

Evaluation of Changes in Curve of Spee among Patients from Age 8 – 14 Years

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Abstract: Introduction: The aim of this study is to evaluate the change in the curve of Spee in children from the age 8 – 14 years using a Vernier caliper and to determine the relationship between gender-wise and year-wise changes. Materials and methods: The longitudinal records of growth data available in the Department of Orthodontics and Dentofacial Orthopaedics, Sharad Pawar Dental College in the form of 5 sets of study models of 50 children (28 boys, 22 girls) from age 8 – 14 years, taken at an interval of 18 months, T0 (8 years of age), T1 (9 ½ years), T2 (11 years), T3 (12 ½ years) and T4 (14 years). The depth of curve of Spee was measured using Vernier Caliper and the measurement was made on the right and left side of the dental arch and the mean value of these two measurements were used as depth of curve of Spee. Results: Female patients showed significant differences when compared to male patients and also showed significant differences when T0 was compared to T2, T3 and T4. Conclusion: The curve of Spee was found to be increased in females.

Keywords: Curve of Spee, Male and Female patients, age changes, Vernier caliper

1. Introduction

Curve of Spee is a naturally occurring curvature found in humans and was reported in the year 1890 by Ferdinand Graf Von Spee.^[1] It is a line tangent to the anterior border of the condyle, the occlusal surface of the second molar and the incisal edges of the mandibular incisors. The functional significance of this curve has not been completely understood. However, it has been suggested that the curve of Spee has a biomechanical function during food processing by increasing the shear strength of posterior teeth and the occlusion efficiency during mastication. The development of curve of Spee probably results from a combination of factors including the eruption of teeth, growth of orofacial muscles and the development of the neuromuscular structures.

Von Spee defined the curve in humans by constructing an arc that runs from the anterior surfaces of the mandibular condyles to the occlusal surfaces of the second molars and the incisal edges of the mandibular teeth. The arc lies at a tangent in the sagittal plane.^[17]

The centre of this cylinder in the sagittal plane has a radius of 6.5 to 7 cm. von Spee described the forward and backward gliding movement of the mandible as taking place in a circular motion along an arc.^[17]

This motion of gliding performed by the mandible can also occur with a slight deviation to either the left or right during function. The skull profile in the figure below shows the occlusal surfaces of the molars which are aligned in a downward convex curve in the maxilla and an upper concave curve in the mandible.^[17]

The morphological arrangement of the teeth in the sagittal plane has been related to the slope of the articular eminence,

craniofacial morphology, lower incisor proclination, the incisor overbite,^[2] the molar cusp height and lower arch circumference.^[4]

In Andrew's description of the 6 characteristics of the human dentition,^[6] he found that the curve of Spee in subjects with good occlusion ranged from flat to mild. He proposed that the ultimate goal of orthodontic treatment was the flattening of the curve of Spee which also offered better intercuspation.

Leveling the curve of Spee is a routine procedure in orthodontic practice. A flat curve is proposed as a way of overcorrection in orthodontic treatment since there is a natural tendency of deepening the curve over time, which can lead to an undesirable increase in overbite and posterior occlusal interferences

There are, however, very few studies in the literature concerning the measurement of the curve of Spee. Baldrige^[7] used the perpendicular distance on both sides of the mandibular cast. Bishara^[8] et al, used the average of the sum of the perpendicular distances to each cusp tip. Sondhi et al,^[9] used the sum of the perpendiculars. Braun et al^[10] and Braun and Schmidt used the sum of maximum depth on both sides. Traditionally these measurements are taken from study models or the photographs of study models with a divider or caliper and a coordinate machine.

Marshall et al., in their study found that there are no significant differences in maximum depth of curve of Spee between both the right and left sides of the mandibular arch or the sexes. So the purpose of this study was to evaluate the changes of curve of Spee between male and female patients between the ages 8 – 14 years in central India population.

2. Materials

This retrospective study was conducted at Department of Orthodontics and Dentofacial Orthopedics, Sharad Pawar Dental College, Datta Meghe Institute of Medical Sciences, Sawangi (Meghe), Wardha. The longitudinal growth data of 50 patients were obtained from the archives of the Department of Orthodontics and Dentofacial Orthopedics.

