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Lower jaw and orolabial analysis in adult Bangladeshi Buddhist Chakma females

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SUMMARY

A single standard of craniofacial norms is not appropriate for application to diverse racial and ethnic groups, so it is necessary to develop craniofacial norms for different groups. This study was descriptive, observational and cross-sectional in nature, with some analytical components. The study group consisted of a convenient sample of 100 adult Bangladeshi Buddhist Chakma females; categorized into two age groups – 25 to 35 years (n = 70) and 35 to 45 years (n = 30).

Nine variables were measured using physical and photographic procedures. Seven indices were calculated from those variables. An independent "t" test was performed to evaluate if there were any significant differences in measurements between the two age groups – 25 to 35 years and 35 to 45 years, setting a p value of ≤ 0.05 as statistically significant. No statistically significant differences in measurements were found between the two age groups, except for philtrum length (p = 0.02) and upper vermilion height to philtrum length index (p = 0.03). The results of this study can be useful for anatomists and anthropologists to serve as a basic framework for estimating the standard of lower jaw and orolabial dimensions of this population, and also to compare the dimensions of other ethnic groups in Bangladesh with this ethnic group.

Key words: Lower jaw – Orolabial anthropometry – Chakma Females

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INTRODUCTION

Variation in different morphological characters is one of the most important phenomena occurring in humans, and is attributed to many factors such as mutation and natural selection. The dimensions of the human body are affected by ecological, biological, geographical, racial, gender and age factors (Jahanshahi et al., 2008). So, anthropometric measurements as a mean of studying variations of human population should be based on the above factors. This necessity rests on the fact that there will be greater validity if an individual is compared to referent data matched for their specific ethnic group, sex and age. Lower jaw and orolabial anthropometry can be useful for quantitative evaluation of dysmorphic syndromes. Morphological features of various syndromes are usually described on the basis of qualitative method, which is subjective and clinical impression can be misleading (Nagle et al., 2005). Even among specialists, there is often disagreement with respect to minor anomalies (Holmes et al. cited by Zankl and Molinari, 2003). Such problems will overcome if craniofacial measurements are taken from a patient compared with the normal values obtained from a reference population. Lower jaw and orolabial anthropometry can also be used in plastic and reconstructive surgery, oral surgery and dentistry. To treat any congenital or post-traumatic disfigurements in members of different ethnic groups successfully, surgeons require access to the normative measurements of that group (Farkas et al., 2005) for precise determination of the degree of deviations from the normal and to assess any improvement achieved through treatment (Edler et al., 2006). It

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is reported by various researchers that facial dimensions continue to modify during adulthood, even after complete biological maturation (Sforza et al., 2010). The dimensions of the orolabial region have been also found to be sexually dimorphic (Sforza et al., 2010; Ngeow and Aljunid, 2009). Chakma is the largest ethnic group found in the hilly areas of eastern Bangladesh (The Chakma, 2008). They are mongoloid in origin (Countries and Their Cultures: Chakmas). According to the 1991 population census of Bangladesh their number is 2,530,000 (The Chakma, 2008). They form the largest Buddhist population in Bangladesh.

As no published data are available at present, it is necessary to standardize the normative value of lower jaw and orolabial measurements for this ethnic group. Therefore, the present study was designed to establish the baseline measurements of the lower jaw and orolabial anthropometrical parameters and indices, and also to evaluate the differences (if any) on age related morphological variations in lower jaw and orolabial region of the adult Bangladeshi Buddhist Chakma females that may be necessary for future reference in these regard.

