Comparative Study on Dimensional Characteristics of Dental Arch between Bamar and Karen

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Abstract

Dental arch dimensions could be used for race determination and sex determination in forensic odontology, treatment planning and management of malocclusion in orthodontic for local population. As the different human ethnic group display unique dental arch characteristics, to compare the dimensional characteristics of dental arch between Bamar and Karen ethnic group, maxillary and mandibular impression taking was done from 104 Bamar subjects of 16-18 years old with normal occlusion from Sagaing Township and Shwebo Township and 104 Karen subjects of 16-18 years old with normal occlusion from Yangon Region. The maxillary and mandibular inter-canine arch widths (UICW, LICW), inter-molar arch widths (UIMW, LIMW), anterior arch lengths (UAAL, LAAL), posterior arch lengths (UPAL, LPAL) were measured on the cast models by using a digital caliper (Mitutoyo, Japan). This study was cross sectional comparative study and collected data were statistically analyzed by Statistical Package for Social Sciences (SPSS) (version 22.0). The mean arch dimensions of Bamar in Sagaing region were; 29.32 mm for UICW, 21.59 mm for LICW, 49.35 mm for UIMW, 39.84 mm for LIMW, 18.07 mm for UAAL, 12.60 mm for LAAL, 16.62 mm for UPAL, 15.82 mm for LPAL, 1.10 mm for depth of Curve of Spee. The mean arch dimensions of Karen in Yangon region were; 34.97 mm for UICW, 25.23 mm for LICW, 54.05 mm for UIMW, 43.66 mm for LIMW, 24.59 mm for UAAL, 17.09 mm for LAAL, 20.60 mm for UPAL, 20.30 mm for LPAL, 1.54 mm for depth of Curve of Spee.. All of the arch dimension of Karens were significantly larger than those of Bamars. Significant sexual dimorphism of dental arch dimensions in both Bamar and Karen was found. This study provides the useful information for comparative studies among the ethnic groups of Myanmar.

Introduction

The dimensions of dental arches exhibit considerable variability within and among human groups. People from different ethnic groups present with different conditions [1]. The width, length and depth of dental arches have had considerable implications in orthodontic diagnosis and treatment planning in a modern dentistry based on prevention and early diagnosis of oral disease [2]. Dental arch dimensions are used in dentistry to guide the provision of accurate orthodontic diagnosis, and in forensic medicine to aid the identification of human remains [3], [4]. Different ethnic groups must be treated according to their own individual characteristics [5]. Observations from literature show that different human ethnic groups display unique dental arch characteristics and measurements [6]. As an example, comparison between Cau-

casian and Japanese mandibular arch forms revealed Caucasians to have smaller inter-canine width and inter-molar width in all three Angle's mal-occlusion classes [7]. The ethnic diverse tribe is expected to have difference in dietary habits as well as the lifestyles. Most studies indicate that normal measurements for one group may not be considered normal for other race or ethnic groups. Different racial groups must be treated according to their own characteristics [8]. In Myanmar, there are eight major national ethnic groups and Bamar is the largest ethnic group; 68% of the population and Karen is the third largest ethnic group; 7% of the population in Myanmar [9]. The indigenous races of Myanmar are of Mongoloid stock and the members of this stock found in Myanmar derive from three main branches, the Tibeto-Burman, the Mon-Khmer and the Tai-Chinese. Bamar is included in the Tibeto-Burman group and Karen is included in the Tai-Chinese Group [10]. There may be ethnic diversity in dimensional characteristics of dental arch between Bamar and Karen. In Myanmar, no studies have been conducted to describe and analyze the dental arch characteristics of ethnic groups of Myanmar. Aim of the present study is to determine and compare the dimensional characteristics of dental arch of two ethnic groups, Bamar and Karen. This study provides the useful information for comparative studies among the ethnic groups of Myanmar.

Material and Method

This study was a cross sectional comparative study from September 2016 to September 2017. According to selection criteria, (16 - 18) year old 104 Bamar students from University of Sagaing and University of Shwebo in Sagaing Region and (16 - 18) year old 104 Karen missionary students from Karen Baptist Theological Seminary and Karen Home Mission School in Yangon Region were selected after explaining the procedure and taking informed consent form. Name, age, gender, ethnicity of the selected subjects and name and ethnicity of the parents and grandparents were recorded in proforma.

