

A Study of Hard Tissue Cephalometric Norms for Kerala Population Using Burstone COGS Analysis

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ABSTRACT

Background: A cephalometric radiograph in diagnosis and treatment planning is an essential tool in orthodontics to assist research workers and orthodontic clinicians. This specific innovative cephalometric analysis (COGS Analysis) was introduced because 'a need had arisen for a method of cephalometric analysis that is sensitive not only to the position of teeth within a given bone, but also to the relationship of jaw elements and makes it most suitable for diagnosis, treatment planning and treatment evaluation, not only of conventional orthodontic patients, but also for patients with skeletal discrepancies who are candidates for dento-facial orthopaedics and orthognathic surgery. This study was carried out to establish cephalometric norms of COGS analysis for Kerala population.

Materials & Methods: 100 Kerala adults (50 males and 50 females) were taken with an age group between 18-25 years having class I molar relationship on both sides with minimal or no crowding, spacing, normal growth pattern and no history of orthodontic treatment /orthognathic surgery. Lateral cephalograms in occlusion were taken with natural head position and no lip strain. The head films were traced and analysed, landmarks and cephalometric parameters used in COGS analysis were followed. It has shown significant difference in effective maxillary length and ramal length in males of Kerala population. Our study findings were similar to COGS norms.

Conclusion: Despite increased effective maxillary length and ramal length in Kerala population, rest all the parameters are similar to Caucasian standards. COGS analysis can be applied for Kerala population.

Keywords: Lateral cephalogram, cephalometric norms, COGS analysis, Kerala population.

INTRODUCTION

Facial esthetics has been a subject of interest to people of all cultures. Since centuries the world is full of evidence of human achievements since antiquity to make themselves more graceful and attractive. As far as orthodontics is concerned, harmonious facial aesthetics and functional occlusion have long been recognized as the two important goals of orthodontic treatment. The quest for the ideal face is not something new. From

ancient Egypt through the Renaissance, many refined concepts of facial esthetics have been recorded in sculptures.

Broadbent introduced Roentgenographic cephalometry in 1931, mainly a tool to study craniofacial growth and development. Since that time cephalometric analysis have been routinely used to determine the relationships of the dentofacial complex. Cephalograms also help to

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determine the changes associated with growth and treatment.

The first step in the diagnosis of the orthognathic surgical patient is to determine the nature of the skeletal and dental defects. For this reason, a specialized cephalometric appraisal system, called Cephalometrics for Orthognathic Surgery (COGS) by Burstone CJ et al in 1978 was developed. This cephalometric analysis was based on the landmarks that can be altered by various surgical procedures.

Cephalometric norms for different ethnic and racial groups have previously been established in many studies. Most investigators have concluded that there are significant differences between the diverse ethnic and racial groups and many cephalometric standards have been developed for. All these studies indicate that normal measurements for one group should not be considered normal for every other race or ethnic group. Different racial groups must be treated according to their own characteristics. People from Kerala communities are ethnically distinct, have unique facial and physical characteristics, distinct language, dress, unique life style and a culture of their own. Hence this study was done to create a specific hard tissue cephalometric norms for Kerala population in order to facilitate proper treatment planning to serve the esthetic needs of the community.

AIMS AND OBJECTIVES

This study was conducted with the following objectives:

- To establish hard tissue cephalometric norms of Kerala population for Burstone COGS analysis.
- To establish the difference in men and women hard tissue cephalometric norms of Kerala population
- To draw a clinical inference from above results

MATERIALS AND METHODS

Sample size constituted of 100 Kerala adults who reported to Department of orthodontics, CIDS. The subjects included 50 males and 50 females. Lateral cephalogram were taken for each subject included in study with their consent. A prestructured proforma was used to collect the relevant

information and record cephalometric measurements for each subject.

Inclusion criteria for sample selection

- Age range 18-25 years
- Class I molar relationship on both sides, with normal overjet and overbite with no or minimal crowding or spacing
- Acceptable, pleasing and preferably straight profiles.

Exclusion criteria for sample selection

- History of orthognathic treatment
- Presence of craniofacial anomalies.
- History of previous orthodontic treatment
- Presence of gross facial asymmetry or deformity.

