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"CURVE OF SPEE – REALITY OR MYTH? ….ITS APPLICATIONS IN ORTHODONTICS"

Orthodontology

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ABSTRACT

Introduction: The purpose of this study was to measure and compare the Curve of Spee in normal occlusion using an innovative device, Monson Sphere analyser (MSA) and conventional method.

Materials and method: 100 patients, both males and females in the age range of 14-18 years were selected for the study. The inclusion criteria was presence of permanent dentition, skeletal Class I malocclusion, normal occlusion with minimal discrepancy, no signs of temporomandibular joint problem. The curve of spee was measured using conventional method and MSA on each lower cast. The cast was checked if the cusp tips of canines, premolars and molars touches the MSA as dictated by the Monson sphere theory. The difference in the depth of Curve of Spee as measured by the two methods was compared.

Results: The MSA was found to coincide in 50 samples with a standard deviation of 0.44mm and mean curve of spee 1.22mm. In the remaining 50 samples with a standard deviation of 0.75mm and mean curve of spee 1.55mm it did not coincide. A significant difference (p value of 0.008) was found between the coinciding and non-coinciding groups of MSA.

Conclusion: Curve of Spee exists in normal malocclusion in regional Indian population as dictated by the Monson's Spherical theory of Occlusion. Monson Sphere analyzer can be used effectively and efficiently for measuring the curve of Spee in various malocclusions.

KEYWORDS

Curve of Spee, normal occlusion, Monson Sphere analyser

INTRODUCTION

Human dentition has evolved to best fullfil the aesthetic, functional and structural requirements. Various parameters have been described for normality of human dental occlusion like Andrews keys of occlusion and other relations of dentition at occlusion and articulation. The three dimensional arrangements of incisal edges and cuspal tips in natural human dentition have been described as classical sphere, in which the occlusal surfaces of all teeth touch a surface of segment of a sphere, called the curve of Monson. According to the Monson's Spherical theory of Occlusion[1] this sphere has 8 inch diameter, with its centre in the region of glabella. In patients with a retrognathic mandible and steep anterior guidance, it has been suggested that the occlusal plane might be constructed with a shorter radius than the 4-inch standard reported by Monson to avoid posterior interferences. The opposite is true in Class III patients, when a larger or flatter curve, typically a 5-inch radius, is more suitable.[2]

The sphere is divided into anteroposterior curve called curve of Spee and mesiolateral curve called curve of Wilson.[3-6] This geometric arrangement defines the most efficient pattern for maintaining maximum tooth contacts during chewing and considered as an important tenet in denture construction.[5]

The curve of spee serves as an important diagnostic tool in determining centric occlusion and protrusive disocclusion in combination with anterior guidance and condylar guidance.[5,6] The normal range for Curve of Spee as described by Andrews is within flat to 2.5mm.

The purpose of this study is to measure and compare the Curve of Spee in normal occlusion using an innovative device, Monson Sphere analyser (MSA)* and conventional method.

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AIM

1. To measure the curve of spee in regional Indian population with normal occlusion

OBJECTIVES

1. To measure the curve of spee in normal occlusion using conventional method
2. To measure the curve of spee in normal occlusion using Monson sphere analyzer
3. To determine the statistical correlation in the above two methods
4. To evaluate if the Monson Sphere analyzer can be used effectively and efficiently for measuring the curve of Spee in various malocclusions

MATERIALS AND METHOD

A sample size of 100 patient both males and females visiting the OPD of Department of Orthodontics, MIDSR dental college in the year 2017-18 not requiring fixed orthodontic treatment were included in the study. The age of the subjects were in the range of 14-18 years.

The inclusion criteria for the subjects was presence of permanent dentition, skeletal Class I malocclusion, normal occlusion with minimal discrepancy, no signs of temporomandibular joint problem and good oral hygiene. Subjects with impacted/supernumerary teeth, skeletal or dental cross-bites, moderate to severe crowding and open bite or deep bite were excluded from the study.

Alginate impressions were made for all subjects. The curve of spee was measured using conventional method on each lower cast. Measurements of the curve of Spee were taken on the left and right sides to within 0.01 mm. The right and left maximum depths were recorded and averaged to arrive at the average maximum depth for each subject.

The Monson sphere analyzer was placed on the lower cast to measure the curve of Spee. The cast was checked if the cusp tips of canines, premolars and molars touches the MSA as dictated by the Monson sphere theory. The Curve of Spee was measured using the MSA and difference in the depth of Curve of Spee as measured by conventional method and with MSA was compared.

Statistical analysis and methods-

Data was collected by using a structured proforma. Data was entered in MS excel sheet and analysed by using SPSS 19.0 version IBM USA. Quantitative data was expressed in terms of Mean and Standard deviation. Comparison of mean and SD between two groups was done by using students unpaired t test.