Inclusion Criteria

(i) Subjects with free of restorations and caries

(ii) Subjects with Skeletal Class I and Dental Class I occlusion

(iii) Subjects with healthy ginivia

(iv) Subjects whose paternal and maternal grandparents (up to second generation) must be the Bamar and the Karen race.

Exclusion Criteria

(i) Subjects with unerupted or missing or supernumerary or extracted teeth (excluding third molars).

(ii) Subjects with morphological anomalies of tooth

(iii) Subjects with cleft lip and cleft palate

(iv) Subjects with pathological periodontal conditions

(v) Subjects who received orthodontic treatment

(vi) Subjects who have spacing, crowding, crossbite and openbite

Maxillary and mandibular impression taking were done. Dental stone models were cast from the impressions by dental stone powder. Name and code number of the subject was labeled on the base of the model. The reference points for the measurements were marked by using the sharp pointed pencil to establish the exact landmark points. (Fig. 1, 2, 3, 4 & 5) Arch dimensions were measured on the casts by us-

ing a digital caliper calibrated to 0.01 mm (Mitutoyo, Japan), and the depth of Curve of Spee was measured by using Michigan periodontal probe. (Fig.6)

Working definitions

(1) Inter - Canine Width (ICW): The distance from the cusp tip of the permanent canine on one side to the cusp tip of the contra lateral permanent canine [11].

(2) Inter - Molar Width (IMW): The distance from the mesio-buccal cusp tip of the first permanent molar on one side to the contra lateral first permanent molars [12].

(3) Anterior Arch Length (AAL): The distance between the mesial contact pointof the permanent central incisor and the point between the permanent canine and the first premolars [13].

(4) Posterior Arch Length (PAL): The distance between the mesial contact point of the permanent canine and the distal contact point of the second premolars [13].

(5) Depth of Curve of Spee: The perpendicular line from the cusp tip of the second premolars to a line connecting the distal cusp tip of the first permanent molar and the incisal edge of the most anterior tooth [13].

Collected data were entered in Statistical Package for Social Sciences (SPSS) (version 22.0). All data were analyzed for means, range, standard deviation, t value and p value. 't' value and 'p' value were used to access the statistical significance of difference in the maxillary and mandibular inter-canine arch widths, inter-molar arch widths, anterior arch lengths, posterior arch lengths and depth of the curve of Spee in mandibular arch between two ethnic groups.

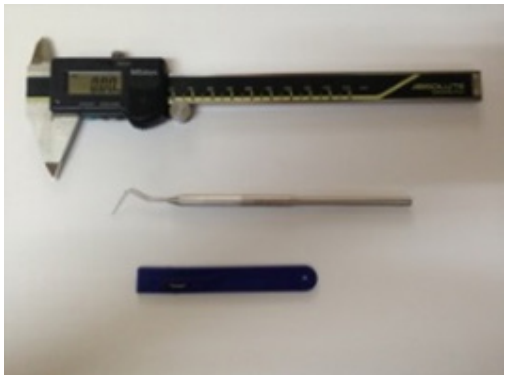

Figure 1: Illustration of Measuring Instruments
1 = Mitutoyo Digimatic Caliper
2 = Michigan periodontal probe
3 = Endodontic Ruler