MATERIALS AND METHODS

The study was descriptive, observational and cross-sectional in nature with some analytical components and carried out in the Department of Anatomy, Bangabandhu Sheikh Mujib Medical University, Dhaka, during the study period of July, 2009 to June, 2010. The study group consisted of a convenient sample of 100 adult Bangladeshi Buddhist Chakma females; categorized into two groups – 25 to 35 years (n = 70) and 35 to 45 years (n = 30). Age of the subject was recorded from their birth and S.S.C certificates and national identity cards. Subjects excluded from the study were those - mixed in origin, history of congenital craniofacial anomaly, major craniofacial trauma, orthodontic treatment, craniofacial reconstructive surgery and had craniofacial deformities or irregular dentitions.

Variables studied (Kolar and Salter, 1997)

a. Variables studied through physical procedures (Fig. 1)
   i. Mandible height (Stomion - Gnathion)
   ii. Mandible breadth (Gonion - Gonion)
   iii. Mouth width (Cheilion - Cheilion)
b. Variables studied through photographic procedures (Fig. 1)
   i. Upper lip height (Subnasale – Stomion)
   ii. Lower lip height (Stomion – Sublabiale)
   iii. Upper vermilion height (Labiale superius – Stomion)
   iv. Lower vermilion height (Stomion – Labiale inferius)
   v. Philtrum length (Subnasale – Labiale superius)
   vi. Philtrum width (Crista philtri – Crista philtri)
c. Calculated variables (see Fig. 1 legend for abbreviations)
   i. Mandibular index (sto-gn / go-go x 100)
   ii. Lower lip height to Upper lip height index (sto–sl / sn–sto x 100)
   iii. Lower vermilion height to Lower lip height index (sto–li / sto–sl x 100)
   iv. Upper vermilion height to Philtrum length index (ls–sto / sn–ls x 100)
   v. Philtrum index (sn–ls / cph–cph x 100)
   vi. Upper lip height to Mouth width index (sn–sto / ch-ch x 100)
   vii. Philtrum width to Mouth width index (cph –cph / ch-ch x 100)

Procedures for measuring studied variables

To avoid accidental injury of the labial region, a photographic procedure was used which had been shown as a valid alternative of manual anthropometry provided that the images had been captured in a standardized fashion, and the points chosen were easily identifiable (Farkas et al., 1980 cited by Edler et al., 2006; Vegter et al., 1997 and Nechala et al., 1999 cited by Edler et al., 2010). Before taking the physical measurements and frontal facial photograph, all facial jewelry was removed from the subject (Simmons et al., 2004) and was asked to maintain a neutral, relaxed facial expression with mouth closed naturally.

All the physical measurements were taken by the same researcher, using a spreading caliper for mandible breadth or digital sliding caliper for mandible height and mouth width. Before the data collec-

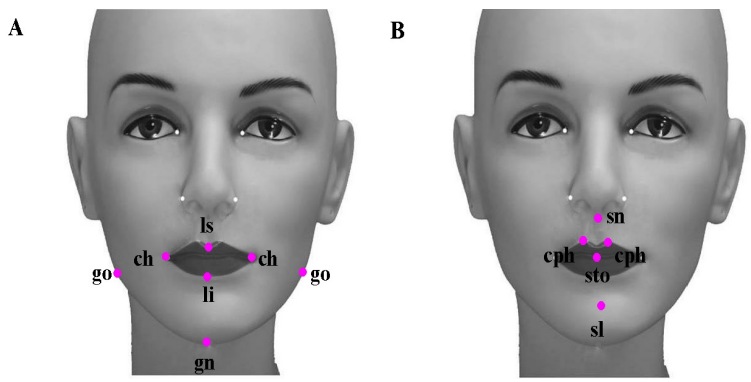

Fig. 1. Diagrammatic representation of some important craniofacial anthropome landmarks in frontal **(A,B)** views of a manikin. Gn, gnathion; sl, sublabiale; Go, gonion; Cph, crista philtr; Ch, cheilion; Sto, stomion; Ls, abiale superius; Sn, subnasale.

tion procedure for each subject, soft tissue and bony landmarks were located through inspection and palpation and bony landmarks were marked on the cutaenous surface to increase accuracy using a black eye pencil (Ferrario et al., 1995).

