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Original Research Article.

Evaluation of Maxillary and Mandibular Arch Widths among Various Malocclusions

Lalima Kumari[1], Kamal Nayan[2*], Anurag Rai[3]

[1]Lecturer, [3]Professor and Head, Department of Orthodontics and Dentofacial Orthopaedics, Patna Dental College and Hospital, Patna, Bihar, India.
[2*]Lecturer, Department of Prosthodontics and Crown and Bridge, Hazaribagh College of Dental Sciences and Hospital, Hazaribagh, Jharkhand, India.

ABSTRACT

Background: Arch dimensions such as arch width, arch length and arch form are very significant to orthodontic treatment. Diagnosis of arch length and width discrepancies are important diagnostic aids, with the help of which treatment outcome can be predicted. The present study was conducted to evaluate the arch width among class I normal occlusion, Class II division 1 and Class III malocclusions.

Materials and Methods: In the present study a total of 75 pairs of study models were selected to evaluate the arch width among class I normal occlusion, Class II division 1and Class III malocclusion. For the evaluation of arch width pretreatment orthodontic study models were selected from orthodontic records. Each malocclusion class consisted of 25 study models. Measurements were performed on the orthodontic study models using an electronic digital caliper measuring to the nearest 0.01 mm. One operator measured the arch width parameters on both jaws. Statistical analysis was performed using the Statistical Package for the Social Sciences software version 21.0 (SPSS Inc., Chicago, IL, USA). A p-value <0.05 was predetermined as statistically significant.

Results: In the present study each malocclusion class consisted of 25 study models of participants seeking orthodontic treatment. Class III and Class I groups showed significantly larger maxillary intercanine widths, larger maxillary intermolar, inter premolar and alveolar widths than Class II division1 groups. In mandible Class III group showed significantly larger mandibular intercanine, inter rmolar than Class I and Class II division 1 groups. Class I shows larger inter-premolar width and inter alveolar width than Class III and Class II division 1 groups.

Conclusion: Our study concluded that arch widh dimensions vary according to malocclusion and hence measurement of arch width provides important information for diagnosis and treatment planning.

Keywords: Arch Width, Class I, Class II Division 1, Class III.

***Correspondence to:**

Dr Kamal Nayan,
Lecturer,
Department of Prosthodontics and Crown and Bridge,
Hazaribagh College of Dental Sciences and Hospital,
Hazaribagh, Jharkhand, India.

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INTRODUCTION

The achievement of a stable, functional and esthetic arch form is of supreme importance in orthodontics.[1] Diagnosis of arch length and width discrepancies are important diagnostic aids, with the help of which an orthodontist can predict the treatment result of a particular case.[2] Dental arch width and form are important factors for determining the stability and success of orthodontic treatment. Though arch width and arch form are interdependent parameters, the dimensional changes of arch width might affect arch form as well.[3] Arch width indicates the transverse dimensions of the maxillary and mandibular arches. Arch width seems to increase from deciduous to permanent dentition. Various land marks had been discussed by different investigators and most studies had discussed the dimensions of the arch across the permanent canines, premolars, first molars at the cusp tips and central fossae to determine the arch width. Among these, the preservation of the inter-canine width is an indispensable part of treatment planning to reduce the risk of post-retention relapse.[4] Various factors such as heredity, growth of the bone, eruption and inclination of the teeth, external influences, function, and ethnic background could affect the size and shape of the dental arches.[5] The present study was conducted to evaluate the arch width among class I normal occlusion, Class II division 1and Class III malocclusion.

MATERIALS AND METHODS

In the present study a total of 75 pairs of study models were selected to evaluate the arch width among class I normal occlusion, Class II division 1and Class III malocclusion. For the evaluation of arch width, pre-treatment orthodontic study models with Angle's Class I, Class II division 1, and Class III malocclusion were selected from orthodontic records. Each malocclusion class consisted of 25 study models of participants seeking orthodontic treatment. Patients with age ranged from 13 to 18 years, bilateral buccal segment, Class I, II, and III molar relationship, good quality study models without severe crowding, rotations, or Class II restorations, presence of all fully erupted permanent teeth in both arches were selected for the study. Measurements were performed on the orthodontic study models using an electronic digital calliper measuring to the nearest 0.01 mm. One operator measured the following parameters on both jaws:

1. Maxillary and mandibular inter canine width: Distance between the cusp tips of the right and left permanent canines
2. Maxillary and mandibular inter-premolar width I: Distance between buccal cusp tips of the right and left permanent first premolars
3. Maxillary and mandibular inter-premolar width II: Distance between buccal cusp tips of the right and left permanent second premolars
4. Maxillary and mandibular intermolar width I: Distance between the mesiobuccal cusp tips of the right and left permanent first molars
5. Maxillary and mandibular intermolar width II: Distance between the central fossa of the right and left permanent first molars
6. Maxillary and mandibular inter-alveolar width: Distance between the mucogingival junctions above the mesiobuccal cusp tips of the right and left permanent first molars.