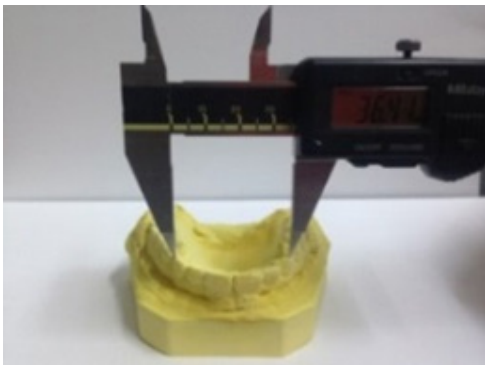

Figure 2: Measurement of inter-canine width with Mitutoyo Digimatic Caliper

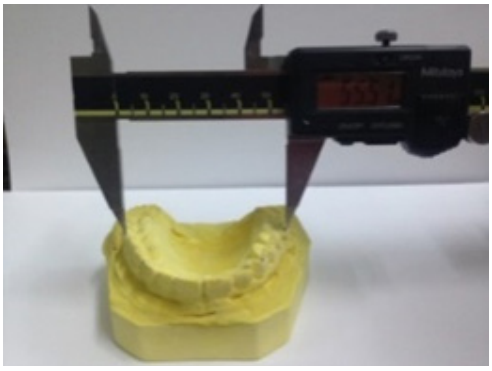

Figure 3: Measurement of inter-molar width with Mitutoyo Digimatic Caliper

Figure 4: Measurement of anterior arch length with Mitutoyo Digimatic Caliper

Figure 5: Measurement of posterior arch length with Mitutoyo Digimatic Caliper

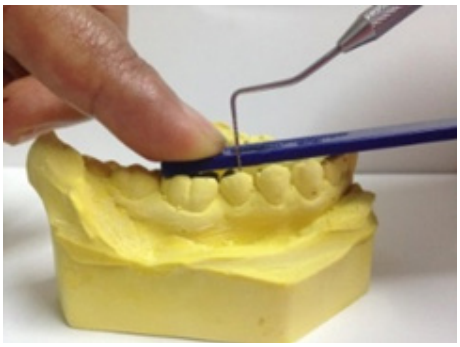

Figure 6: Measurement of Depth of Curve of Spee with Michigan periodontal probe and endodontic ruler

Results

Comparison of the dental arch dimension of Bamar and Karen ethnic groups were shown in millimeter in (Table 1). Mean maxillary and Mandibular dental arch dimensions of Karen ethnic group were significantly larger than those of Bamar ethnic group ($p<0.05$).

Sexual dimorphism of dental arch dimensions in Bamar ethnic group was shown in millimeter in (Table 2). Mean maxillary and Mandibular dental arch dimensions of Bamar males were significantly larger than those of Bamar females ($p<0.05$).

Sexual dimorphism of dental arch dimensions in Karen ethnic group was shown in millimeter in (Table 3). Mean maxillary and mandibular dental arch dimensions of Karen males were significantly larger than those of Karen females ($p<0.05$), except mean mandibular IMW of Karen males was larger than those of Karen females, however statistically not significant.

According to Table 4, almost all the dimensional characteristics of Bamar ethnic group were smallest except UIMW of Moorfields was smallest, UPAL and LPAL of Non-tribal and Tribal in Central India were smaller than Bamar ethnic group.

In comparison with other studies, depth of Curve of Spee of Bamar is smallest in both male and female. The depth of Curve of Spee was approximately equal in Bamar, Karen and Indain, Iraq and Turkey had greater depth of Curve of Spee. (Table 4)

Nummikoski et al. (1988) [19] studied the dimensions of the dental and mandibular arches were determined in 210 subjects belonging to Mexican American, black American and white American ethnic groups. The study revealed that ethnic and sexual differences in the dental and mandibular arch widths were statistically significant. Dental arch of White Americans were significantly narrower than that of the other ethnic groups.

Kasai et al. (1997) [20] studied to provide information about arch shape variations among South Pacific populations. Fijians, Western Samoans and Kiribati people have larger upper and lower dental arches than that of Japanese. The Fijian upper and lower dental arches were significantly larger than those found in other populations and was characterized by a wide posterior arch breadth. The Western Samoan and Kiribati arch shape was more similar to the Japanese arch shape than the Fijian.

Burris and Harris (2000) [21] quantified the differences in arch size and shape in American blacks and whites of the US population. They found that blacks and whites differ substantially for these parameters not only in size, but in shape as well. Arch size is notably larger in American blacks than whites. The present study, Nummikoski et al. (1988) [19], Kasai et al. (1997) [20] and Burris and Harris (2000) [21] showed that there is significantly difference of dental arch dimensions in different ethnic groups.

Conclusion

From the present study, it was found that all arch dimensions of Karen were significantly larger than those of Bamar. Arch dimensions of Bamar and Karen males were significantly greater than those of females. This indicates that there are variations in dental arch dimensions among ethnic groups and between genders. These ethnic differences should be considered during treatment, especially in disciplines such as prosthodontics and orthodontics where arch shape can be modified appreciably. These ethnic differences may also be useful in race and sex determination in forensic odontology.

