

CORRELATION OF CURVE OF SPEE WITH MAXILLO-MANDIBULAR DISCREPANCY AMONG DIFFERENT MALOCCLUSION GROUPS

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ABSTRACT

Objective: To assess the depth of curve of Spee (COS) in different malocclusion groups, to relate this to the maxillo-mandibular discrepancy using ANB, and to determine whether the depth of curve of Spee is affected by maxillo-mandibular discrepancy.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: The study was conducted at KRL General Hospital Orthodontic Department, from Aug 2017 to Jan 2018.

Material and Methods: One hundred and fifty patients between 18-40 years of age were recruited after filling data collection pro forma from their initial lateral cephalometric radiographs and initial study models. Data was recorded in specially made pro forma and analyzed using SPSS 20.0. Analysis included frequencies, mean \pm standard deviation (SD) and Pearson correlation. A p -value <0.001 was considered significant.

Results: Results have established a positive correlation between curve of Spee and ANB values with a highly significant p -value of <0.001 . As the value of ANB increases so does the depth of curve of Spee and vice versa.

Conclusion: There is a significant difference amongst curve of Spee values of class I, class II and class III malocclusions which is linearly coherent with ANB values.

Keywords: ANB, Curve of Spee, Maxillo-mandibular discrepancy.

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INTRODUCTION

Curve of Spee that exists in ideal dental occlusion was first described by F Graf Von Spee in 1890²². He used skulls with abraded teeth to explain normal line of occlusion. This curve is best viewed from lateral aspect. Normal curve of Spee causes total posterior disclusion on mandibular protrusion when given proper anterior guidance¹¹. In clinical orthodontics curve of Spee refers to an occlusal curve of mandibular teeth running tangent from buccal cusp tips of posterior teeth to incisal edges of anterior teeth^{1,15}.

Exaggerated curve of Spee alters muscle balance, ultimately leading to improper functional occlusion. Leveling of curve of Spee is considered ideal goal of treatment in malocclusions which is done by anterior intrusion, posterior extrusion, or a combination of the two². Andrews had given six keys of normal

occlusion, that includes molar relation, crown angulation & inclination, absence of tooth rotations, proximal contacts, and flat curve of spee having no more than 1.5 mm depth⁸. A significant correlation also exists between curve of Spee and overjet, overbite and irregularity index¹².

Occlusal plane changes from flat to exaggerated has practical consequences when considering the arch circumference required to flatten the curve. According to a popular theory 1mm of arch circumference is needed to level every millimeter of curve of Spee. A deep curve of Spee is often found in association with deep overbite in class I, II, and III malocclusions^{3,23}.

Growth of orofacial structures, eruption of various teeth, and development of neuromuscular system strongly affect line of occlusion and curve of Spee. Mandibular sagittal and vertical position relative to cranium also affects curve of Spee. In humans variations in facial patterns also result in differentiating curve of Spee. For example brachycephalic facial patterns

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are often associated with increased curve of Spee¹⁹. Deep overbites however are frequently found in association with exaggerated curve of Spee^{9,14}. Presence of a normal curve of Spee makes it possible for dentition to resist the forces of occlusion; exaggerated^{20,21} curve of Spee leads to muscle imbalance ultimately leading to improper functional occlusion⁴.

The human craniofacial structure and dental arches undergo alterations as they grow. Relatively rapid changes occur when transition in dentition occurs once all permanent teeth erupt smaller changes continue. Cephalometric studies show that craniofacial growth continues well into adulthood. The curve is greatly influenced by the horizontal position of the condyle and is weakly influenced by the vertical dento-skeletal dimension and by the position of the mandible with respect to the anterior cranial base.

Overbite is associated with a decreased gonial angle. El-Dawlatly et al. studied skeletal and dental variables in patients with deep over bite malocclusion and found that deep bite^{17,18} has multi-factorial etiological causes of which an exaggerated curve of Spee and a decreased gonial angle are the primary contributing factors⁵.

Class II division 2 patient usually present with decreased lower face height where lower incisors super erupt giving rise to deep overbite tendency associated with exaggerated curve of Spee⁶.

