"Evaluation of lateral Cephalometric Norms for Burstone's Analysis in Chhattisgarh by using Nemoceph Software with Lateral Cephalograms Taken in Natural Head Position"

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ABSTRACT

The aim of the present study is to evaluate Lateral Cephalometric norms in Chhattisgarh population by Burstone's Analysis with the purpose of establishing normative standards, helpful in planning treatment of orthognathic surgery cases in this ethnic group. Sample size consisted of 200 subjects comprising 100 female and 100 male subjects (age group 18-25 yrs.) Subjects were included on the basis of the following inclusion criteria-1. Both male and female subjects aged between 18-25 years 2. Those subjects were selected who were belonging to the Chhattisgarhi Origin. 3. with acceptable facial profile and class I occlusion, normal overjet and overbite. Minimal amount of spacing and crowding were considered acceptable.4. With no history of prior orthodontic treatment. Kodac 800 orthopantomogram and Lateral Cephalometric Extra oral imaging system was used to take the digital lateral cephalograms of the subjects with functional head positioner, patients standing in natural head position. All the digital cephalograms were subjected to Burstone's Hard tissue Analysis using Nemoceph software.,

Results indicate that both Chhattisgarh males and females compared to Caucasian counterparts have shorter cranial base length, greater facial convexity (which is non significant in males), greater, maxillary and mandibular skeletal prognathism, prominent chin, and decreased posterior divergence of the mandible. Decreased vertical height of maxilla anterioposteriorly, shorter lower face height, upper anterior and posterior dental heights as well as lower anterior and posterior dental heights. Decreased ramal height and mandibular body length less bony chin depth, steeper occlusal plane and increased sagittal base discrepancy and proclination of upper and lower incisors.

So analysing the Craniofacial morphology of Chhattisgarh face, it can be concluded that Chhattisgrh population has a face which is skeletally prognathic, vertically short, steep occlusal plane and bimaxillary protrusive as compared to Caucasians.

INTRODUCTION

Our face determines the physical attractiveness. Facial esthetics has a big influence on our social life Skeletal malocclusions often worsen facial esthetics and may negatively influence patient's quality of life. Patients with severe facial deformity show a significantly higher prevalence of emotional instability introversion, anxiety and unsocialability.[1,2]

Harmonious facial esthetics and optimal functional occlusion has been recognised as the most important goal of orthodontic treatment Knowledge of normal dentofacial pattern in adults in various ethnic and age group is also important for clinical treatment planning and research. Richordson defined the term "ethnic group" as a population with a common bond such as a geographical boundary, a culture or language or being racially or historically related.[3] Roentgenographic Cephalometry was first introduced to orthodontic speciality by Broadbent in Cephalometric a 1931.[4] Cephalometric analysis can be an aid in the diagnosis of skeletal and dental problems and a tool for simulating surgery and orthodontics. Cephalometric analysis also allows the clinician to evaluate changes after surgery [5] A number of Cephalometric analysis are commonly used for orthodontic case analysis.[678]

Cephalometric norms have been established for various ethnic groups using various analysis such as Cephalometric standards for southern Chinese (Michael S. Cooke and Wie)[9], Afro American Brazilians by Guilherme Jhonson et al[10], Chinese norms by Mcnamara Analysis (Wu John)[11], in-napalese population using Stiener's anlysis –for Mongoloids and Indo Aryans (Jagan nath Sharma 2011)[12], North Indians (Lucknow) by Nanda R nanda S (1969).[13] Valiathan A. using Down's analysis for Indian population (1974)[14], Aryo Dravidians by kharbanda O.P et al (1989).[15] These studies have established the racial differences in different ethnic groups as far as craniofacial characteristics are concerned.

Burstone's analysis is especially designed for patients who need Orthognathic surgery and COGS analysis has the following characteristics which make it particularly adaptable for the evaluation of surgical orthognathic problem. The chosen landmarks and measurements can be altered by various surgical procedures; the comprehensive appraisal include all the facial bones and cranial base

references. And rectilinear measurement can be readily transferred to the study cast.[5]

A few studies have been carried out in Chhattisgarh using other Analysis such as Lateral Cephalometric norms by Stieners Analysis (Farishta et al.)[16]. But no study has been carried out using Burstone;s Analysis. Therefore, present study aim for evaluating lateral Cephalometric norms in Chhattisgarh population with respect to established Caucasian norms. For this, observed hard tissue COGS values in males and females of Chhattisgarh population will be compared with male and female of Caucasian population respectively and sexual dimorphism will also analysed in Chhattisgarh population. In this way Cephalometric standards will be developed for Chhattisgarh population which will help in diagnosis and treatment planning of Orthognathic surgery in this particular ethnic group.

