Research Article

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Establishment of cephalometric norms for STCA in Goan population

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ABSTRACT

Background: The art and science of orthodontics has undergone a paradigm shift from Angle's paradigm to soft tissue paradigm. New cephalometric analyses are being introduced to the speciality with main focus on soft tissue contours of the patient. STCA proposed by Anett and Bergmann is one such analysis which has gained popularity in recent times. A study was conducted at Goa dental college with an aim to establish norms for Goan population for STCA. A total of 600 subjects of Goan origin were screened and 85 subjects were selected. Cephalograms were obtained in NHP. STCA was performed and norms were derived for the Goan population.

Keywords: Cephalometric, Goan, STCA.

INTRODUCTION

The concept of treatment goal in orthodontics has undergone a paradigm shift from Angle's paradigm to soft tissue paradigm. Soft tissue paradigm considers ideal facial esthetics as the primary goal of orthodontic treatment. A person's social interactions may be negatively affected if his or her facial esthetics doesn't fit into the normal range of the ethnic or racial group to which she or he belong[1]. So it's of utmost importance that the facial outline and features at the end of treatment must be within the normal range of the population group to which the patient belong. Otherwise, even though the treatment is successful in terms of achieving established parameters for static and functional occlusion[2,3], for the patient it will be a failure. Keeping itself in track with increasing importance to soft tissue esthetics, the art and science of orthodontics has incorporated new treatment planning philosophies and treatment strategies. Same time there was a need for a cephalometric analysis which would stress upon soft tissue outline and drape of the patient and not just skeletal structures. Soft tissue cephalometric analysis (STCA) introduced by William Arnett et al[4,5] fulfilled these requirements and gained popularity among orthodontists. But the original Soft Tissue Cephalometric Analysis (STCA) was developed for Caucasians. Goans differ from Caucasians in their ethnicity and racial origins. Hence there is a need for developing norms for Goan population so that STCA can be used in treatment planning of Goans.

MATERIALS AND METHODS

600 Students from Goa Medical College and Goa Dental College were screened. Students who met the clinical criteria were selected for the study. All subjects and their families were originally from Goa. A questionnaire was given to all students to obtain information regarding their Goan ethnicity. Total of 85 students were selected, comprising of 45 female and 40 male. Since the students were to undergo

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radiographic exposure, informed consent was obtained from each one.

Clinical criteria for selection

- Subject should be of Goan origin
- Age between 18-26
- Straight facial profile
- Pleasant facial appearance
- Full complement of teeth excluding third molars
- No previous orthodontic or prosthodontic treatment
- No functional deviations

Cephalometric criteria for selection

- ANB angle (anteroposterior) in a range of 2.72 ± 1.82
- Average FMA (vertical) angle in the range of 23

Statistical analysis:

To estimate intraoperative tracing error in selecting cephalometric land marks and in measuring the linear and angular values, 15 randomly selected lateral cephalometric radiographs were retraced and remeasured after a period of 21 days by the same orthodontist. A paired t test was carried out to determine intraoperative tracing error. There was no significant difference between measurement recorded on day one and the measurements recorded after 21 days.

1. paired t-test for intraoperative error

$$\frac{(\bar{x}_1 - \bar{x}_2)}{s/\sqrt{n}}$$

$$\text{Where } s = \sqrt{\sum (di - \bar{d})^2 / n - 1}$$

and *di* is the difference formed for each pair of observations

X_1-mean of first set of measurements

X_2- mean of measurements recorded after 21 days

Statistical analysis of the differences between males and females was done with *t* testing. A level of significance of 5% was assigned and *P* values were determined.

Statistical analysis of the differences between Caucasian males and Goan males and again between Caucasian females and Goan females was done by t testing.

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{SE\,(x_1 - x_2)}$$

$$SE\,(\bar{x}_1 - \bar{x}_2) = SD \Big/ \sqrt{\left\{\frac{1}{n_1} + \frac{1}{n_2}\right\}}$$

x_1 = mean of sample one
x_2 = mean of sample two
n_1 = number of individuals in sample one
n_2 = number of individuals in sample two

Fig 1: patient positioning in cephalostat – frontal view.

Fig 2: patient positioning in cephalostat – lateral view.

Fig 3: metal beads in acryilic discs.

Fig 4: cephalogram with metal beads.

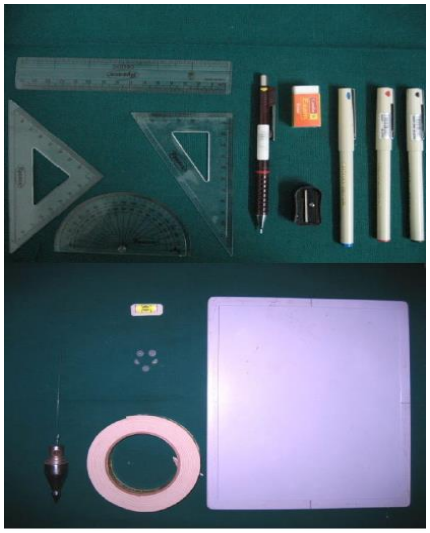

Fig 5: equipment used for tracing cephalogram.