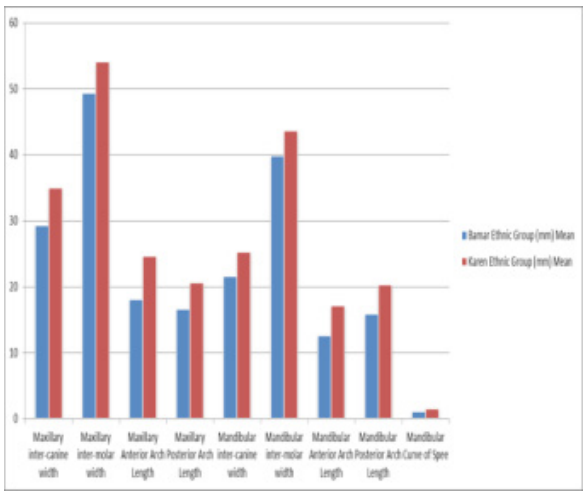

Figure 7. Comparison of the dental arch dimensions of Bamar and Karen ethnic groups (in mm)

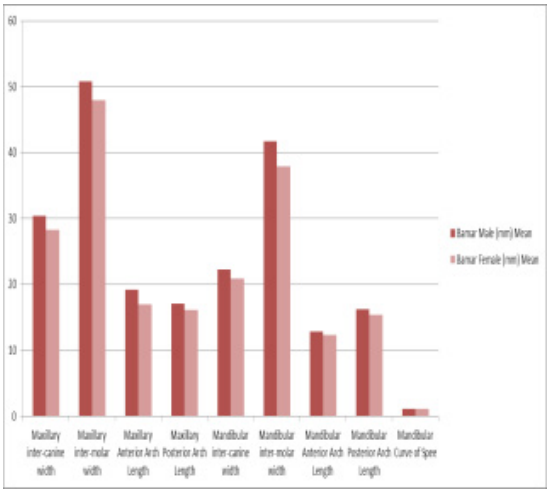

Figure 8. Sexual dimorphism of dental arch dimensions in Bamar ethnic group

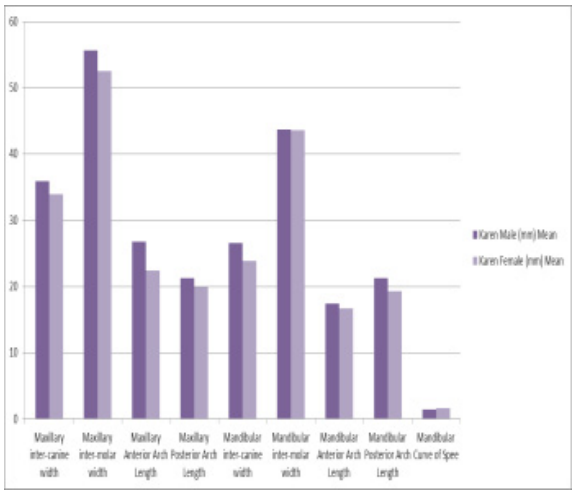

Figure 9. Sexual dimorphism of dental arch dimensions in Karen ethnic group

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Dental Arch Dimensions	Bamar Ethnic Group (mm)		Karen Ethnic Group (mm)		t value	p value
	Mean	SD	Mean	SD		
Maxillary inter-canine width	29.32	1.77	34.97	1.58	-24.19	< 0.01*
Maxillary inter-molar width	49.35	2.04	54.05	2.15	-16.10	< 0.01*
Maxillary Anterior Arch Length	18.07	1.44	24.59	2.69	-21.75	< 0.01*
Maxillary Posterior Arch Length	16.62	1.13	20.60	1.05	-26.20	< 0.01*
Mandibular inter-canine width	21.59	1.15	25.23	1.83	-17.10	< 0.01*
Mandibular inter-molar width	39.84	2.51	43.66	2.05	-11.99	< 0.01*
Mandibular Anterior Arch Length	12.60	0.54	17.09	0.96	-41.09	< 0.01*
Mandibular Posterior Arch Length	15.82	1.03	20.30	1.47	-25.33	< 0.01*
Mandibular Curve of Spee	1.10	0.25	1.54	0.43	-8.9	< 0.01*

Table 1. Comparison of the dental arch dimension of Bamar and Karen ethnic groups (in mm)