MATERIAL AND METHODS

The sample for the present study included 200 subjects which consisted of 100 female and 100 male subjects (age group 18-25 yrs.). The sample was screened from the general OPD of Maitri Dental College, Anjora, Durg as well as from students of Maitri Dental College Subjects were included on the basis of the following inclusion criteria- **(1.)** Both male and female subjects aged between 18-25 years. **(2).** Those subjects were selected who were belonging to the Chhattisgarhi Origin. **(3).** with acceptable facial profile and class I occlusion, normal over jet and overbite. Minimal amount of spacing and crowding were considered acceptable. **(4)**. With no history of prior orthodontic treatment. Each subject filled out the consent form to individually participate in the present study.

The sample was collected prospectively and in a consecutive non biased fashion in order to minimise participation problems. This approach enabled recruitment of diverse range of Chhattisgarh population.

Sample size estimation

Prior to the collection of sample for the present study, a power test was carried out to determine the adequate sample size. The sample size required to yield a 90% power level (i.e 10 % chance of committing type II error) at p less than 0.05 level of significance then using the data above, the required sample size, n, would be 61 for males and 43 for females. So to increase the power and reliability of the results, the sample size is kept at 100 each group.

Radiography

A lateral head radiograph was obtained and used for each subject in the present study(fig 1)Lateral head radiograph used in the present study were all obtained from Department of oral medicine and Radiology, Maitri College of Dentistry and Research Centre, Anjora, Durg. Kodac 8000 orthopantomogram and Lateral Cephalometric Extra oral imaging system was used to take the digital lateral cephalograms of the subjects with functional head positioner, patients standing in natural head position. The Natural head position used was of self-balanced position as suggested by Siersback Nielsen and Solow[17] in 1982. Patients were requested to walk on the spot with decreasing amplitude of head tilting performed until a position of self-balance was obtained before stepping into the Cephalostat. Bilateral ear plugs inserted into external auditory meatii. Teeth fully clenched and lips relaxed. Subjects were exposed to take radiographs.(Fig. 1)

Fig.1

All the images were processed in the processor and automatically transferred to a computer loaded with Kodak software. All the digital images were than compressed to 8Bit jpeg-100 format, taken in a CD ROM and transferred to the tracing software Nemoceph (Version 6.0) for Cephalometric analysis. 16 linear and 6 angular hard tissue parameters given by Legan and Burstone[8] were measured in the present study after identification of appropriate landmarks. (Fig. 2,3)

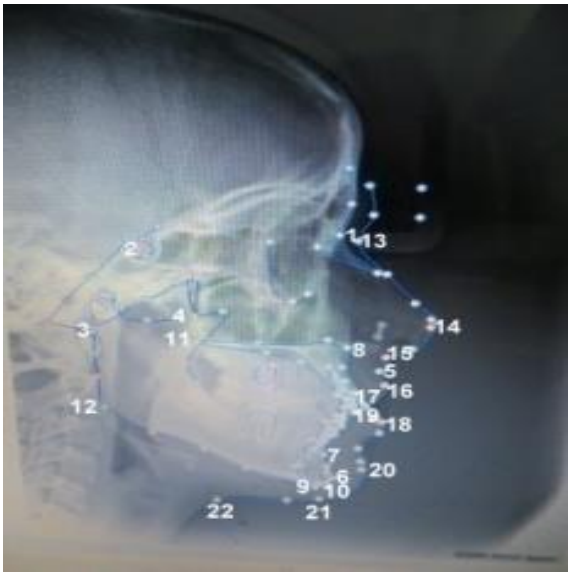

Fig. 2: Cephalometric Landmarks - Hard and Soft tissue.