After examining each subject for his/her dental occlusion, lateral cephalograms in occlusion were taken with a natural head position with no lip strain. The lateral cephalograms were taken using the digital cephalostat (SIRONAORTHOPHOS XG 5 DS). The head films were traced on acetate matt paper (8 x 10 inches) using 3H pencil. The tracings were analysed, landmarks and cephalometric parameters used in McNamara analysis were followed. The results were statically determined using SPSS (23.0) Software-

- 1) Descriptive analysis
- 2) t-test

Measurements used in COGS analysis

Cranial base:

Posterior cranial base: Measured parallel to HP from articulare to pterygomaxillary fissure (ptm)
Anterior cranial base: Measured parallel to HP from Pterygomaxillary fissure (Ptm) to Nasion

Horizontal (skeletal):

Angle of facial convexity: it is the angle formed between Nasion –point A and pogonion
Apical base of maxilla to Nasion: Measured from nasion to point A parallel to HP.
Apical base of mandible to nasion: Measured from Nasion to Point B parallel to HP

Chin prominence : Measured parallel to HP from nasion to pogonion

Vertical (Skeletal,Dental):

Anterior Component:

Middle third facial height: Measured perpendicular to HP from nasion to anterior nasal spine.

Lower third facial height: Measured perpendicular to hp from ANS to gnathion.

Posterior component:

Posterior vertical height: Measured perpendicular to HP from PNS to nasion.

Posterior facial diversions: It is the angle formed between mandibular plane (Go-Gn) to HP.

Dental:

Anterior component:

Anterior maxillary dental height: Measured from a perpendicular line dropped from the incisal edge of upper central edge of upper central incisor to the nasal floor.

Anterior mandibular dental height: Measured from perpendicular line dropped from incisal edge of mandibular anterior teeth to the mandibular plane.

Posterior component:Posterior maxillary dental height ; Measured from the mesiobuccal cusp tip of the maxillary first molar to the nasal floor.

Anterior mandibular dental height : measured from the mesiobuccal cusp tip of mandibular first molar to the mandibular plane.

Maxilla and mandible:

Maxillary length: Distance between ANS and PNS.

Mandibular Ramal Length: Measured from articulare to gonion.

Mandibular body length: Measured from gonion to pogonion.

Gonial angle: Angle formed between articulare gonion and gnathion.

Chin position: measured from point B to pogonion.

Dental:

Occlusal plane angle : angle formed between OP and HP Relation of maxilla and mandible to OP:

Measured from the distance point A to point B dropped perpendicularly to OP.

Upper incisor position: determined by measuring the angle formed between the nasal floor and the long axis of upper central incisor. Lower incisor position : Determined by the angle between mandibular plane and the long axis of the lower central incisor.

RESULT

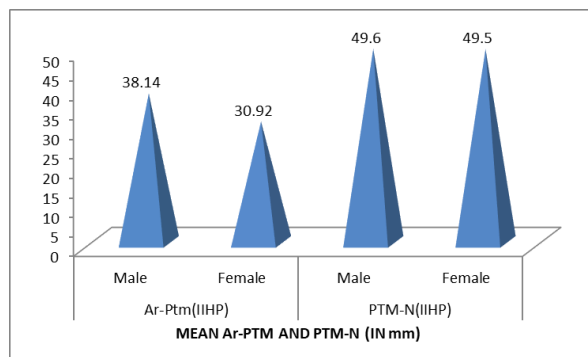
Hard tissue measurements

Table 1: Cranial base

	Gender	Mean	Std. Deviation	T value	P value
Ar-Ptm(IIHP)	Male	38.1400	2.34747	14.17	<0.001 HS
	Female	30.9200	2.73182		
PTM-N(IIHP)	Male	49.6000	8.59046	0.075	0.940 NS
	Female	49.5000	3.93441		

The Ar-ptm values of kerala population showed high statistically significant difference.

The Ptm-N values of kerala population showed no statistically significant difference.



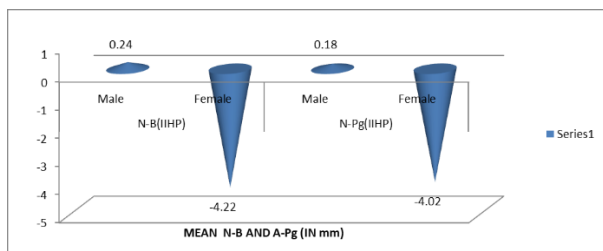
Graph 1: Mean values of parameters Ar-PTM and PTM-N in Kerala population.