RESULTS AND DISCUSSION

STCA was done for the entire sample and their means and standard deviations are displayed in Table 1

Orthodontic cephalometry for a long time concentrated more upon hard tissues [6-11] . Tweed had recognized the importance of facial esthetics and he considered FMIA to be most important parameter for facial esthetics. Steiner proposed S line. McNamara recognized the importance of lower anterior facial height. Rickets proposed E line to analyze facial esthetics. Down concentrated mainly on hard tissue parameters in analysis. The importance of soft tissues was recognized by orthodontists long time ago and some soft tissue analysis have been introduced[12-14]. But most of them have not analyzed the soft tissue features as detailed as STCA of Arnett. STCA has hard tissue parameters and soft tissue parameters and it analyzes face in both anteroposterior and vertical dimensions. STCA also analyzes the thickness of soft tissue drape in various regions of the face. Not only that, STCA is also in accordance with other treatment philosophies. For example, Arnett's analysis describes the relationship of maxillary incisors to upper lip, the same relationship which is given high importance in facial analysis by Sarver, Profit and Ackerman. Soft Tissue Cephalometric Analysis (STCA) provides a way to establish the final position of central incisor which is considered starting point of treatment planning by Mc Laughlin, Bennet and Trevesi.

STCA is divided into five parts.

1. Dentoskeletal factors
2. Soft tissue thickness
3. Facial heights or lengths
4. True vertical line projections
5. Harmony values

Dentoskeletal factors

Dentoskeletal factors are again divided into 2 areas dentoskeletal projections, and heights. Soft tissue profile at the end of the treatment depends on how well these factors are managed by orthodontist and oral surgeon.

In Goans, males and females have same upper lip prominence despite of the fact that upper incisors are less prominent in males. This is because of the

Table 1: Mean and standard deviations for all parameters of STCA.

Parameter	Goan Male		Goan Female		P Value	Difference is significant if p is <0.05
	Mean	S.D.	Mean	S.D.		
Dentoskeletal Factors						
projections						
Mx1 to TVL	-9.5	2.81	-8.8	2.28	0.0010	highly significant
Mx1 to Mx occlusal plane	55.5	4.80	56.8	3.57	0.1449	not significant
Overjet	3.1	0.84	3.2	0.80	0.5611	not significant
Md1 to TVL	-12.5	2.73	-11.5	1.80	0.0089	highly significant
Md1 to Md occlusal plane	59.5	4.29	60.1	5.95	0.6250	not significant
Heights or lengths						
Mx1 exposure	2.6	1.35	3.8	1.62	0.0004	highly significant
Overbite	3.0	1.00	2.9	0.97	0.4753	not significant
Mandibular Height	50.2	3.68	46.3	5.82	0.0004	highly significant
Maxillary posterior height	97.8	3.56	98.2	3.99	0.6319	not significant
Soft Tissue thicknesses						
Upper Lip thickness	14.3	2.12	12.6	1.35	0.0000	highly significant
Lower lip Thickness	15.0	2.00	13.7	1.67	0.0017	highly significant
Pog – Pog'	13.1	1.11	12.8	1.75	0.2760	not significant
Me – Me'	8.6	1.29	8.1	1.78	0.1566	not significant
Facial heights or lengths						
Soft tissue						
Upper lip length	22.1	3.21	19.1	3.51	0.0001	highly significant
Interlabial gap	0.8	1.17	1.5	1.95	0.0433	significant
Mx1 exposure	2.6	1.35	3.8	1.62	0.0004	highly significant
Lower lip length	49.4	3.73	44.8	3.73	0.0000	highly significant.
Lower 1/3 of face	72.6	5.79	65.5	4.49	0.0000	highly significant
Nasion'- Me'	131.1	5.45	120.2	6.62	0.0000	highly significant
Hard tissue						
Maxillary Height	24.7	3.16	23.0	2.75	0.0097	highly significant
Overbite	3.0	1.00	2.9	0.97	0.4753	not significant
Mandibular Height	50.2	3.68	46.3	5.82	0.0004	highly significant
Maxillary posterior height	97.8	3.56	98.2	3.99	0.6319	not significant
Projection to TVL						
High midface projections						
Glabella	-5.2	2.81	-4.8	3.06	0.5921	not significant
Orbital rim	-23.9	2.73	-20.6	2.69	0.0000	highly significant
Cheek bone	-28.5	3.16	-24.6	2.77	0.0000	highly significant
Subpupil	-18.3	3.25	-15.8	2.59	0.0001	highly significant.
Maxillary projections						

