

Comparison of Arch Forms Between Indian and Bhutanese Populations

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ABSTRACT

Aim: Comparison and classification of Indian and Bhutanese arch forms of 60 untreated Indian and 60 untreated Bhutanese adults with normal maxillary and mandibular dental arches.

Materials and methods: 60 Indian & 60 Bhutanese, between the ages of 11 to 26 years were selected for this study. Dental arch forms of both the groups were analyzed according to the method described by Monique Raberin et al. The transverse and sagittal measurements of the dental arches were determined on maxillary and mandibular casts. The reference points were determined as; mid-incisal edge on the labial side, canine cusp tips, mesio-buccal cusps of first molars and disto-buccal cusp tips of second molars.

Results: The most important finding of this study is that the Bhutanese subjects have highest prevalence of wider arch forms as compared to the Indian subjects who significantly have narrow arch forms.

Conclusion: The arch forms of Indians are narrower than those of the Bhutanese. It is recommended to select wider archwires from the available variations to suit many Bhutanese patients.

Keywords: Indian, Bhutanese, Arch forms, Dental casts.

INTRODUCTION

The arch determines the basic pattern of tooth position.¹ It has been known anatomically to be a strong, stable arrangement. The maxillary and the mandibular dentition produce a curved arch when viewed from the occlusal surface which is determined by the shape of the underlying basal bone.² Since Angle³, orthodontists have tried to find standardized arch form. A lot of research work have confirmed that the ideal dental arch might be a single or universal form.⁴

Human dental arch forms have been described using simple qualitative descriptions as well as complex mathematical methods. Hunter⁵ in

1839 proposed one of the earliest descriptions of the dental arch. He described it as the normal anatomic arrangement of teeth. In 1870 Muhlreiter⁶ presented a detailed description of the dentition. Broombell⁷ in 1902 stated that the teeth are arranged in the jaws in the form of parabolic curves. Angle⁸ in 1907 recognized dental arch as parabolic but he stated that arch form varied greatly with race and type of the individual. For more than 100 years' researchers have been trying to define the "ideal" arch form using the concept that the dental arch form was symmetric in nature and can be represented by an algebraic or geometric formula.⁹ The identification and achievement of a stable, functional and esthetic arch form seems to be one of

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Table 1: Characteristics of Study Population.

	Indian Subjects	Bhutanese Subjects	Total Study Participants
Male	24	24	48
Female	36	36	72
Total	60	60	120

Table 2: Age of study Participants.

Category of Students	Average Age (in years)	Range
Indian Male Subjects	19.00±5.83	13 to 24
Indian Female Subjects	20.67±5.27	11 to 26
Bhutanese Male Subjects	24±1.41	22 to 25
Bhutanese Female Subjects	22.0±2.28	18 to 24
Male	21.5±4.75	13 to 25
Female	21.33±3.93	11 to 26
All the Study Population	21.4±4.16	11 to 26

Table 3: Dimensions in mm of the maxillary and mandibular dental arches of the Indian Subjects (N=60).

Dimensions	Mean (in Mm)	Standard deviation
Maxillary		
	Transverse	
	L33:	33.54 3.02
	L66:	51.86 2.05
	L77:	56.89 3.29
	Sagittal	
	L31:	16.90 1.37
	L61:	37.68 2.22
	L71:	53.16 2.81
Mandibular		
	Transverse	
	L33:	26.18 1.90
	L66:	45.39 3.29
	L77:	54.03 3.05
	Sagittal	
	L31:	12.46 2.89
	L61:	31.60 2.11
	L71:	49.12 4.78

Table 4: Dimensions in mm of the maxillary and mandibular dental arches of the Bhutanese Subjects (N=60).

Dimensions	Mean (in Mm)	Standard deviation
Maxillary		
	Transverse	
	L33: 35.46	3.11
	L66: 55.43	3.95
	L77: 61.11	4.21
	Sagittal	
	L31: 16.05	1.50
	L61: 35.20	2.93
	L71: 49.37	3.97
Mandibular		
	Transverse	
	L33: 26.56	2.38
	L66: 48.35	2.99
	L77: 57.30	4.18
	Sagittal	
	L31: 11.58	0.75
	L61: 31.62	2.85
	L71: 46.97	3.42

Table 5: Mean dimensions in mm of the maxillary and mandibular dental arches of Indian subjects according to sex (N=60).

