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Evaluation of Arch Width Variations Among Different Skeletal Patterns in Chhattisgarh Population

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ABSTRACT

Aim: To evaluate the arch width variations among different skeletal patterns in Chhattisgarh population.

Materials and Methods: A total of 66 untreated adults (33 males and 33 females), the age of 15-30, with minimal crowding or spacing and no cross bites, were included in the study. Lateral cephalograms were analyzed to measure the angle between the anterior cranial base and the mandibular plane (MP-SN). Dental casts were used to record maxillary and mandibular inter-canine, inter-premolar, and inter-molar widths.

Results: Findings revealed that males had significantly wider dental arches than females ($P < 0.05$). Additionally, as the MP-SN angle increased, there was a notable reduction in arch width. When compared with data from other populations, the results also suggested that arch width dimensions vary across different ethnic and racial groups.

Conclusion: Dental arch width is affected by gender, ethnicity, and vertical facial structure. Hence, orthodontic treatment should consider using customized arch wires tailored to the individual's original arch form and width.

INTRODUCTION

The relationship between malocclusion and facial form has been a focus of orthodontists since early 20th century. Dental arch width and facial form are important factors for determining success and stability of orthodontic treatment. Arch form is the position and relationship of teeth to each other in all three dimensions[1].

It is also commonly believed that there is interaction between the functional capacity and the size of masticatory muscles and craniofacial form.[2] Three basic types of facial morphology exist: Short, average, and long.

According to Hawley, ideal arch width was based on an equilateral triangle with a base representing the inter-condylar width. The lower anterior teeth were arranged on an arc of a circle with a radius determined by the combined width of the lower incisors and canines, with the premolars and molars aligned with the second and third molars toward the center[3].

Correct identification of a patients' arch form is an important aspect of achieving a stable, functional and aesthetic orthodontic treatment result; failure to preserve the arch form might increase the probability of relapse.[4]

1. MATERIAL AND METHOD:

A total of 66 untreated patients above 15 years old were employed in the study. The samples included natives of Chhattisgarh. Lateral cephalogram and upper and lower impressions were collected from each patient.

Inclusion Criteria: Age group – 15 – 30 years, with all dentition present (except 3rd molars)

Exclusion Criteria: Patient with history of previous orthodontic treatment, dentulous spaces, history of trauma, significant cuspal wear, extensive restorations or prosthetics, anterior and

posterior cross bites and severe crowding (>9 mm) or spacing (>9 mm) were excluded from the study. The lateral cephalograms were traced individually and Sella Nasion Point A **SNA**, Sella Nasion Point B **SNB**, Point A Nasion Point B ANB, and **SN-MP** were measured. The dental arch width was measured on the dental cast using a digital calliper accurate to 0.001 mm.

The following maxillary and mandibular dimensions were measured.

Inter-canine width: Buccal cusp tip and widest labial aspect), **First and second inter-premolar width:** Buccal cusp tip and widest labial aspect)

First inter-molar widths: Mesiobuccal cusp and narrowest lingual aspect.

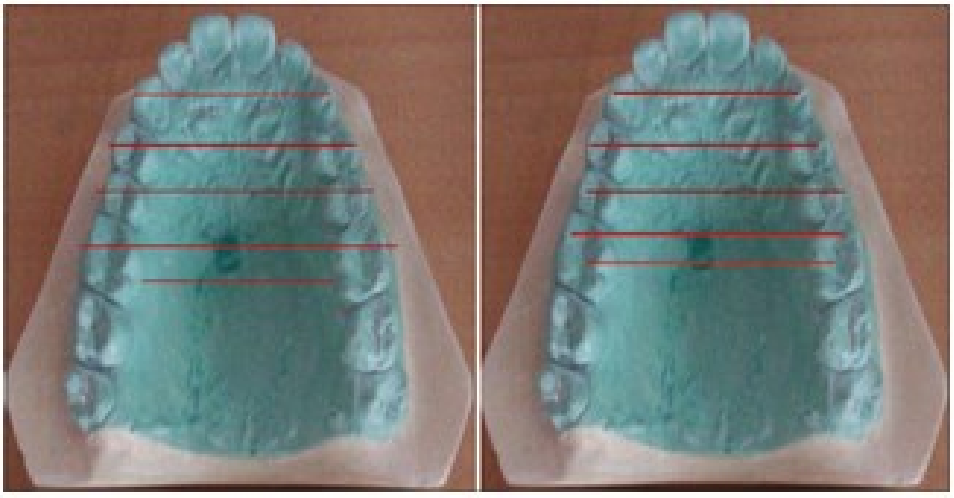

Figure 1: Maxillary study model (arch width measurements)

Statistical Analysis: ANOVA statistics is done to compare the arch widths of the samples at different levels of MP-SN. Descriptive statistics, including mean and standard deviation (SD) were calculated for all measurements