Photographs were taken with a digital camera, at a 7.2 megapixel resolution, under the same lighting conditions using flash mode from a fixed distance of 4 feet using zoom function (Simmons et al., 2004). All the photographic measurements were taken in a computer program named Adobe Illustrator Version-10. Pen tool of Adobe Illustrator was used to place landmarks, and a selection tool was used to take the reading from transform tool of Adobe Illustrator.

The physical measurements and frontal facial photographs were taken at a fixed time between 9 AM and 5 PM to eliminate the discrepancies due to diurnal variations (Jadav and Shah, 2004). All the measurements were taken twice to control measurement error. The final value that was used for the study was the average of the two obtained values. A third reading was taken if the initial two measurements showed a major discrepancy and the two closer readings would then be used (Hajnis et al., 1994 cited by Ngeow and Aljunid, 2009; Starbuck and Ward, 2007).

Data processing and analysis

After data collection, their frequency distributions, central tendencies and dispersions were determined using SPSS version 12. An independent "t" test was performed to evaluate if there was any significant difference in measurements between the two age groups - 25 to 35 years (n = 70) and 35 to 45 years (n = 30) setting a p value of ≤ 0.05 as statistically significant.

RESULTS

Range, mean ± SD and p value of the measurements are shown in Tables 1, 2 and 3. These tables also show statistically non-significant difference between two age groups – 25 to 35 years and 35 to 45 years in all measurements except for philtrum length and upper vermilion height to philtrum length index.

DISCUSSION

Table 1. Measurements of the lower jaw and orolabial region obtained through physical procedures.

Variable	Age group (years)	Range (cm)	Mean (cm) ± SD	p value*
Mandible height	25 – 35	3.59 - 5.34	4.51 ± 0.36	0.25 (NS)†
	35 - 45	3.63 - 5.36	4.41 ± 0.43	
Mandible breadth	25 – 35	9.80 - 11.60	10.50 ± 0.45	0.35 (NS)
	35 - 45	9.80 - 11.40	10.59 ± 0.42	
Mouth width	25 – 35	3.88 - 5.29	4.57 ± 0.31	0.33 (NS)
	35 - 45	3.93 - 5.34	4.64 ± 0.34	

*p>0.05, the result was considered as non-significant. †NS = Non-significant

Table 2. Measurements of the lower jaw and orolabial region obtained through photographic procedures.

Variable	Age group (years)	Range (cm)	Mean(cm) ± SD	p value*
Upper lip height	25 – 35	1.59 - 2.69	1.96 ± 0.19	0.24 (NS)†
	35 - 45	1.61 - 2.62	2.02 ± 0.26	
Lower lip height	25 – 35	1.05 - 1.95	1.46 ± 0.19	0.39 (NS)
	35 - 45	1.08 - 1.99	1.50 ± 0.21	
Upper vermilion height	25 – 35	0.47 - 1.05	0.76 ± 0.12	0.21 (NS)
	35 - 45	0.39 - 1.16	0.73 ± 0.16	
Lower vermilion height	25 – 35	0.65 - 1.41	0.99 ± 0.16	0.31 (NS)
	35 - 45	0.49 - 1.23	0.96 ± 0.20	
Philtrum length	25 – 35	0.69 - 1.76	1.21 ± 0.21	0.02 (S)**
	35 - 45	0.97 - 1.88	1.33 ± 0.23	
Philtrum width	25 – 35	0.59 - 1.38	1.02 ± 0.19	0.85 (NS)
	35 - 45	0.74 - 1.46	1.03 ± 0.16	

*p>0.05, the result was considered as non-significant. †NS = Non-significant. **S = Significant

