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# Comparison of selected cephalometric values of Steiner's and Down's analysis of Tamil Dravidian children aged 7 to 12 years with Caucasian population – A cross sectional study

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| Abstract | Original Research Article |
|---|---|

*Aim:* Different ethnic groups have different facial profile characteristics. The aim of the study was to compare the selected Steiner's and Down's norms of cephalo-metric values of Tamil Dravidian children aged 7 to 12 years with the Caucasian population. *Materials and methods:* This cephalometric study was conducted in Tamil Dravidian children (56 boys and 54 girls) with acceptable facial profile and occlusion within the age range of 7 to 12 years. The study was carried out by means of digitalized Steiner's and Down's analysis. The analysis was done independently by two calibrated pediatric dentists who were blinded to the age and sex of the children. All measurements were tabulated and mean values of the groups were compared by Student t test in SPSS V 22. The intraobserver reliability was calculated by intraclass correlation and the level of significance was set at p value < 0.05. *Results:* There was a highly significant difference (p < 0.0001) in the combined mean values of Steiner's (SNB, ANB, SN/ML) and Down's (Facial angle, convexity, Y axis) analysis when Dravidian children values were compared with the Caucasian standards. No significant difference was noted between boys and girls. *Conclusion:* The Tamil Dravidian children have a retrognathic mandible, convex facial profile and vertical growth pattern when compared to the Caucasian population. No sexual dimorphism was noted between the Tamil Dravidian children.
*Clinical Significance:* The selected steiners and downs norms helps in diagnosis and treatment planning of those growing tamil dravidian children who require orthodontic treatment.
**Keywords:** Steiners, Downs, Tamil, Dravidian, Children.

## INTRODUCTION

Growth and development is a never ending process in human life. It has its own unique course in every individual with a predictable sequence. Establishing norms for growing children is imperative to determine the extent of deviation from normal growth pattern.

Cephalometrics is used as an aid in diagnosis, treatment planning, assesses the progess of treatment and to determine the amount of growth remaining in the child [1]. Steiner [2] and Down [3] are the pioneers to establish cephalometric norms in the Caucasian individuals. Cephalometric norms are not the same for all ethnic groups [4-6]. Globally different races have different ethnic origins. Instead of classifying the people of other ethnic groups as abnormal, they have to

be expressed in terms of deviation from usual pattern and express their variability quantitatively [7].

India is a country with seven different ethnic group among which the Dravidians inhabit southern India especially Tamilnadu [8]. Various studies [9-15] have been carried out in Indian adult population. Out of which two studies were carried out in south Indian adults, one by Arunkumar K.V [16] and the other by Nachiappan S [17] carried out in adult population of Chennai revealed the cephalometric norms for adults undergoing orthognathic surgery. There is a lack of information available on normative values in Tamil Dravidian children who undergo orthodontic treatment. With this background the null hypothesis of the study states that "no difference exists between the Steiner's and Down's norms of Tamil Dravidian children and the

Caucasian population". The aim and objective of the present study is to establish selected Steiner's and Down's cephalometric norms for the Tamil Dravidian children aged 7 to 12 years.

## MATERIALS AND METHODS

An analytical cross sectional, comparative and descriptive clinical study was planned and ethical approval was obtained from institutional review board (SRB/STPG-14A). Written informed consent was obtained from the parents of the participating children. The sample size calculated with type I α error set at 0.05 and Power of test β at 80% was 104. Out of 1542 children screened, a total of 110 children (56 boys and 54 girls) participated in the study. The lateral cephalograms of the selected children were taken with one X-ray machine PLANMECA PROMAX Dimax3. The lateral cephalograms were obtained during a natural head posture, in which the subjects looked at the reflection of their eyes in a mirror placed 5 feet in front of them after first tilting their head forward and backward with decreasing amplitude until a comfortable position of natural balance was found [18]. The preview image before stored as JPEG (Joint Photograpic Experts Group) was zoomed in for observation of all landmarks before the image is saved.

### Inclusion criteria
- Children with nearing or established class I occlusion
- Flush terminal plane or mesial step molar relationship of Primary second molar
- Normal overjet and overbite
- No crossbite or crowding
- Family linkage of each subject was traced upto Three generation belonging to same ethnic origin

### Exclusion criteria
- Children with a history of systemic disease
- Child's parents failed to give a informed consent to participate in the study
- Families with intercaste marriages

### Tracing and Analysis of Ragiographs

The soft copy of the lateral cephalograms stored in JPEG format was then transferred into FACAD software version 3.3.0.1 (Ilexis AB, Sweden) in accordance with the developer's instruction. The steiners and downs analysis landmarks were already stored in FACAD software. The image was calibrated in real time measurement, using the sensor head readings on the image. When point identification is difficult, the image was further enhanced. The definition of the selected angular landmarks based on

Steiner's and Down's analysis are shown in the table 1.The selected angular measurements of the Steiners analysis are Sella – Nasion – Point (SNA), Sella – Nasion – Point B (SNB) , Difference between SNA and SNB (ANB) , Sella-Nasion-Mandibular plane angle (ML/SN) and Downs analysis are Facial angle , Convexity , Frankfort-horizontal-Mandibular plane angle (ML/FH), Y axis. The Steiner's and Down's cephalometric analysis were done independently by two calibrated pediatric dentist. The two examiners were blinded to age and sex of cephalometric image. The intraobserver error was checked by randomly tracing 10 boys and 10 girls lateral cephalograph x-ray at 1week interval.

