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International Journal of Current Research
Vol. 9, Issue, 04, pp.49278-49282, April, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

CURVE OF SPEE AND ITS CORRELATION WITH FACIAL MORPHOLOGY IN SOUTH INDIAN POPULATION

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ARTICLE INFO

Article History:
Received 15th January, 2017
Received in revised form
10th February, 2017
Accepted 07th March, 2017
Published online 30th April, 2017

Key words:

Curve of spee,
South Indian population,
Facial morphology.

ABSTRACT

Introduction: Aim of the study to evaluate the association between facial morphology and various depths of curve of spee and variations in males and females in South Indian population.
Methods: 96 diagnostic casts and lateral head cephalograms of selected subjects on the basis of depths of curve of Spee as measured on the mandibular casts were selected. The subjects were divided into three Groups (Group-I- 0-2 mm, Group -II >2-4 mm and Group-III >4 mm of curve of Spee), (n=32, m=16, f=16) and further into subgroups according to sex. Cephalometric and study cast variables were measured and subjected to statistical analysis with curve of Spee as the dependent variable and others as independent variables.
Results: SNB, APDI, L-E line were negatively correlated and ANB, ODI,G-SN-POG were positively correlated with depth of curve of Spee in both males and females.
Conclusion: Various parameters in the facial morphology contributes to the curve of spee. This, will be helpful in diagnosis as well as determination of this relationship is useful to assess the feasibility of leveling the curve of Spee by orthodontic treatment.

Citation: Dr. Abida Banu, Dr. Rohan Rai and Dr. K. Nillan Shetty, 2017. "Curve of Spee and its correlation with facial morphology in south Indian population", *International Journal of Current Research*, 9, (04), 49278-49282.

INTRODUCTION

A profile view of human skull reveals an upward, concave curve in the mandibular teeth extending from molars to incisors and corresponding downward convex curve in the maxillary arch. These peculiarities of the geometric arrangement of the teeth were first described by Ferdinand Graf Von Spee in 1890, using 120 skulls with abraded teeth to define a line of occlusion, to lie on a cylinder which is tangent to the anterior border of the condyle, the occlusal surfaces of second molar and incisal edges of the mandibular incisors and has since been referred to as 'The curve of Spee'. Results of various studies have shown that the morphologic arrangement of the teeth in the sagittal plane has been related to the deep overbite, lower incisor proclination and lower arch circumference. An increased curve of Spee is often seen in brachycephalic facial patterns and associated with short mandibular bodies (Wylie, 1944; Bjork, 1953). Although, the influence of craniofacial morphology on the curve of speehas been investigated, these studies ignore the simultaneous contribution of multiple factors to the individual variation of the curve. These individual variations play important role in the leveling of curve which is everyday occurrence in orthodontic practices and are required for stable results. Studies also have shown that the curve of Spee is influenced by the ratio between posterior and anterior facial heights (Orthlieb and Slavicek, 1985; Koyama, 1979) and vertical facial type (De Praeter *et al*., 2002). But disagreement is most likely because Koreans have shorter anterior facial height than white people (Paek *et al*., 1989). Results of the study by Cheon *et al*. (2008) in Korean population concluded that there exists a significant correlation between curve of spee and the Koreans dentofacial morphology. However study had limitations because the sample size which was relatively small and limited to Korean population. Hence presence of the curve of Spee based on a morphologic or cephalometric predictor has not been definite.
The purpose of the present study is taken to establish co-relation between curve of spee and facial morphology in South Indian population which would help in effectively diagnosing and planning orthodontic cases as many studies show variation in races.

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MATERIALS AND METHODS

This study was conducted in the department of orthodontics AJ institute of dental science. The data is collected from 96 study models & lateral cephalograms of patients (males and females) of age 18 to 25 years.Subjects with a full complement of teeth & with all teeth in occlusion up to the second molar is selected. Anterior or lateral cross bite, cast restoration or cuspal coverage and history of orthodontic intervention excluded.