Table 2: Horizontal skeletal relations

	Gender	Mean	Std. Deviation	T value	P value
N-A-Pg (angle)	Male	4.8200	2.04730	2.154	0.034 S
	Female	5.8600	2.73309		
N-A(IIHP)	Male	1.9200	1.61422	4.363	<0.001 HS
	Female	-.3000	3.21508		
N-B(IIHP)	Male	.2400	3.04095	5.127	<0.001 HS
	Female	-4.2200	5.34633		
N-Pg(IIHP)	Male	.1800	2.33597	4.344	<0.001 HS
	Female	-4.0200	6.42536		

The N-A-Pg values of Kerala population showed statistically significant difference.

All other values of horizontal skeletal relations of the Kerala population showed highly statistically significant difference.



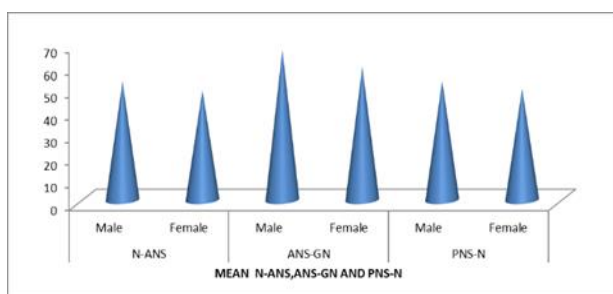
Graph 2: Mean values of parameters N-B and N-Pg in Kerala population.

Table 3: Vertical skeletal and dental relations

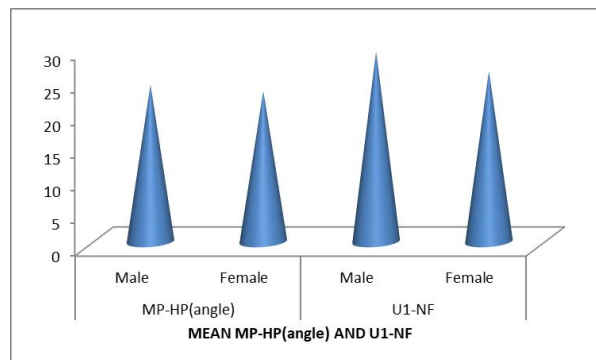
	Gender	Mean	Std. Deviation	T value	P value
N-ANS	Male	52.6200	2.94778	7.121	<0.001 HS
	Female	48.7400	2.48103		
ANS-GN	Male	66.5000	2.12132	13.842	<0.001 HS
	Female	59.0200	3.17831		
PNS-N	Male	52.9600	3.01669	6.923	<0.001 HS
	Female	49.4000	2.03038		
MP-HP(angle)	Male	24.1200	9.66720	0.698	0.487 NS
	Female	23.1000	3.66032		
U1-NF	Male	29.2000	3.23880	4.457	<0.001 HS
	Female	26.2000	3.48759		
L1-MP	Male	43.2000	2.32993	11.279	<0.001 HS
	Female	38.0600	2.22610		
U6-NF	Male	25.1200	1.95500	8.910	<0.001 HS
	Female	21.9800	1.54510		
L6-MP	Male	35.0200	2.03530	11.937	<0.001 HS
	Female	30.4000	1.82946		

The values of MP-HP (angle) showed no statistically significant difference in Kerala population.

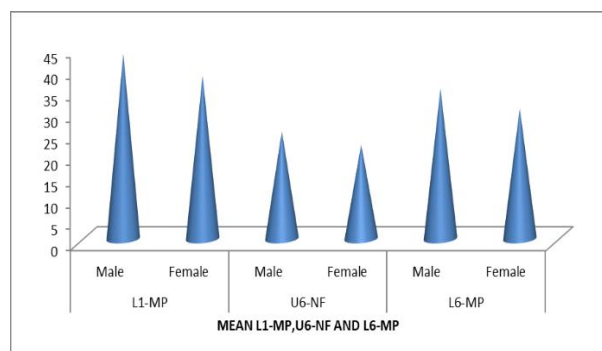
All the other values of vertical skeletal and dental relations of the Kerala population showed highly statistically significant.



Graph 3: Mean values of parameters N-ANS, ANS-GN and PNS-N in Kerala population.