A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

RESULTS

Table 1 gives the descriptive statistics for evaluating whether curve of spee coincides with the MSA. The MSA was found to coincide in 50 samples with a standard deviation of 0.44mm and mean curve of spee 1.22mm. However, in the remaining 50 samples with a standard deviation of 0.75mm and mean curve of spee 1.55mm it did not coincide.

A significant difference (p value of 0.008) was found between the coinciding and non-coinciding groups of MSA as described in Table 2 (Graph 1 gives the plotted diagram for the same).

DISCUSSION

Bonwill, one of the first to describe the dental arches, noted that an equilateral triangle existed between the centres of the condyles and the mesial contact areas of the mandibular central incisors. He depicted this as having 4 inch sides. In other words, the distance from the mesial contact area of the mandibular central incisor to the centre of either condyle was 4 inches, and the distance between the centres of the condyles was 4 inches. In 1932 Monson used Bonwill's triangle and proposed a theory that a sphere existed with a radius of 4 inches, the centre of which was an equal distance from the occlusal surfaces of the posterior teeth and from the centres of the condyles.[8]

Analysis of curve of spee may help the dentists in determining the development in saggital plane. The curve of spee can be altered pathologically by presence of rotations, tipping, extrusion in the dentition resulting in excursive interferences causing wear, fracture of restorations and temporomandibular joint dysfunctions. Therefore, curve of spee should be used as the first reference for both prosthetic and orthodontic reconstruction.[9]

In complete denture prosthodontics, stimulating the curve of spee in harmony with condylar guidance, incisal guidance, plane of occlusion, and prosthetic tooth cusp height is essential for developing a bilaterally balanced occlusion, believed to maintain optimal denture stability.[10] In orthodontics, curve of spee in one of the six important keys necessary for maintaining a harmonious Class I occlusal relationship, as dictated by Andrew.[7]

In our article, we measured the curve of spee in normal occlusion with mild malocclusion using a conventional method and using MSA device. Both measurements stated that curve of spee is seen in normal occlusion even before orthodontic treatment is carried out with mild standard deviation. Also, the device MSA can be used for the evaluation of the same on study model casts since it follows the Monson's spherical theory of occlusion.

The MSA is an efficient device for measuring and comparing curve of spee on different study model casts. However, further studies will be needed to evaluate its implications in post-treatment orthodontic stability and various other uses.

CONCLUSION

- Curve of Spee exists in normal malocclusion in regional Indian population as dictated by the Monson's Spherical theory of Occlusion.
- Monson Sphere analyzer can be used effectively and efficiently for measuring the curve of Spee in various malocclusions.
- Also with the limitations of the study, the following conclusion can be drawn:

a. the larger sample size can be considered for obtaining greater statistical significance

b. Orthodontic pre-treatment and post-treatment study models should be compared for determining further implications of MSA in orthodontics.

Figure 1: Measurement of the maximum depth of the curve of Spee

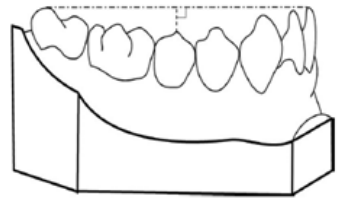


Figure 2: Monson sphere analyzer

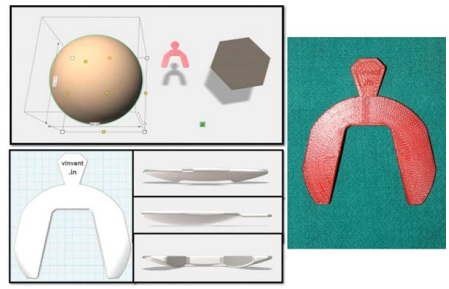


Figure 3: evaluation of MSA on normal casts



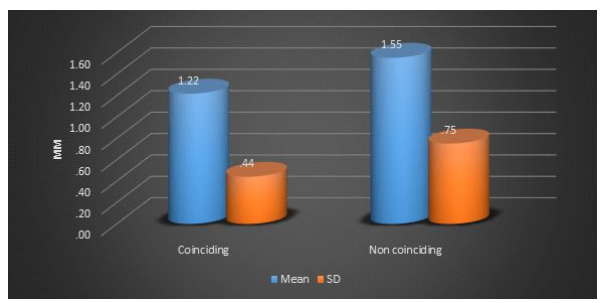
Table 1: Descriptive statistics for curve of spee as evaluated using MSA

	N	Mean	Std. Deviation	Std. Error	Range	Minimum	Maximum
Coinciding (in mm)	50	1.22	0.44	0.06	2.2	0.3	2.5
Non-coinciding (in mm)	50	1.55	0.75	0.11	3.3	0.2	3.5

Table 2: Comparison between coinciding and non-coinciding MSA group

GP	N	Mean	Std. Deviation	t	df	p	Inference
Coinciding	50	1.22	.44	-2.72	98	0.008 (<0.05)	Significant
Non coinciding	50	1.55	.75				

Graph 1: Comparison between coinciding and non-coinciding MSA group



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