The patients were divided into 3 groups

1. Group I (n=32;16 males and 16 females)
2. Group 2 (n=32;16 males and 16 females)
3. Group 3 (n=32;16 males and 16 females)

High quality orthodontic impressions for diagnostic casts were taken by alginate impression material in the rim lock impression trays. The lateral cephalograms of the selected subjects were taken using the standard technique employed in the department of orthodontics AJ institute of dental science. The lateral cephalograms were traced on acetate tracing sheets 50 micron in thickness using a sharp 4H pencil on a view box using trans illuminated light in a dark room.

Measurement of curve of spee on study cast

The depth of curve of Spee was measured as the perpendicular distance between the deepest buccal cusp tips and a scale that was laid on the top of the mandibular dental cast, touching the incisal edges of the central incisors and the distal cusp tips of the most posterior teeth in the lower arch (Fig. 1). The depth of curve of Spee was measured with divider placed between the deepest cusp tip and the scale. The measurements was made on the right and left side of the mandibular cast and the mean value of these two measurements was used as the depth of curve of Spee. (Steven *et al*., 2008)

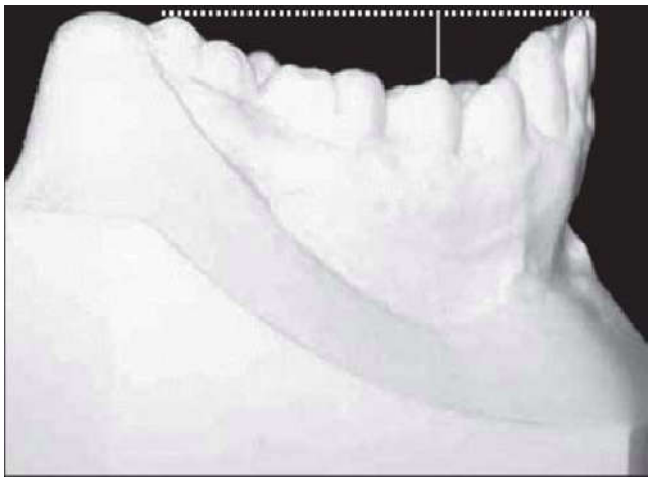


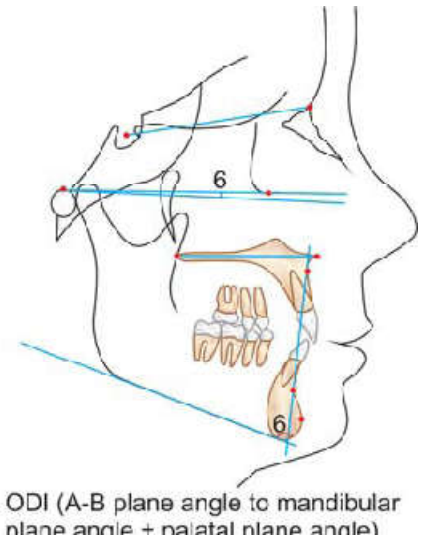
Figure 4. Measurement of curve of Spee

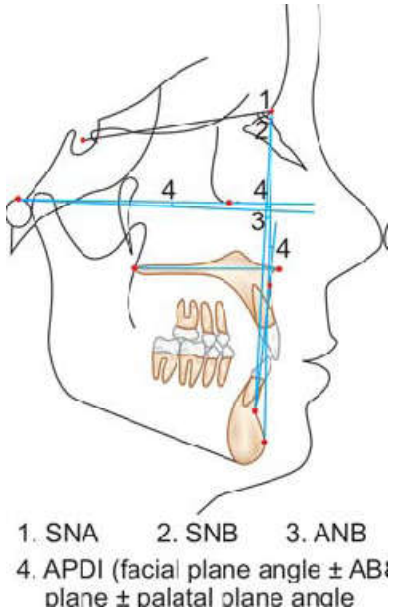
Statistical analysis

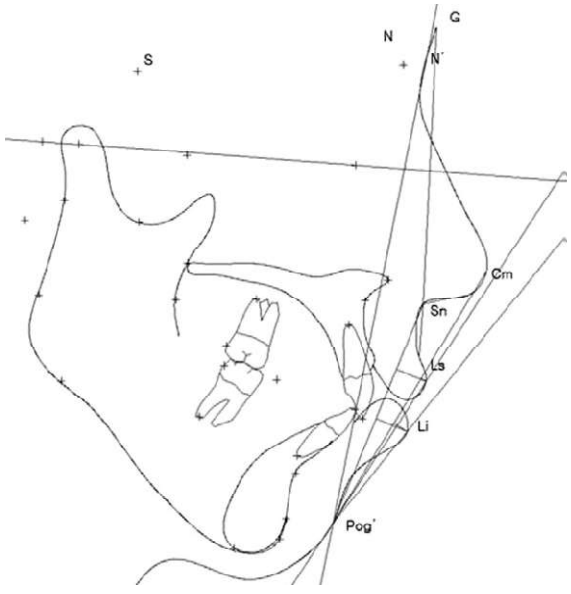