The sample consisted of two groups.
 Group 1 – Male – 29 patients
 Group 2 – Female – 21 patients

They were labelled and categorized according to the date and interval of data collection as:

- T0 - Treatment record of first appointment at 8 years of age.
- T1 - Treatment record of second appointment at 9 ½ years of age.
- T2 - Treatment record of third appointment at 11 years of age.
- T3 - Treatment record of fourth appointment at 12 ½ years of age
- T4 - Treatment record of fifth appointment at 14 years of age.

The bases for the study models were formed as per the standard base makers.

3. Method

The depth of curve of Spee was measured with a Vernier Caliper as the perpendicular distance between the deepest cusp tip and a flat plane, that was laid on 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 as described by Braun et al and Braun and Schmidt. The measurement was made on the right and left side of the dental arch and the mean value of these two measurements were used as depth of curve of Spee.

4. Results

The purpose of the study was to evaluate the changes of curve of Spee in children from 8 – 14 years of age. Statistical analysis was carried out using IBM SPSS Version 11.

The data obtained was subjected to statistical analysis which showed that female patients showed a highly significant difference during the course of treatment while male patients had no significant differences in the curve of Spee. (Table 1). When the data was reviewed, it showed that there were no statistically significant differences seen between T0 and T1, T2, T3 and T4 in males ($p = 0.77$) while a significant difference was seen in between the T0 and T1, T2, T3 and T4 in females ($p = 0.000$). The statistical significance was set at $p \geq 0.05$

Table 1

	Sex	N	Mean	Std. Deviation	Std. Error Mean
t0	Male	29	1.5259	.95043	.17649
	Female	21	.9286	.70331	.15347
t1	Male	29	1.7241	.95043	.17649
	Female	21	1.6786	.72948	.15919
t2	Male	29	2.0517	.78881	.14648
	Female	21	1.8214	.81064	.17690
t3	Male	29	2.0086	1.03182	.19160
	Female	21	2.0595	.73274	.15990
t4	Male	29	2.0948	.75715	.14060
	Female	21	2.1786	.72948	.15919

Descriptive statistics, including the mean and standard deviation values were calculated for all the parameters in each group. ANOVA test was used to determine the significant differences between the mean and standard deviations of the various parameters in the 2 groups. (Table 2)

Table 2

Sex		Sum of Squares	df	Mean Square	F	Sig.
Male	Between Groups	7.015	4	1.754	2.156	.077
	Within Groups	113.871	140	.813		
	Total	120.885	144			
Female	Between Groups	20.224	4	5.056	9.183	.000
	Within Groups	55.060	100	.551		
	Total	75.283	104			

Descriptive statistics, including the mean and standard deviations values were determined for each group of treatment periods.

5. Discussion

The aim of this study was to compare changes in Curve of Spee from the ages 8 – 14 years. In this study, there was a statistically significant difference between the curves of Spee seen in females than males. Significant differences were found between T0 and T1, T2, T3, T4 in females and in males

Marshal et al in 2008, [5] studied the development of the curve of Spee longitudinally in a sample of untreated subjects with normal occlusion from the deciduous dentition to adulthood. No significant differences in the curve of Spee was found between either the right and left sides of the mandibular arch or the sexes.

The assessment of relationship of curve of Spee with respect to the gender is needed to understand the influence of the multiple factors that leads to variations in the depth of the curve.

Analysis of the curve of Spee may assist dentists in determining the development of the occlusion in the sagittal plane. Osborn [3] reported that the curve of Spee had a positive correlation with the inclination of masseter muscle. This forward tilt of the mandibular posterior teeth arrangement maximizes the muscular efficiency during chewing. The curve of Spee, when iatrogenically altered by rotation, tipping, or extrusion, results in abnormal

mandibular elevator muscle activity, especially of the masseter and temporalis muscles.

Shannon et al. in 2004, ^[11] concluded that there was no significant relapses in the curve of Spee between Class I, Class II Division 1 or Class II Division 2 malocclusions.

Magill ^[12] found significantly more relapse of deepbite patients for whom more correction was achieved with treatment. It would be expected to relate similarly to the relapse of the curve of Spee. However, there was no significant correlation between the amount of overbite correction and curve relapse.