(1. Nasion **2.** Sella **3.** Articulare(Ar) **4.** PTM **5.** PointA **6.** Pogonion(Pg) **7.** Supramentale (point B) **8.** ANS **9.** menton(Me) **10.**Gnathion(Gn) **11.**PNS **12.**Gonion(Go) **13.** Glabella(G) **14.** Collumella(Cm) **15.** Subnasale(Sn) **16.** Labrale superioris(Ls) **17.** Stomion superioris(Stms) **18.** Labrale inferioris(Li) **19.** Stomion inferioris(Stmi) **20.** Soft tissue pogonion(Pg') **21.** soft tissue menton(Me') **22.** Cervical point(C)

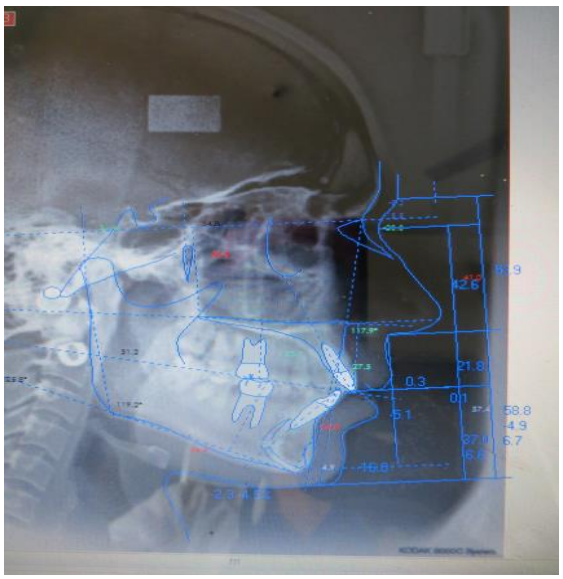

Fig. 3: Burstone Hard tissue Analysis

Photographic setup

Two extraoral photographs were taken for each and every subject, that is Frontal and a profile view. All the photographs of the subjects were taken by Canon Power shot SX 260 camera.

Photographs were taken in photographic room of the Department of Orthodontics and Dentofacial Orthopedics, Maitri College of Dentistry and Research Centre, Anjora- Durg.

Fig. 4: Female subjects with acceptable profile and normal occlusion: Frontal and profile view

Fig. 5: Male subjects with acceptable profile and normal occlusion: Frontal and profile view

Statistical analysis of the data

Unpaired *t*-tests were used to compare the mean differences of each cephalometric measurement between the Chhattisgarh and the Caucasians. The minimum level of statistical significance was set at $P < 0.01$.

RESULTS

The comparative results using descriptive statistics (mean and standard deviations) for COGS analysis of skeletal and dental Cephalometric values in Chhattisgarh and Caucasiasns (European Americans) are presented in table1, 2 and 3.

Table 1: Hard tissue COGS-Comparison of Burstone's values for Caucasian females with present study values for Chhattisgarh Females.

Measurements	Description	Caucasian Females N= 15		Chattisgarh Female sample N=100		Significance
		Mean	±S.D.	Mean	±S.D.	
Posterior Cranial base	Ar-PTM (HP)	32.8	1.9	29.454	4.1	0.00001
Anterior cranial base	PTM-N (HP)	50.9	3	44.038	6.561	0.00001
Facial convexity	N-A-Pg angle	2.6	5.1	4.708	6.121	0.00001
Maxillary Protrusion	N-A (HP)	-2	3.7	1.762	5.403	0.00001
Mandibular protrusion	N-B (HP)	-6.9	4.3	-2.384	6.921	0.00001
Chin protrusion	N-Pg (HP)	-6.5	5.1	-0.67	7.643	0.00001
Upper anterior face height	N-ANS (_HP)	50	2.4	42.439	10.47	0.00001
Lower anterior face height	ANS-Gn (_HP)	61.3	3.3	54.599	6.862	0.00001
Upper posterior face height	PNS-N (_HP)	50.6	2.2	43.504	6.873	0.00001
Mandibular plane angle	MP-HP angle	24.2	5	21.527	6.243	0.00001
Upper anterior dental height	U1-NF (_NF)	27.5	1.7	24.808	3.731	0.00001
Upper posterior dental height	Upper molar-NF (_NF)	23	1.3	20.82	3.11	0.00001
Lower anterior dental height	Lower incissor-MP(_MP)	40.8	1.8	38.601	32.246	0.00001
Lower posterior dental height	Lower molar-MP (_MP)	32.1	1.9	27.968	3.449	0.00001
Mandibular ramus length	Ar-Go (linear)	46.8	2.5	42.836	5.983	0.00001
Mandibular body length	Go-Pg (linear)	74.3	5.8	68.753	7.873	0.00001
Chin depth	B-Pg (MP)	7.2	1.9	6.247	6.447	0.00001
Gonial angle	Ar-Go-Gn angle	122	6.9	117.557	6.539	0.00001
Occlusal plane	OP-HP angle	7.1	2.5	8.466	5.304	0.00001
Wits Analysis	A-B (OP)	-0.4	2.5	1.671	2.414	0.00001
Upper incisor inclination	Upper incissor-NF(angle)	112.5	5.3	113.881	36.785	0.009
Lower incisor inclination	Lower incissor-MP(angle)	95.9	5.7	102.403	6.935	0.00001

Linear measurements are expressed inilimeters and angular measurements are expressed in degree.