The data so obtained was subjected to the statistical analysis using statistical package program STATA version 9.2. Descriptive statistics, including the mean and standard deviation values are calculated for all the parameters in each Group. ANOVA with Tukeys test is used to determine the significant differences between the mean and standard deviations of various parameters in the three groups but among the same sex.

RESULTS

The data so obtained was subjected to the statistical analysis. Descriptive statistics, including the mean and standard deviation values were calculated for all the parameters in each Group. This used to determine the significant differences between the mean and standard deviations of various parameters in the three Groups but among the same sex. Anova test shows comparison value between cephalometric variables and within group and found that L-E line is highly significant between the group and subgroups.

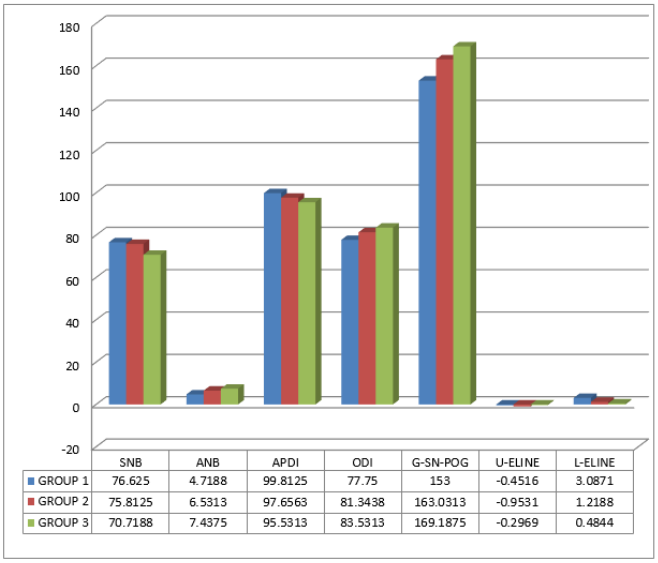






G-Sn-Pg, UI – E line, LI – E line

Test shows the correlation shows SNB, APDI, L-E line were negatively correlated and ANB, ODI, G –SN-Pog positively correlated with depth of curve of Spee in both males and females. Multiple regression analysis was performed to see the linear dependence of various studied parameters on curve of Spee. Corresponding coefficient and their 95% confidence interval (CI) are described. Regression analysis shows that there was highly significant correlation between curve of Spee and U-E line L-E line but APDI was moderately significant. In the enter method, other variables in the study were included in the regression model, and these variables explained only 25.7% of the total variance of the curve of Spee as shown in table.