### Statistical Analysis

Data was tabulated and entered in SPSS version 22.0 (IBM Corp, USA). Significance level is fixed as 5% (α = 0.05). The Normality tests Kolmogorov-Smirnov and Shapiro-Wilks tests were done to determine normal distribution. The mean values between groups were compared with independent samples Student t-test. The intraobserver reliability of the examiners was measured by intraclass correlation (ICC).

## RESULTS

The demographic data of the study was illustrated in table 2. The mean age of children involved in the study was 8.96±1.46. The mean age of the 56 boys and 54 girls were 8.79±1.41 and 9.13±1.51 respectively.

Table 3 illustrates the combined mean values of selected cephalometric angles. Except the SNA values the Tamil Dravidian children showed statistically significant difference with caucassian population with p value <0.001.

Table 4 illustrates the selected angular values of boys and girls. In boys there is a significant increase in the ANB angle (4.14±2.10, p < 0.0001), and ML/SN (33.77 ± 4.26, p < 0.0001) where as the SNB values had decreased (78.10 ± 3.33, p <0.0001) when compared with Caucasian population. Similarly in females there was a statistically significant increase in the SNA (8.74±3.32), ANB (4.23±1.92), ML/SN (34.65±4.13) values and decrease in the SNB (78.49±2.97) values. In both gender there was a significant decrease in facial angle and increase in the convexity, ML/FH and Y axis was seen when compared with Caucasian population. The values between boys and girls, had no significant difference in the selected angular values.

Figure 1 illustrates the intraobserver reliablity of the two examiners. Excellent intraclass correlation coefficient was found for both the examiners with ICC value > 0.95.

**Table-1: Definition of Cephalometric landmarks**.

| Sella (S) | The center of the pituitary fossa |
|---|---|
| Nasion (N) | The most anterior point of the nasofrontal suture in the midsagittal plane |
| Subspinale (A) | The deepest point in the midsagittal plane between the anterior nasal spine (ANS) and prosthion |
| Pogonion (Pg) | The most anterior point in the midsagittal plane of the contour of the chin |
| Supramentale (B) | The deepest point in the midsagittal plane between infradentale and Pg, usually anterior to and slightly below the apices of the mandibular incisors |
| Menton (Me) | The lowest point of the contour of the mandibular symphysis |
| Gnathion (Gn) | The midpoint between Pg and Me, located by bisecting the facial line NPg And the mandibular plane (lower border) |
| Orbitale (Or) | The craniometric point at the lowest point on the lower edge of the orbit |
| Porion (Po) | The most superior and outer bony surface point of the external auditory meatus |

**Table-2: Demographic data of the children**

| | Boys | Girls |
|---|---|---|
| No of children (N) | 56 | 54 |
| Age (Mean ± SD) | 8.79±1.41 | 9.13±1.51 |

**Table-3: Comparison of combined mean values of selected Steiner's and Down's analysis for Tamil Dravidian children and Caucasian population**

| S. No | Angle | Caucasian (Mean±SD) in degrees | Tamil Dravidian (Mean±SD) in degrees | t value | p value |
|---|---|---|---|---|---|
| 1 | SNA | 82±3.9 | 82.49±3.46 | 1.43 | 0.153 |
| 2 | SNB | 80±3.6 | 78.29±3.15 | -5.43 | <0.0001** |
| 3 | ANB | 2±1.8 | 4.19±2.01 | 10.988 | <0.0001** |
| 4 | ML/SN | 31.92±4.9 | 34.20±4.20 | 5.234 | <0.0001** |
| 5 | Facial angle | 87.8±3.6 | 83.85±5.06 | -7.09 | <0.0001** |
| 6 | Convexity | 0±5.0 | 8.32±4.66 | 18.10 | <0.0001** |
| 7 | ML/FH | 21.9±3.2 | 30.13±5.15 | 15.330 | <0.0001** |
| 8 | Y axis | 59.4±3.8 | 61.60±5.18 | 4.32 | <0.0001** |

*p value calculated using student t test. $p < 0.05$ considered significant, **$p<0.0001$ considered highly significant