Statistical analysis was performed using the Statistical Package for the Social Sciences software version 21.0 (SPSS Inc., Chicago, IL, USA). A p-value <0.05 was predetermined as statistically significant.

Table 1: Mean and standard deviation of maxillary arch widths in Class I, Class II div 1, and class III groups.

Variable		Mean ± SD (mm)
Intermolar width	**Class I**	50.55±3.21
	Class II	48.56±3.34
	Class III	51.23±2.28
Intermolar width II	**Class I**	46.22±1.33
	Class II	45.32±2.54
	Class III	46.01±3.23
Intercanine width	**Class I**	35.89±3.42
	Class II	34.23±2.87
	Class III	36.01±2.20
Inter premolar width	**Class I**	42.12±3.01
	Class II	40.23±2.68
	Class III	42.56±3.12
Inter premolar width II	**Class I**	45.45±3.78
	Class II	44.67±2.45
	Class III	47.82±3.86
Inter alveolar width	**Class I**	57.88±2.69
	Class II	57.34±2.89
	Class III	57.94±3.80

Table 2: Mean and standard deviation of mandibular arch widths in Class I, class II division 1, and class III groups.

Variable		Mean ± SD
Intermolar width	**Class I**	45.20±2.71
	Class II	45.01±2.34
	Class III	47.70±3.78
Intermolar width II	**Class I**	41.56±2.33
	Class II	42.32±5.54
	Class III	43.51±3.63
Intercanine width	**Class I**	27.89±1.42
	Class II	27.49±2.17
	Class III	28.41±2.01
Inter premolar width	**Class I**	35.78±2.67
	Class II	34.89±2.45
	Class III	35.08±2.89
Inter premolar width II	**Class I**	40.32±2.41
	Class II	39.73±2.66
	Class III	36.65±3.21
Inter alveolar width	**Class I**	57.38±2.77
	Class II	55.24±2.79
	Class III	42.23±4.18

RESULTS

In the present study, arch width dimensions were measured in class 1, class II div 1 and class III malocclusions using study models. Class III and Class I groups showed significantly larger maxillary intercanine widths, larger maxillary intermolar, inter premolar and alveolar widths than Class II division1 groups [Table 1]. In mandible Class III group showed significantly larger mandibular intercanine, intermolar width than Class I, and Class II division I groups [Table 2]. Class I group showed larger inter-premolar width and inter alveolar width than Class III and Class II division 1 groups.

DISCUSSION

The size and shape of arches have considerable implications in orthodontic diagnosis and treatment planning, as it affects the space available, dental esthetics, and stability of the dentition.[6]

In the present study Class III and Class I groups showed significantly larger maxillary intercanine widths, larger maxillary intermolar, inter premolar and alveolar widths than Class II division1 groups. In mandible Class III group showed significantly larger mandibular intercanine, intermolar than Class I and Class II division 1 groups. Class I show larger inter-premolar width and inter alveolar width than Class III and Class II division 1 groups.

Intercanine widths were investigated in a few of the previous studies, and conflicting results were found. In the present study, Class I group showed significantly larger maxillary intercanine width than Class II division 1 group. This is in concurrence with studies by Staley et al.[7] and Huth et al.[8] but differed from studies by Sayin and Turkkahraman[9]. Our study also reported that Class III group showed significantly larger mandibular intercanine, intermolar width than Class I and Class II division 1 groups. Sperry et al[10] showed that the Class III group with mandibular prognathism more commonly had mandibular tooth size excess for the overall ratio than the Class I and Class II groups. Similarly, Hnat et al[11] reported that, when the mandibular tooth size is increased, mandibular arch length and arch width increase occurs, and this suggestion supports our results.

A study by Kuntz et al. showed no difference in the maxillary intercanine width between the CI and CIII groups.[12] Similar to our study, Braun et al[13]investigated the form of the human dental arch using 40 sets of pretreatment orthodontic models of patients and found that Class III maxillary dental arch widths are an average of 5.1 mm greater than the arch widths of Class I cases and this begins in the lateral incisor–canine area and proceeds distally. He also indicated that the mandibular dental arches associated with Class III malocclusions are wider than the Class I mandibular arches beginning in the premolar area.

Similar to present study, Staley et al.[7] and Huth et al.[8] Also reported a similar findings of larger intermolar width in class I malocclusion as compared to class II div 1 cases. They also reported a larger maxillary alveolar width in class I cases as compared to class II div 1 malocclusion cases which was inconsistent with the findings of present study.

CONCLUSION

Our study concluded that arch width vary significantly in different types of malocclusion. In the present study, Class III and Class I groups showed significantly larger maxillary intercanine widths, larger maxillary intermolar, inter premolar and alveolar widths than Class II division1 groups. In mandible Class III group showed significantly larger mandibular intercanine, intermolar than Class I and Class II division 1 groups. Class I showed larger inter-premolar width and alveolar width than Class III and Class II division 1 groups. Since study was conducted on a small population without considering gender differences, further study is required with a larger sample size for both male and female separately.

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