

Influence of malocclusion on the depth of curve of Spee

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Abstract

Objective: To evaluate and compare the depth of curve of Spee in class I, class II div1, class II div 2, class II subdivision and class III malocclusion.

Methods: A Cross sectional study was done at Dr Irshat-ul-Ebad Khan Institute of Oral Health Sciences, Karachi, Pakistan (DIKIOHS) from Oct 2009 to March 2010. The sample of 100 adolescent patients selected according to the inclusion criteria was divided into five groups. Group 1 class I malocclusion had 29 patients, Group 2 class II div 1 malocclusion had 33 patients, Group 3 class II div 2 malocclusion had 16 patients, Group 4 class II subdivision malocclusion had 13 patients, Group 5 class III malocclusion had 9 patients. The depth of curve of Spee was measured as the perpendicular distance between the deepest cusp tip and a flat plane that was laid on the occlusal surface of the mandibular dental cast. 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. The measurements were analyzed and statistically compared in SPSS version 10 by students "t" test ($P < 0.05$).

Results: Mean depth of Curve of Spee in class I malocclusion was 2.4mm, in class II div 1 malocclusion mean depth was 2.8 mm, in class II div 2 malocclusion mean depth was 4.3 mm, in class II subdivision mean depth was 2.5mm in class III malocclusion mean depth was 2mm.

Conclusion: The curve of Spee was deepest in class II div 2 malocclusion.

Keywords: Pakistan, Dentition, Malocclusion, Teeth, Adolescent (JPMA 61: 1056; 2011).

Introduction

Occlusal curvature is a naturally occurring phenomenon in the human dentition. Ferdinand Graf Von Spee¹ found in the dentition of other mammals and fossil humans,² a line of occlusion, which was termed as curve of Spee and was described in humans in the late 19th century. Clinically the distal marginal ridges of the posterior teeth in the arch and the incisal edges of the central incisors determine the curve of Spee.¹

The morphological arrangement of the teeth in the sagittal plain has been related to the slope of the articular eminence, craniofacial morphology,³ lower incisor proclination, the incisor overbite,⁴ the molar cusp height and

lower arch circumference.^{5,6} However it is suggested that the curve of Spee has a biomechanical function during food processing by increasing the crush-shear ratio between the posterior teeth and the efficiency of Occlusal forces during mastication.⁷

Andrews⁸ described the six characteristics of normal occlusion and found that the curve of Spee in subjects with good occlusion ranged from flat to mild, noting that the best intercuspation occurred when occlusal plane was relatively flat. He proposed that flattening the occlusal plane should be the treatment goal in orthodontics. This concept especially as applied to deep overbite patients, has been supported by others⁹ and produces variable results with regards to

maintaining a level curve after treatment.^{4,10} It has been suggested that the deciduous dentition has a curve of Spee ranging from flat to mild, whereas the adult curve of Spee is more pronounced.¹¹ The development of curve of Spee probably results from combination of factors including eruption of teeth, growth of orofacial structures, and development of neuromuscular system.¹²

Orthodontic correction of overbite often involves leveling the curve of Spee by anterior intrusion, posterior extrusion, or a combination of these actions. The process of proclining the lower incisors has been used in some cases to decrease the relative vertical overlap of the lower incisors by the upper incisors.¹³

However, there is a little consensus in literature concerning the measurement of curve of Spee. Baldrige⁶ used the perpendicular distance on both sides. Bishara et al¹⁴ used the average of the sum of the perpendicular distances to each cusp tip. Sondhi et al¹⁵ used the sum of the perpendiculars. Braun et al and Braun and Schmidt¹⁶ 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.⁴

The purpose of the study was to evaluate and compare the depth of curve of Spee in class I, class II div1, class II div 2, class II subdivision and class III malocclusion in individuals between 12-29 years age. The influence of gender on the curve of Spee was also investigated.