**Table-4: Comparison of mean values of the selected Steiner's and Down's analysis of the boys and girls with the Caucasian population**

| S. No | Angle | Caucasian (Mean±SD) in degrees | Male (Mean±SD) in degrees | p value* | Female (Mean±SD) in degrees | p value* |
|---|---|---|---|---|---|---|
| 1 | SNA | 82±3.9 | 82.26±3.61 | 0.468 | 82.74±3.32 | 0.026* |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | SNB | 80±3.6 | 78.10±3.33 | <0.0001** | 78.49±2.97 | <0.0001** |
| 3 | ANB | 2±1.8 | 4.14±2.10 | <0.0001** | 4.23±1.92 | <0.0001** |
| 4 | ML/SN | 31.92±4.9 | 33.77±4.26 | <0.0001** | 34.65±4.13 | <0.0001** |
| 5 | Facial angle | 87.8±3.6 | 84.25±5.31 | <0.0001** | 83.42±4.79 | <0.0001** |
| 6 | Convexity | 0±5.0 | 8.17±4.99 | <0.0001** | 8.48±4.31 | <0.0001** |
| 7 | ML/FH | 21.9±3.2 | 29.47±5.3 | <0.0001** | 30.86±4.93 | <0.0001** |
| 8 | Y axis | 59.4±3.8 | 61.0±5.39 | <0.0001** | 62.25±4.92 | <0.0001** |

*p value calculated using student's t test. p<0.05 considered significant, **p<0.0001 considered highly significant
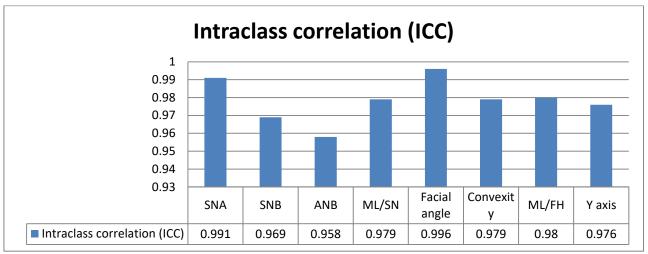


**Fig-1: Intraobserver reliability of the examiners**

## DISCUSSION

Scientific racism divides humans into three types namely Caucasoid, Mongoloid and Negroid. The Dravidians have their origin from the negroid races. Hence the cephalometric norms of the tamil Dravidian children may differ from the caucasian norms. The age limit of 7 to 12 years has been chosen as suggested by The American association of orthodontics (AAO). The early orthodontic screening as early as 7 years of age provides the best opportunity for every child to have a healthy and beautiful smile. Selected angular measurements has been included in the study as suggested by the southern illinos university's basic 10 angle analysis [11] which helps to classify the child's malocclusion into class I, Class II and class III pattern. The accuracy, reliability and reproducibility of FACAD digital tracing used in the study has been validated by Farooq *et al.* [19].

The SNA value indicated that the cephalometric values of maxilla in Dravidian children are similar to the Caucasian standards. The SNA values coincide with the south kanara children [11] and madras city adults [13]. The values are greater than north Indian [10], Mewari [14] and nalgonda[15] children.

The SNB value indicated that the mandible in Dravidian children is retruded than the Caucasian population. This was in accordance with the aryodravidians [8], south kanara children [11] and north indian children. The values are lesser when compared to the Mewari [14] and Nalgonda children [15]. The Dravidian children have an increased ANB and convexity angle indicating a class II and convex profile. Except for north Indian children [10] the ANB values are greater for Mewari [14], Nalgonda [15] and south kanara children [11].

The down norms obtained in our study are in accordance with Negro children norms reported by altemus LA in 1960 [20]. The facial angle was less when compared with Caucasian population which is in accordance with the south kanara and nalgonda children. The Y axis angle in Dravidian children showed a vertical growth pattern similar to south kanara children [11]. The north Indian children on the contrary showed a horizontal growth pattern. An increased mandibular plane angle was observed in our study which is in contrast to south kanara children [11]. Study by Casko SJ and Sheperd WB [7] in 1984 suggests that ANB angle is positively correlated with SNA and

SN/ML, while it is negatively correlated with the facial angle. The SNB is positively correlated with facial angle and negatively correlated with SN/ML. This type of tendency is seen in the results of our study when the norms are compared with the Caucasian population. No sexual dimorphism has been observed in our study. No sexual dimorphism has been noted in our study could be due to the fact that growth of the children is not completed before puberty and at this age only the cranial growth is completed.

## CONCLUSION

Tamil Dravidian children have a retrognathic mandible with a vertical mandibuar growth pattern and convex facial profile when compared to Caucasian population. No sexual dimorphism was noted in children of 7 to 12 years of age.

### Clinical Significance

The selected steiners and downs norms helps in distinguishing the facial profiles of the Tamil Dravidian children from the Caucasian norms. It also aids in precise diagnosis and treatment planning of those growing Tamil Dravidian children who require orthodontic treatment.

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