Graph 4: Mean values of parameters MP-HP(angle) and U1-NF in Kerala population.



Graph 5- Mean values of parameters L1-MP,U6-NF and L6-MP in Kerala population.

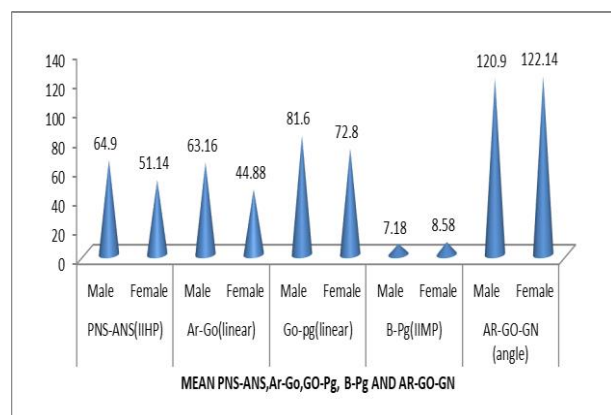
Table 4: Maxilla and mandible

	Gender	Mean	Std. Deviation	T value	P value
PNS-ANS(IHPP)	Male	64.9000	71.33716	1.363	0.176 NS
	Female	51.1400	2.28580		
Ar-Go(linear)	Male	63.1600	25.60003	5.028	<0.001 HS
	Female	44.8800	2.35294		
Go-pg(linear)	Male	81.6000	2.44114	12.723	<0.001 HS
	Female	72.8000	4.23783		
B-Pg(IIMP)	Male	7.1800	1.46650	4.031	<0.001 HS
	Female	8.5800	1.97008		
AR-GO-GN (angle)	Male	120.9000	2.62834	2.107	0.038 S
	Female	122.1400	3.22623		

The values of PNS-ANS showed no significant difference in Kerala population.

The values of AR-GO-GN (angle) showed significant difference in Kerala population.

All other values of maxilla and mandible of Kerala population showed highly statistically significant difference.



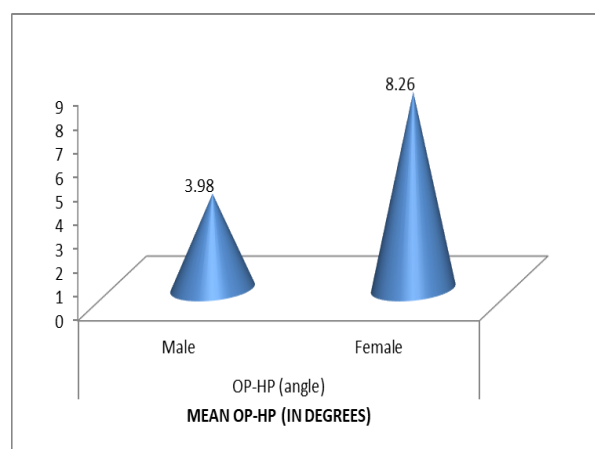
Graph 6: Mean values of parameters PNS-ANS, Ar-Go, Go-Pg and AR-GO-GN in Kerala population.

Table 5: Dental

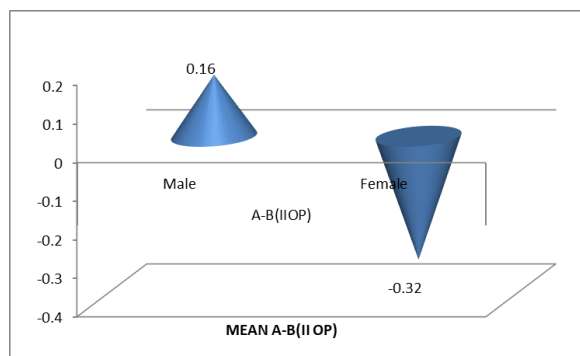
	Gender	Mean	Std. Deviation	T value	P value
OP-HP (angle)	Male	3.9800	4.62685	5.986	<0.001 HS
	Female	8.2600	2.03851		
A-B (IIOP)	Male	.1600	1.62078	1.633	0.106 NS
	Female	-.3200	1.30055		
U1-NF (angle)	Male	110.3800	1.91546	1.941	0.055 NS
	Female	112.1600	6.19532		
L1-MP (ANGLE)	Male	95.8800	3.19208	0.729	0.468 NS
	Female	96.3600	3.39123		

The values of OP-HP (angle) showed highly statistically significant in Kerala population.

