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A CORRELATIVE STUDY TO ASSESS THE RELATIONSHIP BETWEEN CURVE OF SPEE AND VARIOUS SKELETODENTAL PARAMETERS IN DIFFERENT MALOCCLUSION GROUPS

Dental Science

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ABSTRACT

Aim: was to determine depth of curve of spee in different malocclusions and correlation of COS depth to various skeletodental parameters in different malocclusions.

Method: 120 lateral cephalograms, study models and frontal photographs of untreated patients were included and assigned to five malocclusion groups. COS depth, overjet, overbite and arch depth were measured on the study models. Facial index was calculated on frontal photographs whereas other skeletodental parameters (mandibular anterior dental height, mandibular posterior dental height, IMPA, mandibular plane angle, J-ratio, lower facial height, UFH/LFH, mandibular body length and ramus height) were analyzed on lateral cephalograms.

Results: The COS depth was maximum in class II division2 group with a mean of 2.69+/-1.04mm and lowest in class III malocclusion group with a mean of 1.66+/-0.75mm. Statistically positive correlation was found between COS depth and overjet in class I, class II division 1, class II subdivision , where as positive correlation was found between COS depth and overbite in class II division 2 group and class III group.

Conclusion: The COS was deepest in class II division 2 malocclusion. The contributing factors to increased curve of spee in class II division 1, class I were overjet and IMPA whereas overbite and facial index made significant contribution to curve of Spee in class II division 2. IMPA was the major factor for depth of COS in class III malocclusion group.

KEYWORDS

IMPA, COS, Malocclusion, Overjet

Introduction:

Exaggerated curve of spee is a common malocclusion that is frequently observed in dental malocclusions that present with deep vertical overbite, posterior extrusion and incisor proclination[1]. Brachycephalic facial pattern[2] and short mandibular bodies[3], are seen to be associated with increased curve of spee.

Osborn[4] suggested that curve of spee develops from a combination of factors including growth of orofacial structures, eruption of teeth, development of the neuromuscular system and craniofacial variation. Levelling of the curve of spee represents a routine procedure in orthodontic practice and the more pronounced the curve is, the greater the additional space required to flatten the dentition. The assessment of the depth of the curve of spee is therefore a critical point for the orthodontic diagnosis and treatment protocol[5].

In the present study, curve of spee is measured from most distal part of second molar to the incisal edge. Inclusion of the incisors in the interpolation generates a larger and flatten curve and increases variability[6]. The purpose of the present study was to determine whether presence of curve of Spee can be linked to facial metrical characters and to establish a relationship between depth of curve of Spee and various skeletodental features.

Materials and Methodology:

The present cross-sectional study was conducted in the Department of Orthodontics and Dentofacial Orthopaedics, Swami Devi Dyal Hospital and Dental College, Barwala, Distt. Panchkula (Haryana). The pre-treatment records (lateral cephalograms, study models and frontal photographs) of 120 subjects within the age range of 14-26 years were included in the study.

Based on the ANB angle, the 120 subjects selected were classified into three groups: Group I (skeletal class I malocclusion), Group II (skeletal class II malocclusion) and Group III (skeletal class III malocclusion). Group II, was further subdivided into Groups IIa, IIb and IIc, based on Angle's classification of malocclusion.

I. Analysis of Orthodontic study models:

To obtain precision in measurement of the depth of curve of Spee and arch depth, digital photographs were obtained using a standardized photographic set-up and a DSLR camera. Models were placed on the model platform and photographs were taken from right, left and occlusal surface of models. These photographs were then uploaded in Adobe Photoshop 7.0 for measurement of COS depth and arch depth.

A. Curve of spee measurement: With the help of ruler tool, a horizontal line was placed touching the incisal edges anteriorly and extended posteriorly to the distal cusp of last erupted molar. Another vertical line perpendicular to previous line was drawn to the deepest cusp and the distance was measured. Similar procedure was done on the left side also.

B. Arch depth Measurement: Photographs were cropped in 1:1 magnification and then with the help of ruler tool, a horizontal line was placed tangential to mesial surface to first molars of one side and extended to mesial surface of first molar of contralateral side. Another vertical line starting at the level of incisal edges midway between central incisors perpendicular to this line was drawn and distance of this vertical line was measured as arch depth.