A study conducted in Indian population by Batham et al. showed a positive correlation between individuals with higher maxillo-mandibular discrepancies and deeper curve of Spee. Smaller values of ANB like in class I skeletal patterns showed normal to decreased curve of Spee, however with increased values of ANB i.e. in class II skeletal patterns deep curve of Spee were found⁷.

MATERIAL AND METHODS

It was a descriptive case series study conducted in the Orthodontic department of KRL (Kahuta Research Laboratories) General Hospital,

Islamabad after the approval from Institutional Review and Ethics Committee for a period of six months, from August 2017 till January 2018. One hundred and fifty patients were included using Non-Probability Consecutive sampling technique. Sample size was calculated using correlation calculator, the correlation coefficient of 0.557, power of test is 90% and probability of type I error is 5%, the sample size came out to be 25. However, due to normality assumption I took sample of 150.

Patients between age group 18-40 years having full complement of teeth except third molar were included in the study. Cephalometric

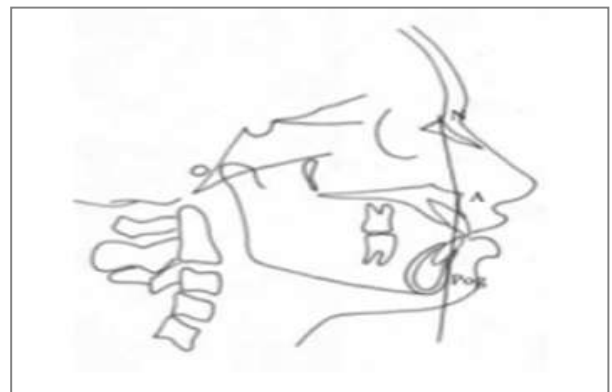


Figure-1: Pre-treatment cephalometric radiograph used for evaluation of maxillo-mandibular discrepancy (ANB).

radiographs available with high clarity and good contrast were made essential for inclusion in this study.

Patients having previous history of Orthodontic treatment, restoration and cuspal coverage, history of any systemic disease that could affect general development were excluded from this study.

Patients having congenital anomalies of teeth, history of trauma to the neck or dentofacial region were also excluded from the study.

After taking approval from the hospital's ethical committee subjects fulfilling the inclusion criteria were invited to take part in the study. The complete study was explained to them and an informed consent for their participation in the study was ensured.

The initial lateral cephalometric radiographs and initial study models of subjects were taken (fig-1). Curve of Spee was measured on study models in millimeters using divider by placing a scale on mandibular occlusal plane touching the incisor and last molar (fig-2). A metal ruler accurate to 0.5 mm, was used. The depth of curve of Spee was measured with divider placed between the deepest cusp tip and scale. The measurement was made on the right and left side of mandibular cast and the mean of these two measurements was used as the depth of curve of Spee.

Lateral cephalograms for all the subjects were taken with teeth in maximum intercuspation, standing in an upright position with FH plane being parallel to the floor. All radiographs were exposed from the same cephalostat with standard film to tube distance and patient to source distance was standardized to 5 feet.

Cephalograms were traced manually with a 0.5-mm lead pencil, on acetate sheets on an illuminator, and landmarks were traced, the

A total of 150 patients were selected to participate in the study and of these 79 were male and 71 were female. The mean age of the patients was 21 years and 12 months with SD \pm 2.64.

Pearson correlation between Curve of Spee and maxillo-mandibular discrepancy (ANB) shows a positive correlation value of 0.739

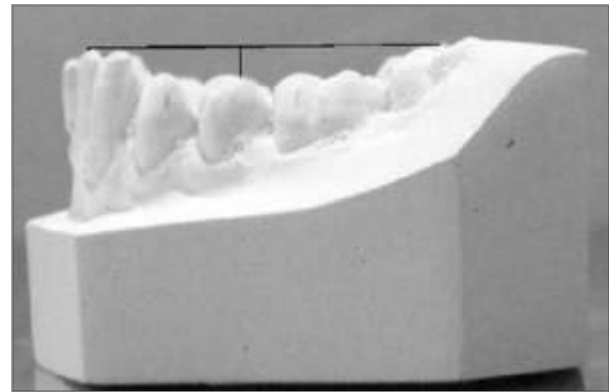


Figure-2: Pre treatment study models used for evaluation of curve of Spee.