Table 2: Hard tissue COGS-Comparison of Burstone's values for Caucasian males with present study values for Chhattisgarh males.

Measurements	Description	Caucasian Males N=14		Chhattisgarh male sample N=100		Significance
		Mean	S.D.	Mean	S.D.	
Posterior Cranial base	Ar-PTM(HP)	37.1	2.8	31.864	4.883	0.00001
Anterior cranial base	PTM-N (HP)	52.8	4.1	47.018	7.643	0.00002
Facial convexity	N-A-Pg angle	3.9	6.4	4.577	6.238	0.5
Maxillary Protrusion	N-A (HP)	0	3.7	0.977	4.515	0.008
Mandibular protrusion	N-B (HP)	-5.3	6.7	-3.332	5.907	0.003
Chin protrusion	N-Pg (HP)	-4.3	8.5	-1.761	6.54	0.0029
Upper anterior face height	N-ANS(_HP)	54.7	3.2	46.236	7.224	0.00001
Lower anterior face height	ANS-Gn(_HP)	68.6	3.8	58.531	7.71	0.00001
Upper posterior face height	PNS-N (_HP)	53.9	1.7	45.308	7.406	0.00001
Mandibular plane angle	MP-HP angle	23	5.9	20.282	4.936	0.0001
Upper anterior dental height	Upper incisor-NF (_NF)	30.5	2.1	25.746	4.416	0.00001
Upper posterior dental heigght	Upper molar-NF (_NF)	26.2	2	22.606	3.81	0.00001
Lower anterior dental height	Lower incisor-MP(_MP)	45	2.1	38.632	5.574	0.00001
Lower posterior dental height	Lower molar-MP(_MP)	35.8	2.6	31.06	4.208	0.00001
Mandibular ramus length	Ar-Go (linear)	52	4.2	48.61	7.302	0.00001
Mandibular body length	Go-Pg (linear)	83.7	4.6	71.502	9.394	0.00001
Chin depth	B-Pg (MP)	8.9	1.7	5.302	2.345	0.00001
Gonial angle	Ar-Go-Gn angle	119.1	6.5	114.814	16.054	0.00001

Occlusal plane	OP-HP angle	6.2	5.1	7.579	4.062	0.0069
Wits Analysis	A-B (OP)linear	-1.1	2	0.642	2.379	0.0001
Upper incisor inclination	U1 - NF angle	111	4.7	122.069	6.214	0.0001
Lower incisor inclination	L1 - MP angle	95.9	5.2	103.367	7.358	0.0001

Highly significant differences observed. Linear measurements are expressed in milimeters and angular measurements in degrees

Table 3: Hard tissue COGS-Comparison of Chhattisgarh males and females.

Description	Chhattisgarh Females		Chhattisgarh Males		t' VALUE	Significance	
	Mean	±SD	Mean	±SD			
Ar-Ptm	29.454	4.1	31.864	4.883	3.78	0.0002	HS
Ptm-N	44.038	6.561	47.018	7.643	2.958	0.003	HS
N-A-PG	4.708	6.121	4.577	6.238	0.15	0.88	NS
N-A	1.762	5.403	0.977	4.515	1.115	0.266	NS
N-B	-2.384	6.921	-3.332	5.907	1.042	0.309	NS
N-Pg	-0.67	7.643	-1.761	6.54	1.085	0.28	NS
N-ANS	42.439	10.47	46.236	7.224	2.985	0.003	HS
ANS_Gn	54.599	6.862	58.531	7.71	3.81	0.0001	HS
PNS-N	43.504	6.873	45.308	7.406	1.785	0.075	NS
MP-HP	21.527	6.243	20.282	4.936	1.564	0.12	NS
u1-NF	24.808	3.731	25.746	4.416	1.623	0.106	NS
A-6-NF	20.82	3.11	22.606	3.81	3.631	0.0004	HS
L1-MP	38.601	32.246	38.632	5.574	0.009	0.99	NS
B6-MP	27.968	3.449	31.06	4.208	5.683	0.0001	HS
Ar-Go	42.836	5.983	48.61	7.302	6.116	0.0001	HS
Go-Pg	68.753	7.873	71.502	9.394	2.243	0.026	HS
B-Pg	6.247	6.447	5.302	2.345	1.378	0.169	NS
Ar-Go-Gn	117.557	6.539	114.814	16.054	1.582	0.115	NS
OP-HP	8.466	5.304	7.579	4.062	1.328	0.18	NS
AB(OP)	1.671	2.414	0.642	2.379	3.036	0.0027	HS
U1-NF	113.881	36.785	122.069	6.214	2.195	0.029	HS
L1-MP	102.403	6.935	103.367	7.358	0.953	0.34	NS