Distribution of mean value among three groups

Multiple linear regression

		SNB	ANB	APDI	ODI	G-SN-POG	U-ELINE	L-ELINE
COS	PEARSON CORRELATION	-.012	-.081	-.056	.194	-.008	.049	-.302
	SIG. (2 TAILED)	.456	.217	.295	.029 (S)	.468	.317	.001 (H.S)
	N	96	96	96	96	96	96	96

	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.	R SQUARE
REGRESSION	41.389	7	5.913	4.343	.000 (H.S)	0.257
RESIDUAL	119.801	88	1.361			
TOTAL	161.190	95				

DISCUSSION

The relationships between the curve of Spee and dentofacial morphology were investigated using dental models and lateral cephalograms. The measurement of curve of Spee was done and the average of the distance on right and left side was taken as the depth of curve of Spee Nanda (1983) Dale (1985) and Baydas *et al*. (2004). In this study six cephalometric parameters were used, which were further divided into skeletal and soft tissue parameters. Since the curve of Spee was significantly influenced by sagittal and vertical craniofacial morphology as suggested by Farella *et al*. (1953) the cephalometric parameters were further divided into two skeletal horizontal, two skeletal vertical, and three soft tissue parameters. In this study considered age group was in the range of 18 to 25 years to omit any effect of growth on the curve of Spee since, the depth remained relatively constant during adulthood as compared to the flat curve in deciduous dentition and maximum deepening during adolescent dentition Marshall *et al*. (2008). This was also supported by Farella *et al*. (2002) who said that homogenous dental wear could be the reason for maintenance of curve of Spee in adulthood. Study by Hasan *et al*. (2015) and Cheon *et al*. (2008) concluded that curve of spee was not influence by gender but Baydas (2004) stated that depths of Curve of Spee is correlated to overjet, overbite and also demonstrated significant differences among males and females. The findings in this study suggested that the depth curve of Spee was influenced by the position of the mandible with respect to the anterior cranial base, i.e. SNB. The negative correlation value suggested that more the mandible was positioned anteriorly the depth of curve of Spee was less, and as the SNB angle decreased from Groups I to III. Curve of spee also increased in both males and females. This was supported by studies done by Farella *et al*. (2002) and Cheon *et al*. (2008) It was found that the subjects with higher maxillomandibular discrepancies tend to have deeper curve of Spee.

The curve of Spee was influenced by the skeletal pattern of the subjects as suggested by the values of APDI, that is smaller the APDI value in relation to the normal mean greater was the probability of distocclusion, thus suggesting Class II skeletal pattern and deep curve of Spee. This finding was similar to a study conducted by Cheon *et al*. (2008). There have been limited studies to assess the relationship between the curve of Spee and cephalometric soft tissue measurements. A significant correlation was discovered between the curve of Spee in the mandibular arch, G-Sn-Pog and the maxilla to E-line in this study. This correlation seems to be because the G-Sn- Pog' and the maxilla to E-line measurements have significant correlations with the anteroposterior position of the mandible with respect to the anterior cranial base. Multiple regression analysis suggests that the curve of Spee is more influenced by facial morphology. Overall, these findings suggest that the sagittal organization of the teeth adjusts to dentofacial variation by varying the depth of the curve of Spee to a minor extent. Only 25.7% of the variance of the curve could be explained by the dentofacial variables in the regression model. Most of the variation of the curve remains unexplained by dentofacial morphology and could probably be explained better by other factors.

Conclusion

Following conclusions were drawn on the basis of the findings of this study:

1. The depth of curve of Spee was greatly influenced by sagittal maxillomandibular discrepancies. The values for parameters SNB, ANB and APDI suggested that the mandible was located more posteriorly in deep curve of Spee Group
2. The correlation coefficients obtained from the study suggested that the depth of curve of Spee was positively correlated with ANB, ODI, G–SN-Pog as the value of above mentioned parameters increases as the depth of curve of Spee increases and negatively correlated with SNB, APDI, Lower lip to E-line that is, with decrease

in the depth of curve of Spee the value of above mentioned parameters decreases.

3. Regression analysis shows that there was highly significant correlation between curve of Spee and L-Eline, G-SN-Pog, SNB, ODI, APDI, and U-Eline was moderately significant. In the enter method, other variables in the study were included in the regression model, and these variables explained only 25.7% of the total variance of the curve of Spee.

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