Dimensions	Males	Female	p value (Independent sample t- test)
Maxillary			
Transverse			
L 33	33.77±3.00	33.39±3.30	NS
L66	52.47±2.55	51.46±1.78	NS
L77	58.18±1.07	56.04±4.08	NS
Sagittal			
L31	16.76±1.89	16.99±1.10	NS
L61	37.45±3.29	37.83±1.52	NS
L71	54.02±3.08	52.59±2.75	NS
Mandibular			
Transverse			
L33	27.02±1.95	25.62±1.81	NS
L66	47.34±4.76	44.09±0.93	NS
L77	55.07±2.77	53.33±4.23	NS
Sagittal			
L31	12.29±1.47	12.51±3.71	NS
L61	31.41±2.71	31.73±1.88	NS
L71	46.62±3.11	50.78±5.20	NS

Table 6: Mean dimensions in mm of the maxillary and mandibular dental arches of Bhutanese subjects according to sex (N=60).

Dimensions	Males	Female	p value (independent sample t test)
Maxillary			
Transverse			
L 33	36.39±4.07	34.84±2.50	NS
L66	57.66±4.82	53.95±2.76	NS
L77	64.35±4.52	58.95±2.83	NS
Sagittal			
L31	16.89±1.93	15.49±0.95	NS
L61	35.90±4.77	34.73±1.10	NS
L71	50.72±5.95	48.46±2.18	NS
Mandibular			
Transverse			
L33	26.82±3.55	26.38±1.60	NS
L66	51.26±1.83	46.41±1.69	p=0.003 Significant
L77	60.94±2.84	54.87±3.00	p=0.013 Significant
Sagittal			
L31	11.97±0.82	11.31±0.63	NS
L61	32.94±2.67	30.75±2.83	NS
L71	49.56±3.74	45.25±1.94	p=0.042 Significant

Table 7: Comparisons of Mean dimensions in mm of the maxillary and mandibular dental arches of Indian & Bhutanese students (N=60).

Dimensions	Indian Mean in mm	Bhutanese mean in mm	p value (Independent sample t- test)
Maxillary			
Transverse			
L 33	33.54±3.02	35.46±3.11	NS
L66	51.86±2.05	55.43±3.95	p=0.021 Significant
L77	56.89±3.29	61.11±4.21	p=0.023 Significant
Sagittal			
L31	16.90±1.37	16.05±1.50	NS
L61	37.68±2.22	35.20±2.93	p=0.048 significant
L71	53.16±2.81	49.37±3.97	p=0.024 significant
Mandibular			
Transverse			
L33	26.18±1.90	26.56±2.38	NS
L66	45.39±2.39	48.35±2.88	NS
L77	54.03±3.05	57.30±4.18	NS
Sagittal			
L31	12.46±2.89	11.58±0.75	NS
L61	31.60±2.11	31.62±2.85	NS
L71	49.12±4.78	46.97±3.42	NS

Table 8: Classification of the arch forms of Indian Subjects and distribution of five forms according to sex (N=60).

Type of Arch	Male (%)	Female (%)	Total(N)	Percentage
Narrow	12(20%)	18 (30%)	30	50%
Wide	6 (10%)	6 (10%)	12	20%
Mid	6 (10%)	12 (20%)	18	30%
Pointed	0	0	0	0
Flat	0	0	0	0

Table 9: Classification of the arch forms of Bhutanese Subjects and distribution of five forms according to sex (N=60).

Type of Arch	Male (%)	female (%)	Total (N)	Percentage
Narrow	0	0	0	0
Wide	18 (30%)	36 (60%)	54	90%
Mid	6(10%)	0	6	10%
Pointed	0	0	0	0
Flat	0	0	0	0

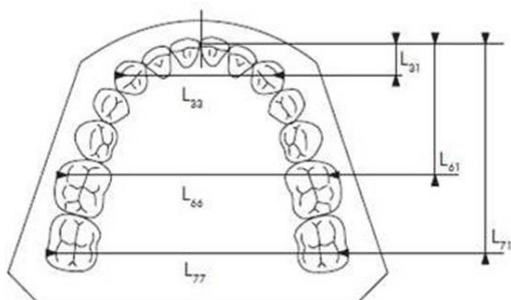


Fig 1: Shows different landmarks.