(significant at 0.01 level 2 tailed) This shows that as the ANB value increases in all three types of malocclusions viz class I, class II, class III value

Table: Descriptive statistics of Class I, II and III patients.

Variables	Class I	Class II	Class III
Curve of Spee	1.9 \pm 0.85	3.4 \pm 1.09	2.2 \pm 1.04
ANB	2.2 \pm 1.06	6.3 \pm 1.24	3.1 \pm 1.78
Valid N (listwise)	22	62	64

angular measurement to evaluate the maxillo-mandibular discrepancy (ANB) was then taken.

Linear and angular readings were be measured with the help of a millimetric ruler and a protractor, respectively. Corrected values of linear measurements were recorded to eliminate a magnification error of 10%.

All the acquired data was then entered in SPSS 21 for data processing. Analysis included frequencies, mean \pm standard deviation (SD) and Pearson correlation. A *p*-value $<$ 0.001 was considered significant.

RESULTS

Results have established a positive effect between Curve of Spee and maxillo-mandibular discrepancy.

of curve of Spee also increases.

Sixty four percent of the patients included in this study exhibited class III relationship. They had mean ANB - 3.15 degree with (SD \pm 1.78). Whereas curve of Spee in this group had mean 2.23 millimeters with (SD \pm 1.78) (table).

Sixty two percent of the patients in this study exhibited class II dentoskeletal relationship, having mean ANB of + 6.38 degree with (SD \pm 1.24). Curve of Spee value in this group had mean value of 3.44 millimeters with (SD \pm 1.09). Increase curve of Spee values were strongly associated with class II deep bite cases.

Twenty two percent of the patients included in this study exhibited class I dentoskeletal relationship. They have mean ANB of + 2.22

degree with (SD \pm 1.06). Curve of Spee in class I group had mean value of 1.90 millimeters with (SD \pm 0.85).

Multiple Regression Analysis was later on performed to see how various variables show linear dependence on curve of Spee. Regression analysis showed negative, insignificant correlation of age and gender with curve of spee. However, ANB value showed a positive correlation with curve of Spee which is highly significant with p -value <0.001 .

DISCUSSION

Measuring the depth of the Curve of Spee is considered to be a critical point for treatment protocols. In this study, the depth of Curve of Spee was not influenced by gender¹³ or age of patients, this lack of correlation between Curve of Spee and sexual dimorphism is in accordance with the previous studies.

There has been no proper method for calculation of curve of Spee, some studies used the radiographic method while others used dental casts for it. Braun and Schmidt, 1956 used lateral cephalograms for measuring curve of Spee however, this method has limitations of radiographic films such as projection errors that would decrease the reliability of the curve of Spee measurements.

Braun et al. 1999¹⁶ used study models for measuring curve of Spee. This study also used study models because of more reliability and less chances of error.

A study conducted by Braun and Schmidt (1956) had suggested that there were no apparent differences between curve of Spee in Class I and Class II malocclusions. In contrast to this a study put forward by Farella et al. 2002¹⁰ found that in class II or class III the position of mandibular condyle changes influencing the depth of curve of Spee.

The results of this study showed that ANB value had positive correlation with curve of Spee meaning that as one of the values increased the other also shows an increase and vice

versa. Patients that had higher values of ANB corresponding to higher maxillo-mandibular discrepancy had deeper curve of Spee values.

Class I patients in this case having lesser values of ANB angle also had lesser curve of Spee values but as the values of ANB increased as in Class II cases mostly curve of Spee starts becoming exaggerated.

A study conducted by Cheon et al¹⁴ and another by Orthlieb JD both suggested that ANB values were higher in class II cases and so were the curve of Spee values whereas in class III cases ANB values were lower and so were their curve of Spee values. Results concluded from data of this study shows that Curve of Spee shows positive correlation with ANB value or maxillo-mandibular discrepancy.

CONCLUSION

Results concluded from data of this study shows that Curve of Spee shows positive correlation with ANB value or maxillo-mandibular discrepancy.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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