Braun and Schmidt ^[10] compared non-growing white males and females with Class I and Class II malocclusions who had never received treatment. They reported that the shape of the curve of Spee was the same for men and women based on the contact points between the mandibular teeth taken from lateral cephalometric radiographs.

It can also cause excursive interferences resulting in wear, fracture of restorations, and temporomandibular joint dysfunction. The maxillary and mandibular curves of Spee could be used as the first reference for prosthetic and orthodontic reconstruction.

6. Conclusion

Findings of this study suggested that the gender differences should be taken into consideration when reconstructing the occlusal curvature, i.e., curve of Spee.

We found no statistically significant differences between the depth of the curve of Spee and the left and right sides of the arches. This result contrasts with the results of Farella et al ^[2], who found that left-side curves were significantly deeper in both sexes.

7. Future Scope

This study could be used as a guideline for determining the changes in the Curve of Spee using a larger population, any class of malocclusion and also for sexual dimorphism.

References

- [1] Senthil Kumar, Tamizharasi S.: Significance of curve of Spee: An orthodontic review. Journal of Pharmacy and Bioallied Sciences Vol 4 August 2012 Supplement 2 - Part 3
- [2] Farella M, Michelotti A, van Eijden TMGJ, Martina R. The curve of Spee and craniofacial morphology: a multiple regression analysis. Eur J Oral Sci 2002;110: 277-81.
- [3] Osborn JW. Relationship between the mandibular condyle and the occlusal plane during hominid evolution: some of its effects on jaw mechanics. Am J Phys Anthropol 1987; 73: 193-207
- [4] De Praeter J, Dermaut L, Martens G, Kuijpers-Jagtman AM. Long-term stability of the leveling of the curve of

- Spee. Am J Orthod Dentofacial Orthop 2002; 121: 266-72
- [5] Marshall SD, Caspursen M, Hardinger RR, Franciscus RG, Aquilino SA, Southard TE. Development of curve of spee. Am J Orthod Dentofacial Orthop 2008; 134: 344-52
- [6] Andrews FL. The six keys to normal occlusion. Am J Orthod 1972; 62: 296-309
- [7] Baldrige DW. Leveling the curve of Spee: its effect on the mandibular arch length. JPO J Pract Orthod 1969; 3: 26-41
- [8] Bishara SE, Jakobsen JR, Treder JE, Stasi MJ. Changes in the maxillary and mandibular tooth size-arch length relationship from early adolescence to early adulthood. A longitudinal study. Am J Orthod Dentofacial Orthop 1989; 95: 46-59
- [9] Sondhi A, Cleall JF, Begole EA. Dimensional change in the dental arches of orthodontically treated cases. Am J Orthod 1980; 77: 60-74
- [10] Braun ML, Schmidt WG. A cephalometric appraisal of the curve of Spee in Class I and Class II Division 1 occlusions for males and females. Am J Orthod 1956; 42: 255-78
- [11] Changes in the curve of Spee with treatment and at 2 years posttreatment - Kyle R. Shannon, DDS, MS, and Ram S. Nanda, DDS, MS, PhD
- [12] Magill JM. Changes in the anterior overbite relationship following orthodontic treatment in extraction cases. Am J Orthod 1960; 46: 755-88
- [13] Baydas B, Yavuz I, Atasaral N, Ceylan I, Dagsuyu IM. Investigation of the changes in the positions of upper and lower incisors, overjet, overbite, and irregularity index in subjects with different depths of curve of spee. Angle Orthod 2004; 74(3):349-55
- [14] Praeter J, Dermaut L, Martens G, Kuijpers-Jagtman AM. Longterm stability of the leveling of the curve of Spee. Am J Orthod Dentofacial Orthop 2002; 121: 266-72
- [15] Bernstein RL, Preston CB, Lampasso J. Leveling the curve of Spee with a continuous archwire technique: a long term cephalometric study. Am J Orthod Dentofacial Orthop 2007; 131(3):363-71
- [16] Andrews, LF. The six keys to normal occlusion. Am J Orthod 1972; 62(3):296-9
- [17] Beidenbach et al. the gliding path of the mandible along the skull. Archives of Anatomy and Physiology; 16: 285-294, 1890.