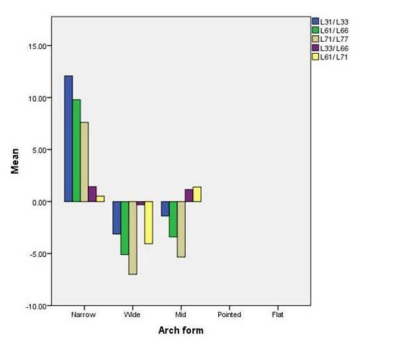


Fig 2: Bar graphs of maxillary arch in Indian subjects.

the important objectives during the course of treatment.¹⁰ Anthropologists assume that various racial types have differently shaped arches. Aitchison¹¹ showed dental arch variations among racial groups.

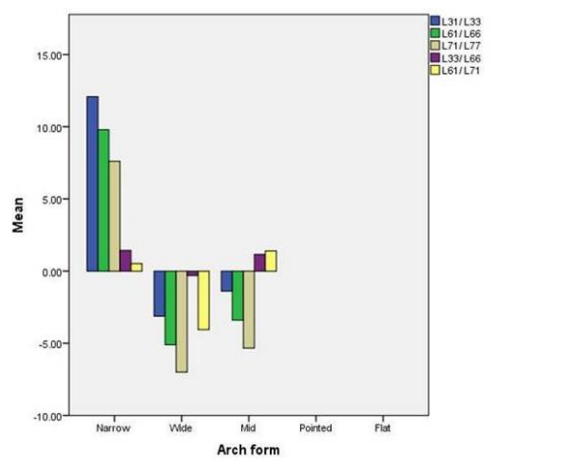


Fig 3: Bar graphs of mandibular arch in Indian subjects.

The present aim of our research was to:

- 1) Classify the arch forms of 60 untreated Indian and 60 untreated Bhutanese adults with normal maxillary and mandibular dental arches using the classification developed by Monique Raberin et al.⁴
- 2) Comparison of Indian and Bhutanese arch forms.
- 3) To check the distribution of arch forms between both the sexes in both the Indian and Bhutanese subjects.

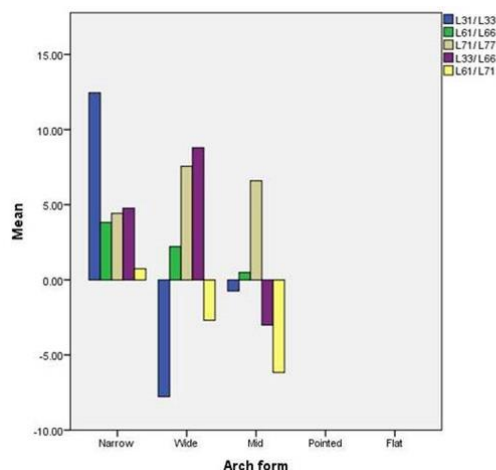


Fig 4: Bar graphs of maxillary arch in Bhutanese subjects.

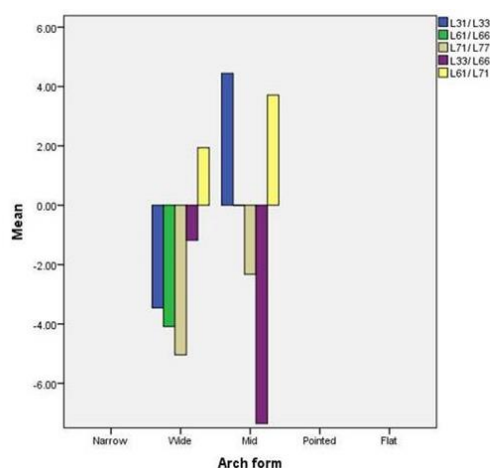


Fig 5: Bar graphs of mandibular arch in Bhutanese subjects.

MATERIALS AND METHODS

60 Indian & 60 Bhutanese, between the ages of 11 to 26 years were selected for this study (Table I,II). Both the Indian and Bhutanese sample comprised of 24 males and 36 females each. The subjects included had normal dental arches, full complement of permanent teeth, Angle's class I occlusion and a clinically acceptable symmetry of the arches. Dental arch forms of both the groups were analyzed according to the method described by Monique Raberin et al.⁴ The transverse and sagittal measurements of the dental arches were determined on maxillary and mandibular casts. The reference points were determined as; mid-incisal edge on the labial side, canine cusp tips, mesio-

buccal cusps of first molars and disto-buccal cusp tips of second molars.