Nasal projection	16.2	1.85	14.2	1.93	0.0000	highly significant
Alar base	-12.5	4.55	-10.9	1.76	0.0324	significant
A point'	-1.8	1.23	-1.4	1.34	0.1787	not significant
Mx1	-9.5	2.81	-8.8	2.28	0.0010	highly significant
Upper lip anterior	2.2	2.51	2.6	1.69	0.3568	not significant
Upper lip Angle	9.4	10.08	11.0	7.68	0.4046	not significant
Nasolabial Angle	95.1	16.57	95.2	12.71	0.9653	not significant
Mandibular projection						
Md1	-12.5	2.73	-11.5	2.46	0.0089	highly significant
Lower lip anterior	-0.1	3.18	-0.0	2.38	0.8175	not significant
B' point	-9.9	3.57	-9.0	3.15	0.2388	not significant
Pog'	-6.2	3.25	-6.5	3.34	0.7416	not significant
Throat length (neck throat point to Pog')	56.3	4.93	56.5	5.03	0.8381	not significant
Harmony values						
Total facial harmony						
Facial angle	167.3	5.67	168.8	5.42	0.2189	not significant
Glabella – A 'point	3.5	2.82	3.4	2.80	0.8972	not significant
Glabella – Pog'	-0.5	3.85	-0.5	4.33	0.9938	not significant
Orbit to jaws						
Orbital rim' – A point'	22.5	3.11	19.1	3.02	0.0000	highly significant
Orbital rim' – Pogonion'	18.6	4.44	14.1	4.05	0.0000	highly significant
Maxilla to mandible harmony						
Subnasale- Pog'	6.2	3.24	6.5	3.31	0.6113	not significant
A' point- B' point	7.3	3.32	7.1	3.01	0.7659	not significant
Upper lip anterior–lower lip anterior	3.08	2.92	4.2	4.51	0.1551	not significant
Intramandibular relation						
Md1- Pog'	6.3	3.15	6.6	2.95	0.6697	not significant
Lower lip anterior-Pog'	5.2	3.34	6.1	2.88	0.1848	not significant
B' point- Pog'	3.3	1.67	2.7	1.44	0.0530	not significant

fact that males have thicker lips. Goan females show more incisor exposure than Goan males which can be due to shorter upper lip length in Goan females. Anterior mandibular height and anterior maxillary height are more in Goan males than in Goan females, this due to the fact that Goan males have longer facial height and lower third facial height than Goan females.

Soft tissue thickness

Lips are thicker in Goan males compared to females. Thicker lips in Goan males have compensated for reduced prominence of incisors. Hence lip prominence is similar between males and females. Thicker lips respond less to orthodontic tooth movement because they are self supportive. So lip response to orthodontic tooth movement can be expected more in Goan females.

Facial heights or lengths

The values for all the parameters showed statistically significant difference between males and females. Both hard tissue and soft tissue heights were more in males compared to females, except for interlabial gap and maxillary incisor exposure. Greater maxillary incisor exposure at rest gives a youthful appearance to face.

True vertical line projections

In Goans soft tissue orbital rim, cheek bone and Sub pupil are more prominent in females. Goans males have more prominent nose than Goan females. This means that anterior positioning of maxilla can be carried out surgically more conveniently in Goan males. Due to prominent nose, incisors can be left prominent at the end of the treatment in Goan males compared to Goan females.

Harmony values

Harmony values were created to measure the balance and harmony between the facial structures. Harmony or balance between different facial landmarks is an important component of facial beauty. Harmony values are the horizontal distances between two landmarks, measured perpendicular to True Vertical Line.

Total facial harmony

Facial angle is similar between Goan males and females. Anteroposterior relationship between forehead and maxilla is similar between Goan males and females.

Soft tissue orbital rim to jaw harmony

Soft tissue orbital rim is positioned more posteriorly in Goan males compared to Goan females. Anteroposterior distance between soft tissue orbital rim and maxilla is less in Goan females compared to Goan males. Mandible is positioned more anteriorly in relation to orbital rim in Goan males than in Goan females.

Maxilla to mandible harmony

The posterior divergence in lower third of Goan females is more gradual unlike Goan males. Anteroposterior distance between lips is more, it is still more between A' point and B' point and it is highest between Subnasale and Pogonion.

Intramandibular harmony

There is no statistically significant difference between males and females

CONCLUSION

- Harmony values are similar in males and females except the relationship of jaws to orbital rim. Orbital rim and cheek bone are more prominent in females.
- Goan females have more prominent incisors than males.
- Inclination of maxillary and mandibular incisors to their respective occlusal planes is similar in males and females.
- Lips are thicker in Goan males than in females.
- All the soft tissue facial heights are smaller in Goan females except for maxillay incisor exposure and interlabial gap, these two are more in females. Females have more youthful smile.
- Within the lower third of face all facial projections except for incisors are similar in males and females.

CONFLICT OF INTEREST

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

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