Subjects and Methods

The cross sectional study was carried out at Department of Orthodontics of Dr Irshat-ul-Ebad Khan Institute of Oral Health Sciences (DIKIOHS) DOW University from Oct 2009 to March 2010. One hundred adolescent patients (31 males and 69 females with age range between 12-29 years) fulfilled the inclusion criteria and were inducted in the study. Data was collected for routine orthodontic patients with an informed consent at DIKIOHS. The inclusion criteria was healthy subjects having complete dentition, second molars erupted and except for third molars no other maxillary and mandibular teeth were absent, none of the patients had a history of orthodontic treatment, with no severe craniofacial

disorders such as cleft palate, anterior or lateral cross bite, pathological condition, or restorations. The sample consisted of five groups.

Group 1 class I malocclusion = 29 patients

Group 2 class II div 1 malocclusion = 33 patients

Group 3 class II div 2 malocclusion = 16 patients

Group 4 class II subdivision malocclusion = 13 patients

Group 5 class III malocclusion = 09 patients

We also divided the depth of curve of Spee in three groups:

Group A = Normal curve of Spee i.e. 2-3 mm

Group B = Deep curve of Spee i.e. >3mm and

Group C= Flat curve of Spee i.e. <2mm

Impressions were taken for all the patients. Impressions were poured with ortho plaster and casts were prepared. The depth of curve of Spee was measured (Figure) 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 done by Braun et al⁵ and Braun and Schmidt.¹⁶ 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.

To evaluate the measurement error, 30 casts were randomly selected and the measurements were repeated. The measurement were analyzed and statistically compared in SPSS version 10 by students "t" test ($P < 0.05$).

Results

Our result showed that 52 patients had a normal curve of Spee, 33 had a deep curve and 15 had a flat curve of Spee. The minimum depth that we have recorded was 0.75mm and maximum was 6mm and mean was 2.84mm.

Mean depth of Curve of Spee in class I malocclusion was 2.4mm, in class II div 1 malocclusion mean depth was 2.8 mm, in class II div 2 malocclusion mean depth was 4.3 mm, in class II subdivision patient mean depth was 2.5mm in class III malocclusion mean depth was 2mm as shown in Table-1.

Table-1: Minimum, Maximum and Mean Depth of Curve of Spee in Different Malocclusions.

	Number of patients	Minimum Depth	Maximum Depth	Mean Depth
Curve of Spee in Class I Malocclusion	29	1.00	3.75	2.4052±0.67946
Curve of Spee in Class II div1 Malocclusion	33	0.75	5.50	2.8709±0.94982
Curve of Spee in Class II div 2 Malocclusion	16	2.25	6.00	4.3125±1.08589
Curve of Spee in Class II Subdivision Malocclusion	13	1.00	3.50	2.5385±0.80264
Curve of Spee in Class III Malocclusion	9	1.00	4.00	2.0556±0.99826

Table-2: Depth of Curve of Spee in Different Malocclusion.

		Class I	Class II DIV 1	Class II DIV 2	Class II Subdivision	Class III	Total
Curve of Spee	Normal curve of Spee 2-3mm	19	20	3	7	3	52
	Deep curve of Spee >3mm	6	10	13	3	1	33
	Flat curve of Spee <2mm	4	3		3	5	15
Total		29	33	16	13	9	100

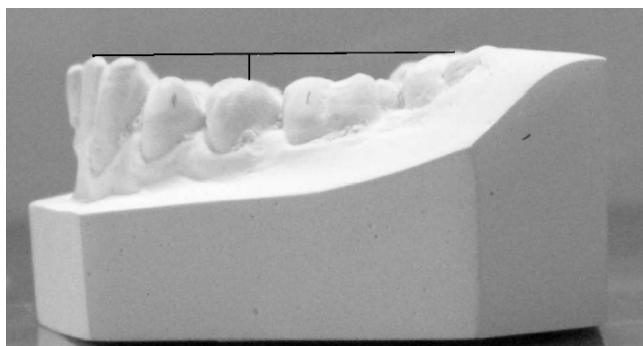


Figure: The measurement of depth of curve of Spee.