The dimensions of the arches were determined according to 3 sagittal and 3 transverse measurements as seen in figure I. Arch breadth was evaluated from the inter-canine width (L33), the mean intermolar width (L66) between the first molars and the posterior intermolar width (L77) between the second molars. The arch length was evaluated from the canine depth (L31), the mean arch length (L61) measured from the incisal edge to the line joining the mesiobuccal cusps of the first molars and the total length (L71) measured from the incisal edge to the line joining the distobuccal cusps of the second molars. These six factors characterized both the form and dimension of a dental arch.

The five independent ratios that determined the arch forms were; L31/L33, L61/L66, L71/L77, L33/L66, and L61/L71.

Based on the five independent ratios, Monique Raberin et al⁴ the arch forms were classified as;

- Form 1 Narrow: 3 sagittal/transverse ratios are positive
- Form 2 Wide: 3 sagittal/transverse ratios are negative
- Form 3 Mid: None of the ratios significantly deviates from the average
- Form 4 Pointed: Only L31/L33 ratio has the intensity higher than the average
- Form 5 Flat: Only L31/L33 ratio has the intensity below the average

The sagittal and transverse ratios were determined by analyzing the 120 pairs of casts. The arches were classified based on the mean values of the Indian and the Bhutanese measurements, which were determined separately. The individual values of the Bhutanese subjects were compared with the mean value of the Bhutanese group and similar findings were noted for the Indian group. The mean values for each type of arch form were compared for each group (Indian and Bhutanese).

RESULTS

The dimensions of the maxillary and mandibular dental arches of the Indian subjects are given in table III and that of the Bhutanese are given

in table IV. The mean dimensions of the Indian and Bhutanese sample are depicted in table V and table VI respectively. Table VII shows that on comparing the Indian and Bhutanese subjects, the transverse measurements (L66, L77) and sagittal measurements (L61, L71) were statistically significant. Classification of the arch forms and distribution according to the sex for the Indians is given in table VIII and for the Bhutanese is given in table IX. The figures (II,III,IV,V) give the relative deviation from the mean value for the Indian and the Bhutanese group.

DISCUSSION

The most important finding of this study is that the Bhutanese subjects have highest prevalence of wider arch forms as compared to the Indian subjects who significantly have narrow arch forms. According to Raberin⁴, the landmarks which comprise of anterior segment, premolar-molar segment and a molar line, define breaking points of the arches that limit sectors on which different muscle groups act. The arch forms used by this method basically show two trends: relatively stretched arches given by Form 1 (narrow) and Form 4 (pointed); and relatively stocky arches shown by the Forms 2 (wide), 3 (mid) and 5 (flat).¹²

In the Indian sample, 50% had narrow arch forms, 20% had wide and 30% had mid arch forms. Wide dental arch form was the most predominant arch form type in the Bhutanese subjects, which comprised of 90% of the total sample studied. Rest of the samples that is around 10% had mid arch forms.

In this present study the distribution of arch forms between the sexes was not similar in both the Indian and Bhutanese subjects. Indian male students had 20% narrow arch forms, 10% wide and 10% had mid arch forms whereas the Indian female students had 30% narrow arch forms, 10% wide and 20% mid arch forms. The Bhutanese male samples had around 30% wide and 10% mid arch forms. Whereas the female samples in the Bhutanese group 60% wide arch forms. The transverse and sagittal measurements were statistically significant in case of maxillary arch in both the Indian and Bhutanese subjects. For the mandibular arch none of the measurements were statistically significant.

The findings of the present study are almost similar to previous studies done by Irey et al² who examined the Chinese populations. The Chinese have comparatively wider arches than the Indian population. Another study done by Shrestha et al¹² shows that the Nepalese population have highest prevalence of flat dental arches. Researchers tried to determine a single, ideal arch form that could be used in clinical practice. The present research concludes that the dental arch forms do not present a single or universal form, but there are at least five different clinical types seen in untreated adults with symmetrical arch and normal occlusion.¹²

CONCLUSION

The basic principle of arch form in orthodontic treatment is that within reason, the patients original arch form should be preserved. The arch forms of Indians are narrower than those of Bhutanese. It is recommended to select wider archwires from the available variations to suit many Bhutanese patients.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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