* | 59.5±4.1 | 55.2±3.8* |

*p<0.05 is significant .

Table-2 shows maxillary inter-premolar, inter-molar and alveolar widths were significantly smaller in females than males in class I crowded group. Maxillary inter-canine and alveolar widths were significantly smaller in females than males in class III malocclusion group.

Figure-2: Comparison of maxillary measurements between normal occlusions, class I crowded and class III malocclusions among male and female samples.

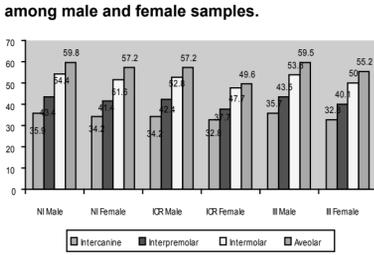


Fig-2 showed that the comparison of maxillary measurements between normal occlusions, class I crowded and class III malocclusions among male and female samples.

group were found smaller than the normal occlusion group. In the mandible, it was found that inter-molar and alveolar width were smaller in class I crowded group than the normal occlusion group. In comparison between normal occlusion and class III malocclusion, it was found that class III maxillary alveolar width were smaller than the class I normal occlusion. In comparison of maxillary measurements between normal occlusion, class I crowded and

class III malocclusion among males and females, it was found that class I crowded male had significantly larger inter-premolar, inter-molar and alveolar width. In class III malocclusion, males had a significantly larger inter-canine and alveolar width than the females.⁷ In the mandible, it was revealed that males had a significantly larger inter-molar and alveolar arch width than the females in all three groups. Comparison of maxillary and mandibular measurements within the all class groups, among the males, it was revealed that the maxillary and mandibular inter-molar width were significantly smaller in class I crowded males.⁸ Within the all class groups, among the females, it was found that maxillary inter-molar, alveolar and mandibular inter-molar width were significantly smaller in class I crowded females than the class I normal females.

Conclusions:

The result of this study evaluated under three study groups (normal occlusion, class I crowded and class III). Among different arch dimension maxillary arch widths were found to have significantly smaller in class I crowded and class III malocclusion compared with normal occlusion. In conclusion, the hypothesis was partially rejected by the findings of this study. It may be suggested that Orthodontist who is aware of these differences in arch dimension will be beneficial to diagnose and treatment planning of orthodontic cases more accurately.

Table-3: Comparison of mandibular measurements between normal occlusions, class I crowded and class III malocclusions among male and female subjects.

| Different arch width | Normal occlusions | | Class I crowded | | Class III malocclusion | |
|---------------------------------|-------------------------|---------------------------|-------------------------|---------------------------|-------------------------|---------------------------|
| | Male n=13 Mean±SD | Female n=14 Mean±SD | Male n=13 Mean±SD | Female n=12 Mean±SD | Male n=16 Mean±SD | Female n=14 Mean±SD |
| Mandibular inter-canine width | 26.1±1.4 | 25.2±1.3 | 25.9±2.6 | 25.6±1.7 | 27.3±1.9 | 25.9±2.3 |
| Mandibular inter-premolar width | 35.1±1.9 | 32.9±3.1 | 32.6±4.1 | 32.2±1.9 | 34.8±3.4 | 33.4±3.3 |
| Mandibular inter-molar width | 46.2±2.4 | 44.2±2.9* | 45.2±2.8 | 42.7±2.5* | 46.5±3.1 | 44.4±3.0* |
| Mandibular alveolar width | 57.7±2.4 | 55.4±2.9* | 56.6±2.8 | 53.8±2.6* | 59.5±2.6 | 57.3±2.7* |

*p<0.005 is significant .

Table-3 showed that the mandibular inter-molar and alveolar widths were significantly smaller in females than the males in all three groups.

Figure-3: Comparison of mandibular measurements between normal occlusions, class I crowded and class III malocclusion among male and female samples.

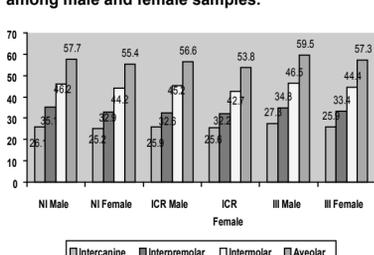


Fig-3 showed that the comparison of mandibular measurements between normal occlusions, class I crowded and class III malocclusions among male and female samples.

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