Results indicate that both Chhattisgarh males and females compared to Caucasian counterparts have shorter cranial base length, greater facial convexity (which is non significant in males), greater, maxillary and mandibular skeletal prognathism, prominent chin, and decreased posterior divergence of the mandible. Decreased vertical height of maxilla anterioposteriorly, shorter lower face height, upper anterior and posterior dental heights as well as lower anterior and posterior dental heights. Decreased ramal height and mandibular body length less bony chin depth, steeper occlusal plane and increased sagittal base discrepancy and proclination of upper and lower incisors.

DISCUSSION

The Sample

The sample for the present study incuded Chhattisgarh males and females belonging to the age group 18-25 yrs which typically represent young adults. Most of the patient presenting for the orthognathic surgery are young adults. Due to the process of facial growth and development, children may not be useful for prospective orthognathic surgery cases. Similarly patients of advanced age may show changes due simply to the aging process such as loss of vertical dimension between the jaws caused by attrition and loss of teeth.

When one starts to discuss ethnic norms, it is even more imperitive to differentiate between what is normal or average and what is considered beautiful or aesthetically pleasing, since there may be profound differences between the two.[18]

Racial skeletal and dental characteristics of face play a critical role in orthodontic and orthognathic treatment planning. Therefore, the mean values for measurement of one racial group could not be considered normal for others.[19]

The decrease in overall length of the cranial base can also be attributed to the short stature of Chhattisgarh population as compared to Caucasians. In Karnataka population it was shown to be marginally increased.

The N-A-Pg angle denotes the overall convexity of the face. The Chhattisgarhi males showed no significant difference for N-A-Pg but, the values for this variable were significantly increased in Chhattisgarh female when compared to Caucasian female($P \leq 0.0001$). This indicates that Chhattisgarh females have more protrusive profile. The horizontal skeletal parameters were found to be larger in both the genders in Chhattisgarh as compared to

Caucasians[8] in their respective genders, In males these differences were significant($p<0.05$)but these values were highly significant for females ($p<0.001$). These findings were in agreement with Bangladeshi[20], Black Americans[21], Central indian,[3] and North Indian[22] population. This represents tendency towards skeletal bimaxillary progrnthism.

All the vertical skeletal parameters were significantly shorter in Chhattisgarh population. Posterior facial divergence was found to be less in both the genders in Chhattisgarh as compared to Caucasians[5] ($p\leq0.0001$). This was suggestive of anticlockwise rotation of Mandible Similar findings with regard to this parameter were seen in North India[22]population. In Rajasthan[23] no significant differences were observed. The decrease in MP-HP angle reflects the decrease in posterior divergence of face and these findings are in accordance with the study of Ashima Valiathan.[14] The overall decrease in vertical dimensions may be attributed to decreased overall height in males and females of Chhattisgarh population as compared to Caucasians. And this also reflects the general association between size of the head and body of the person which is in accordance with the Factor analysis given by Solow (1966) in an attempt to classify the association of craniofacial morphology.[17]

Antero-posterior position of maxilla and mandible *(A-B* ll OP*)* tells us about dysplasia in sagittal plane with greater apical base discrepancy in Chhattisgarh individuals ($p\leq0.0001$) than Caucasian. Similar results were seen in Bangladesh[19] and Central India and North india.[23]

CONCLUSION

This Cephalometric study has evaluated the Cephalometric standards of Chhattisgarh population in relation to COGS Analysis done originally on Caucasian population.

The study provides the baseline data for the diagnosis and treatment planning of orthognathic surgery in Chhattisgarh population.

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