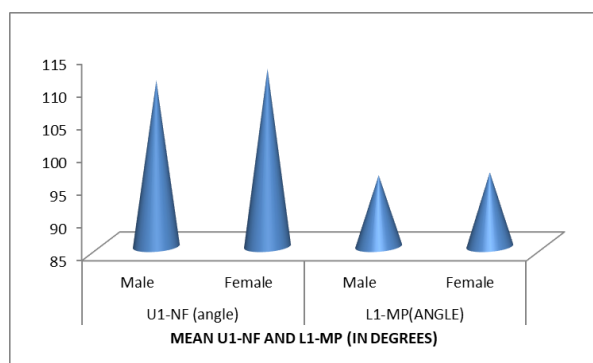
All other values of dental showed no significant difference in Kerala population.



Graph 7: Mean values of parameters OP-HP (angle) in Kerala population.



Graph 8: Mean values of parameters A-B (II OP) in Kerala population.



Graph 9: Mean values of parameters U1-NF and L1-MP in Kerala population.

DISCUSSION

The successful treatment of the orthognathic surgery patient is dependent on careful diagnosis. Cephalometric analysis can be used as an aid in the diagnosis of skeletal and dental problem as well as a tool for simulating surgery by the use of acetate overlays. The first step in the diagnosis of the orthognathic surgical case is to determine the nature of skeletal and dental defects, thereby helping in the decision making with regard to compensations and decompensations. Cephalometric analysis tempered with good clinical judgement can be a valuable tool in establishing the most appropriate treatment plan.

Various cephalometric analysis are put forward by various authors. Those that gained importance in orthognathic surgery are Burstone hard tissue analysis. These were organized by Caucasian for their ethnic group.

India is a subcontinent with a large number of racial subgroups and several religion and interracial

mixture. Study conducted by Ashima Valiathan on Indians and Ravindra Nanda and Ram S. Nanda on North Indian population and Ashima Valiathan on Kerala population, Grewal H, Siddu SS, Kharabanda OP on Indo-Aryans has shown that there is significant difference in values. Hence there is a need to make different norms for racial subgroups in India.

Having recognized the fact that the norms prescribed for one ethnic group need not be suitable for others. An attempt was made in this study to establish the cephalometric norms using COGS analysis for Kerala population. It was thought that the established norms will be helpful in treatment planning to attain better results.

When we compared our results with Japanese population, posterior cranial base and anterior cranial base length was more in our population. Upper posterior face height and upper posterior dental height is more in our population, lower anterior face height is more but chin protrusion is less. Mandible plane angle is less in our population, upper incisor inclination is more in Japanese and lower incisor inclination is more on our population compared to Japanese population.

When we compared our results with American blacks, posterior and anterior cranial base is more in Blacks. Facial convexity, Maxillary and mandibular protrusion and chin prominence was less in our population. Maxillary length was less. Lower anterior facial height, mandibular plane angle, mandibular body length is less but ramal length was more in our population.

In Australian Aboriginals facial convexity was less compared to our population. Mandibular plane angle was less but they had greater degree of upper and lower incisor proclination than our population.

Iranians showed a flat skeletal convexity and retruded maxillary and mandibular apical base compared to our population. Occlusal plane to cranial base angle is more. When upper and lower increased protrusion is less in Iranians. Mandibular plane angle was more in Iranian compared to our populations.

CONCLUSION

From the present study following conclusions were made

- The Kerala adult population had a normally positioned maxilla and mandible in relation to cranial base.
- The horizontal skeletal relation in Kerala population indicates normally positioned maxilla, mandible and chin.
- The Kerala adult population had a normal middle and lower third facial height.
- The upper, lower anterior and posterior dental height is normal in Kerala population compared to standard Caucasian population.
- There was an increase in effective maxillary length in males of Kerala population compared to caucasian population.
- There was increase in ramal length in males of Kerala population compared to Caucasian population.
- The maxillary and mandibular apical bases are normal in relation to occlusal plane in kerala adult population when compared to Caucasian population.
- The upper and lower incisor is normally inclined in Kerala population compared to standard Caucasian population.

CONFLICT OF INTEREST

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

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