* Significant at $p < 0.05$

Dental Arch Dimensions	Bamar Male (mm)		Bamar Female (mm)		t value	p value
	Mean	SD	Mean	SD		
Maxillary inter-canine width	30.38	1.55	28.26	1.27	7.57	< 0.01*
Maxillary inter-molar width	50.79	1.36	47.91	1.55	10.06	< 0.01*
Maxillary Anterior Arch Length	19.18	1.02	16.96	0.81	12.18	< 0.01*
Maxillary Posterior Arch Length	17.10	1.31	16.13	0.63	4.77	< 0.01*
Mandibular inter-canine width	22.29	1.00	20.90	0.84	7.60	< 0.01*
Mandibular inter-molar width	41.76	1.27	37.92	1.90	12.10	< 0.01*
Mandibular Anterior Arch Length	12.86	0.64	12.35	0.24	5.39	< 0.01*
Mandibular Posterior Arch Length	16.23	1.13	15.41	0.74	4.32	< 0.01*
Mandibular Curve of Spee	1.08	0.23	1.12	0.26	-0.64	0.51

Table 2. Sexual dimorphism of dental arch dimensions in Bamar ethnic group (in mm)

*Significant at $p < 0.05$

Dental Arch Dimensions	Karen Male (mm)		Karen Female (mm)		t value	p value
	Mean	SD	Mean	SD		
Maxillary inter-canine width	35.96	1.21	33.97	1.27	8.14	< 0.01*
Maxillary inter-molar width	55.60	0.95	52.49	1.88	10.60	< 0.01*
Maxillary Anterior Arch Length	26.79	1.99	22.40	0.93	14.38	< 0.01*
Maxillary Posterior Arch Length	21.28	0.88	19.92	0.72	8.61	< 0.01*
Mandibular inter-canine width	26.61	1.21	23.85	1.18	11.71	< 0.01*
Mandibular inter-molar width	43.68	1.99	43.64	2.12	0.11	0.91
Mandibular Anterior Arch Length	17.46	0.81	16.72	0.97	4.17	< 0.01*
Mandibular Posterior Arch Length	21.27	1.44	19.33	0.60	8.92	< 0.01*
Mandibular Curve of Spee	1.44	0.36	1.64	0.47	-2.32	0.02*

Table 3. Sexual dimorphism of dental arch dimensions in Karen ethnic group (in mm)

* Significant at $p < 0.05$

Ethnic Group	UICW	UIMW	UAAL	UPAL	LICW	LIMW	LAAL	LPAL
Australian aborigine [14]	44.6	50.4	18.6	31.0	22.5	46.1	18.1	38.5
New Guinea [14]	35.4	47.6	22.3	32.2	28.2	47.5	17.1	32.0
West Africa [14]	34.7	47.9	22.7	32.9	28.4	47.0	17.8	32.4
Mongoloid [14]	43.2	50.8	18.2	39.7	22.7	48.1	18.8	36.7
Moorfields [14]	39.0	48.9	21.0	28.9	25.0	45.3	17.1	31.5
Anglo-saxon [14]	35.7	55.4	21.9	32.0	27.2	44.6	16.6	34.1
West Midlands [14]	39.9	49.7	17.7	33.3	26.5	45.1	17.5	36.0
Non-tribal in Central India [15]	38.35	57.35	22.60	14.30	25.45	45.0	16.0	13.50
Tribal in Central India [15]	35.75	56.55	23.20	14.20	26.45	45.80	15.70	13.15
Bamar (present study)	29.32	49.35	18.07	16.62	21.59	39.84	12.60	15.82
Karen (present study)	34.97	54.05	24.59	20.60	25.23	43.66	17.09	20.30

Table 4. Comparison of Inter-canine width, inter-molar width, anterior arch length and posterior arch length of maxilla and mandible of Bamar and Karen and Other Studies

Ethnic Group	Depth of Curve of Spee	
	Male	Female
Turkey [16]	2.3	2.03
Iraq [17]	2.65	2.20
India [18]	1.51	1.77
Bamar (Present Study)	1.08	1.12
Karen (Present Study)	1.44	1.64

Table 5. Comparison of depth of Curve of Spee of Bamar and Karen and Other Studies