Table 3. Measurements of calculated lower jaw and orolabial indices

Craniofacial index	Age group (years)	Range (cm)	Mean (cm) ± SD	P value*
Index obtained through physical procedure				
Mandibular index	25 – 35	33.28 - 54.50	43.02 ± 4.18	0.13 (NS)†
	35 - 45	32.96 - 50.19	41.66 ± 3.92	
Index obtained through photographic procedure				
Lower lip height to Upper lip height index	25 – 35	45.72 - 93.64	74.97 ± 10.50	0.99 (NS)
	35 - 45	52.94 - 94.09	74.95 ± 11.02	
Lower vermilion height to Lower lip height index	25 – 35	43.60 - 93.69	68.44 ± 10.21	0.09 (NS)
	35 - 45	28.00 - 87.79	64.27 ± 12.57	
Upper vermilion height to Philtrum length index	25 – 35	30.72 - 128.99	65.85 ± 20.12	0.03 (S) **
	35 - 45	26.35 - 103.57	56.65 ± 17.31	
Philtrum index	25 – 35	71.13 – 245.76	122.75 ± 30.16	0.19 (NS)
	35 - 45	87.20 – 202.22	131.06 ± 25.10	
Index obtained through physical and photographic procedure				
Upper lip height to Mouth width index	25 – 35	33.33 - 57.58	43.16 ± 5.05	0.68 (NS)
	35 - 45	35.42 - 57.06	43.63 ± 5.65	
Philtrum width to Mouth width index	25 – 35	12.64 - 32.60	22.32 ± 4.12	0.88 (NS)
	35 - 45	16.73 - 34.89	22.18 ± 3.60	

* p>0.05, the result was considered as non-significant. †NS = Non-significant. **S = Significant

When craniofacial anthropometry was introduced into clinical practice to quantify changes in the craniofacial framework, features distinguishing various races or ethnic groups were discovered (Farkas et al., 2005). So it is accepted that a single standard of facial aesthetics is not appropriate for application to diverse racial and ethnic groups (Wuerpel, 1936; Moyers, 1988; Proffit, 1999 cited by Joy et al., 2009). Moreover, differences in craniofacial norms across different ages have also been documented. Therefore, there is a need to develop craniofacial norms for different age groups as well. This necessity rests on the fact that there will be greater validity if an individual is compared to referent data matched for their specific ethnic group and age. The participants included in this study were from the southern part of Bangladesh (Chittagong and Rangamati cities).

In general, the present data were satisfactorily in concurrence with previous reports. For example, the mandible breadth of Chakma females was almost similar to Santhal (Ghosh and Malik, 2007), Manchu (Kubo, 1997), Evenks (Watanabe, 2000), Mongol (Okumura, 1999), Korean (Kim et al., 2003) females.

Three-dimensional data collected by digital indirect anthropometry were reported by Sawyer et al. (2009) for adult Caucasians, and by Sforza et al. (2010) for white Italians. In comparison some values were larger some were smaller than the current ones. Such difference may be due to difference in technique. The present study use physical or photographic procedures while Sawyer et al. (2009) used stereophotogrammetry and Sforza et al. (2010) used computerized electromagnetic digitizer. Besides these, ethnicity of the sample was also different.

Sforza et al. (2010) show that the dimensions of the lips and orolabial region modify between young adulthood and adult up to eighth decade of life. But in this study except for philtrum length and upper vermilion height to philtrum length index such significant modification could not evaluate. The present study was a cross-sectional in nature, so it may not represent the actual growth pattern of lips and orolabial region. However, only a few longitudinal studies showed age related significant modifications in lips and orolabial region.

Limitations

The subjects were selected from a convenient sample, and also relatively small as compared to the total number of population. Besides this, it is a cross-sectional study. So, a longitudinal study on a larger sample is required to confirm the findings of this study.

Conclusion

The result of the present anthropometric study can be useful for anatomists and anthropologists to serve as a basic framework for estimating the standard of lower-jaw and orolabial dimensions of this population, and also to compare the craniofacial dimensions of other ethnic groups of Bangladesh with this ethnic group.

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