Total of 52 patients had normal curve of Spee, 33 patients had deep curve of Spee, 15 patients had flat curve of Spee as shown in Table-2. In class I malocclusion cases, 65% had normal curve of Spee, 20.3% had deep curve and 13.3% had flat curve of Spee. In class II div 1 malocclusion 60% had normal curve of Spee, 30% had deep curve and 9% had flat curve. In class II div 2 malocclusion most of the patients had deep curve i.e. 81% of the patients had deep curve and 18.7% had normal curve of Spee. In class II subdivision malocclusion 53% had normal curve depth, 23% had deep curve and 23% had flat curve depth. In class III patients 55% had flat curve of Spee, 33% had normal curve 11% had deep curve of Spee.

Discussion

Orthodontists do not evaluate and consider the Curve of Spee in all cases, treatment planning should be a combination of cephalometric analysis and dental discrepancy¹⁷ but consideration of the curve of Spee is an important factor in diagnosis.^{14,15} Although leveling the curve of Spee is an everyday occurrence in orthodontic practice, little research has been dedicated to the examination of the relationship between the depth of the curve of Spee and different malocclusions. In the present study, therefore, the relationships between the depth of the curve of Spee in class I, class II div1 and 2, class II subdivision and class III malocclusion have been evaluated.

In this study the gender of the subjects had no significant effect on the variables assessed which confirms previous reports of the absence of sexual dimorphism in the curve of Spee in class I, II and III malocclusions.^{3,16}

Our study results showed that depth of curve of Spee was deepest in class II div 2 malocclusion and was flat in class III malocclusion suggesting that the curve of Spee in mandibular arch is influenced by the anterioposterior position of the mandible. This coincides with the previous reports that the radius of curve of Spee is shorter in those with class II malocclusion than class III malocclusion.¹⁸

The amounts of overbite and over jet significantly influence the variation of the curve of Spee in the mandibular arch. The depth of the curve of Spee in the mandibular arch increases with an increase in over jet and overbite.¹⁹ The results obtained from our study confirmed the above finding as depth of curve of Spee increases in class II div 1 and 2 malocclusions in which there are increase overjet and overbite. Trauten et al²⁰ and Orthlieb¹⁸ reported that there was a negative curve of Spee in open-bite cases, whereas a deep curve of Spee in deep-bite cases was found. On the other hand, Farella et al³ found that the curve of Spee is more marked in short-face subjects and less marked in long-face subjects. Similarly, we found that the curve of Spee is deepest in class II div 2 malocclusions that have deep overbite and short face heights (Low angle) than in the normal and flat Spee groups and it was flat in class III malocclusion that have both high and low angle variants.

Shannon and Nanda²¹ found that Class II malocclusion had significantly deeper pretreatment curve of Spee measurements than Class I malocclusions and same is the case in our study. The curve of Spee contributes to set up the anterior overbite and is favorable to the approach of the maxillary and mandibular occlusal planes, in mandibular elevation. According to this concept, the curve of Spee depth in individuals with Class II malocclusion should be deeper than in individuals with clinically normal occlusion.²² Andrews⁸ also suggested that one of the six keys to normal occlusion is the existence of a leveled occlusal plane or a mild curve of Spee, which was observed in the present study, with a mean value of 1.01 mm to the curve of occlusal plane. An excessive overbite can be an indication of incorrect curve of Spee; in the same way, an exaggerated curve of Spee can be accompanied by an increased overbite.²³

The clinical evaluation should be associated and considered in orthodontic treatment planning. One of the orthodontic treatment purposes is leveling the curve of

Spee⁶ and for this leveling, the value of the curve of Spee depth should be considered and quantified in space management procedures²⁴ to prevent incisor flaring and consequently assuring aesthetics, stability of the treatment results and function. Analysis of the curve of Spee might assist dentists in determining the sagittal organization of the teeth. The curve of Spee can be used as a reference for prosthetic restoration and orthodontic treatment. Management of the curve of Spee is critical for achieving stability of complete dentures and could play a role in the success of implant-supported restoration.³

Several studies have compared treatment techniques to deal with exaggerated curves of Spee and the stability of those treatments²⁵ Our findings provide insight into the magnitude of the curve of Spee in different malocclusion.

Conclusion

The study concluded that the mean value of curve of Spee was 2.84mm. The depth of curve of Spee was deepest in class II div 2 malocclusion and flat in class III malocclusion.

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