2. RESULT

Variable	Groups	Mean	SD	f-value	p-value
Inter canine (Maxilla)	Hypo Divergent	36.5545	2.14381	0.63	0.531 (n.s)
	Normo Divergent	35.9409	2.67095		
	HyperDivergent	35.7087	2.86625		
Inter canine (Mandible)	Hypo Divergent	26.8455	1.58346	1.54	0.221 (n.s)
	Normo Divergent	26.6591	1.93530		
	HyperDivergent	25.8261	2.56820		
Inter premolar 1 (maxilla)	Hypo Divergent	43.1864	1.75426	1.02	0.45 (n.s)
	Normo Divergent	42.5091	3.14611		
	HyperDivergent	42.0217	3.10980		
Inter premolar 1 (mandible)	Hypo Divergent	35.4591	1.40904	1.86	0.16 (n.s)
	Normo Divergent	34.2045	2.28212		
	HyperDivergent	34.5783	2.75960		

Inter molar MB (maxilla)	Hypo Divergent	52.9136	2.63281	0.14	0.86 (n.s)
	Normo Divergent	52.8000	3.19121		
	HyperDivergent	52.4783	2.55698		
Inter molar MB (mandible)	Hypo Divergent	46.2545	2.19235	2.39	0.09 (n.s)
	Normo Divergent	44.6727	3.69816		
	HyperDivergent	44.6043	2.41237		
Inter molar P/L (maxilla)	Hypo Divergent	36.9318	2.58722	1.42	0.226 (n.s)
	Normo Divergent	37.9364	2.86365		
	HyperDivergent	36.7174	2.24168		
Inter molar P/L (maxilla)	Hypo Divergent	32.7023	2.25381	0.42	0.65 (n.s)
	Normo Divergent	32.3864	2.58038		
	HyperDivergent	32.0870	1.87042		

Statistical test: ANOVA; (p<0.05- significant, CI=95%), n.s- not significant, s-significant

DISCUSION

Vertical facial form is an important element of orthodontic assessment. It is an essential criterion for each orthodontist to understand the relationship between vertical facial height and dental arch width for proper diagnosis and treatment planning. Large variations are found in the vertical dimension and these affect the clinician's approach to successful diagnosis, treatment planning, and mechanics[5].

The study conducted by M. Prasad showed that, in maxillary and mandibular arches, there was no statistically significant inverse relationship between vertical facial height and dental arch widths among the maxillary canines, first premolars, second premolars, and first molars in male and female samples.[6]

The prediction of inter-arch width helps us in situations such as cross bites, ectopically positioned teeth, transpositions, scissors bite, impacted teeth, missing teeth, etc., where we cannot determine exact inter-arch widths and fabricate customized arch wires for the patient.

Inter-arch width measurements showed that there is significant difference in arch widths among males and females in untreated Chhattisgarh population. In this study it was observed that boys displayed larger arch width than girls and given that this is due to the fact that boys tend to be physically larger than girls. Increase in arch width during growth was found more in males than females and this can be a reason for males having broader arch than females[7,8]

Proffit et al. have proved that the mean bite force is greater for short face, normal in average face, and low in high-angle subjects.[9] The mechanical stress brought about by occlusal bite forces and volume of certain masticatory muscles might influence the size of adjacent craniofacial skeletal regions. This might be another reason for variation in arch widths according to facial pattern[10].

Helkimo et al. have found that mean bite force values were significantly higher in males than in females. The increased bite force might be a reason for the increased arch width in males when compared to females[10].

Eroz et al. conducted the study and the results demonstrated that the male arch widths were significantly greater than female arch widths[11].

Satirglu et al conducted a study in which ultrasonographically measured masseter muscle thickness. They found that individuals with thick masseter had a vertically shorter facial pattern and individuals with thin masseter have a long face[12]. Mandible also constricts along with maxilla since maxillary and mandibular arches are mutual counterparts according to Enlows counterpart principle[13]. Functional matrix theory also suggests that width of palatal complex is influenced by location of tongue[14]. Spronsen et al found that long-faced subjects have significantly smaller masseter and medial pterygoid muscles than normal subjects[15].

The relationships between the vertical facial morphology and dental arch widths in untreated Chhattisgarh adults show no inverse relationship. Hence, irrespective of ethnicity and race of the population group, SN-MP and inter-arch widths cannot be used in assessing the vertical and transverse craniofacial and dentoalveolar morphology.

The variation of arch widths between different growth patterns and between males and females highlights the variations of arch widths according to race, ethnicity, and gender and also the importance of using customized arch wires according to pre-treatment arch form and width for every patient during orthodontic treatment.

CONCLUSION

Relationship between dental arch width and vertical facial pattern is determined by the steepness of mandibular plane in untreated Chhattisgarh adult population. The relationship was not found to be an inverse relation in both males and females of untreated Chhattisgarh

adults, as MP-SN angle increased, the dental arch widths tended to decrease.

A generalized prediction was done for the dental arch widths with a given SN-MP.

The dental arch widths of males were found to be wider than females among untreated Chhattisgarh adults.

Since dental arch width is associated with gender, vertical facial morphology, and population groups, during orthodontic treatment, it is suggested to use individualized arch wires according to each patient's pre-treatment arch form and widths.

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