II. Photographic measurements:

Extraoral frontal photograph at rest was taken to determine the facial form.

1. Soft tissue nasion (N')
2. Soft tissue Gnathion (Gn')
3. Zygomatic prominence (Zy')

Facial index (N'-Gn'/ Zy'-Zy'): It is taken as the ratio of length of face to its maximal width between the zygomatic prominencies .

III. Cephalomteric Measurements:

SNA, SNB, Anterior mandibular dental height, Posterior mandibular dental height, Incisor mandibular plane angle (IMPA), Mandibular plane angle (SN-MP), Jarabak's ratio (S-Go/N-Me), Lower facial height (LFH=ANS-Me), UFH/LFH (N-ANS/ANS-Me), Mandibular body length (Go – Pog) and Ramus height (Ar- Go).

Results: The mean and standard deviation of depth of COS for each group was analyzed and it showed no clinically significant difference between right and left sides, so mean value was taken into consideration.

The depth of curve of Spee was maximum in class II div.2 subjects (group IIb) and least in class III subjects (group III). Depth was observed in this order: class II div. 2> class II div. 1>class II subdiv.> class I >class III with statistically significant difference (p= 0.01*) as shown in table 1.

There was positive correlation between depth of curve of spee and overjet in groups I, IIa, and IIc but there was no correlation in groups II b and group III. Overbite was positively correlated with depth of curve of spee in groups IIb and group III as shown in table 2.

Multiple regression analysis with the enter method showed that Overjet had a significant contribution to depth of cos in class IIc, class IIa and class I. Overbite had the contribution to depth of cos in class II div.2 malocclusion (**β= 0.437)** only. **IMPA** had the contribution to depth of cos in class II div.1 group and class II (Table 3).

Discussion: The assessment of relationship of curve of spee with multiple factors may be helpful in knowing the etiology of development of curve of spee and hence treatment planning to level it. Hence, our present study was aimed to assess and correlate the relationship of COS with dentoskeletal morphology to understand the influence of multiple factors that lead to its development.

According to Carter and McNamara[7] there was no reported difference in depth of the COS between male and female subjects when it was measured on pretreatment dental casts. Farella and colleagues[8] also reported the same therefore, no attempt was made to separate the sample according to sex in this study.

In the present study depth of curve of spee was more in class II div.2 subjects (group 3), followed by class II div .1 subjects (group 2) > class II subdiv. subjects (group 4)>class I subjects (group1) and least depth was seen in class III subjects (group 5). However, it did not show statistically significant difference between class II div. 1 and div.2 subjects. This is supported by study done by Veli and colleagues[9] who also reported no significant difference in depth of curve of spee between class II div.1 and class II div.2 subjects.

The depth of curve of spee significantly increases with increase in the overjet[10] and results obtained from our study confirmed the above findings. The data obtained in the present study showed that depth of of curve of spee in mandibular arch increases with an increase in overjet. Veli and colleagues[9] also reported statistically significant correlation between curve of spee and overjet. Overbite when correlated with COS in different malocclusion groups, showed statistically significant correlation. Pearson correlation coefficient and multiple regression showed positive correlation of overbite with cos in class II div. 2 and class III group. Burstone[11] stated that the treatment of deepbite might involve intrusion of maxillary anterior teeth, intrusion of mandibular anterior teeth, extrusion of maxillary and mandibular posterior teeth, or any such combination. However, Schudy advocated that a deepbite and a deep COS should be corrected by extrusion of the molars because intrusion of anterior teeth has a high potential for relapse.

Pearson coefficient test results showed that facial index was related to a deeper cos in class II div.2 malocclusion but it didn't show significant correlation with curve of spee in other malocclusions. This was supported by Farella et al[8] who reported that cos is more marked in individuals with short faces and deep bites.

Multiple regression analysis showed IMPA was contributing to curve of spee depth in class II div. 2 and class III malocclusion groups. Balridge[12] stated that leveling of spee's curve causes an increase in arch circumference and proclination of lower incisors.

Overall, the findings of the present study suggest that the stomatognathic system adjusts to dentoskeletal variation by varying the shape of the curve of spee, but to a minor extent. One of the orthodontic treatment purposes is levelling the curve of spee and for this levelling, the value of curve of spee depth should be considered and quantified in space management procedures to prevent incisor flaring and consequently assuring aesthetics, stability of the treatment results and function.

Conclusions:

1. The depth of cos was greatest in the class II div.2 group followed by class II div1, class II subdiv., class I and class III with the least amount of depth.
2. In class II div. 1 malocclusion, the contributing factors to COS were overjet and IMPA.
3. In class I malocclusion, overjet was positively correlated with COS.
4. In class II div.2 malocclusion, overbite and facial index were related to COS.
5. In class II sub div. malocclusion, overjet and mandibular plane angle were contributing factors for COS where as Jarabak's ratio was negatively related to it.
6. In class III, IMPA was major factor for the depth of COS.

Table 1: Average COS (right and left side) mean in different groups

Groups	COS (Avg)		Anova	p value
	Mean	SD	6.82	<0.01*
Class I	1.89	0.81		
Class IIA	2.62	0.91		
Class IIB	2.78	0.77		
Class IIC	2.41	0.97		
Class III	1.86	0.56		
Tukey HSD Post-hoc Test... Group 1 vs Group 2: Diff=0.7300, 95%CI=0.0926 to 1.3674, p=0.0162* Group 1 vs Group 3: Diff=0.8900, 95%CI=0.2526 to 1.5274, p=0.0017* Group 2 vs Group 5: Diff=-0.7600, 95%CI=-1.3974 to -0.1226, p=0.010* Group 3 vs Group 5: Diff=-0.9200, 95%CI=-1.5574 to -0.2826, p=0.001*				

Table 2: Pearson correlation coefficients for the measured skeletodental variables

	Group I		Group IIA		Group IIB		Group IIC		Group III	
	r	p value	r	p value	r	p value	r	p value	R	p value
Arch depth	0.06	0.75	0.09	0.64	-0.26	0.17	-0.29	0.22	-0.02	0.92
Overjet	0.58	<0.01*	0.59	<0.01*	0.27	0.15	0.71	<0.01*	-0.17	0.37
Overbite	0.29	0.12	0.13	0.52	0.49	0.01*	0.42	0.07	0.38	0.04*
Facial index	0.1	0.96	-0.28	0.13	0.39	0.03*	-0.06	0.8	-0.09	0.64
UFH/LFH	0.09	0.64	0.11	0.56	-0.15	0.43	0.52	0.02*	0.25	0.18
1-MP(mm)	0.07	0.71	-0.03	0.88	0.06	0.75	-0.27	0.25	-0.12	0.53
7-Mp(mm)	-0.08	0.67	0.12	0.61	0.01	0.96	-0.3	0.19	-0.13	0.49
IMPA	-0.17	0.37	-0.47	0.01*	0.02	0.92	-0.26	0.27	-0.44	0.02*
Mand. Body	-0.09	0.64	0.08	0.67	-0.02	0.92	-0.33	0.16	0.14	0.46
Ramus height(mm)	-0.24	0.20	-0.32	0.09	0.21	0.26	-0.42	0.07	-0.09	0.64
LFH(mm)	-0.11	0.56	-0.02	0.92	0.05	0.79	-0.21	0.37	-0.19	0.31
SN-MP	-0.12	0.53	0.20	0.29	-0.18	0.34	0.52	0.02*	0.01	0.96
J-Ratio	-0.05	0.79	-0.29	0.12	0.12	0.61	-0.58	0.01*	-0.11	0.56

Table 3: Multiple regression Analysis of Variables

Group	Measurement	B	SE B	ß
1. Class I	Overjet	0.157	0.037	0.479*
2. Class IIA	Overjet	0.164	0.036	0.484*
	IMPA	-0.168	0.069	-0.438*
3. Class IIB	Overbite	0.156	0.039	0.437*
	Facial index	0.143	0.035	0.426*
4. Class IIC	Overjet	0.189	0.033	0.494*
	SN-MP	0.178	0.030	0.438*
	J-ratio	-0.79	0.031	-0.411*
5. Class III	IMPA	-0.81	0.033	-0.428*

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