ORIGINAL ARTICLE

Determination of Curve of Spee in Healthy Permanent Dentition and Its Application in Complete Denture Wearers

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ABSTRACT

Objective: To determine the depth of the curve of Spee in healthy permanent dentition for its application in complete denture wearers.

Study Design : Cross-sectional study.

Place and Duration of Study: The study was conducted at Lahore Medical and Dental College from 20th April to 20th October 2023.

Materials and Methods: A total of two hundred patients aged 18 – 32 years were included in this study. Mandibular casts of patients were obtained. Each of the casts had fully developed dentitions except for the third molars. Independent sample t-test was used to determine mean depth of the curve of Spee between females and males. Data was collected, results were then statistically analyzed using SPSS version 25. A p-value ≤ 0.05 was considered significant.

Results: The mean age of subjects was 25.19 ± 3.529 with minimum and maximum age as 18 and 32 years. The depth of the curve of Spee was found to be P=0.380 and t= -1.540, the curve of Spee is not significantly different in both genders. The curve of Spee mean value was 1.990 ± 0.6175 mm.

Conclusion: This study has revealed that the depth of the curve of Spee in natural dentition remains constant irrespective of age and gender. Therefore, the curve of Spee values can be used in the rehabilitation of complete denture wearer.

Key Words: *Balanced Occlusion, Complete Edentulism, Curve of Spee, Dentition, Occlusal Plane.*

Introduction

Human dentition, i.e., the teeth and their supporting tissues is a mutually protected, organized arrangement of maxillary and mandibular teeth.[1] With age and poor oral hygiene, severity of periodontitis (peridontium inflammation) increases, that may be one of the major cause of loss of teeth leading to edentulism.[2,3] Determining occlusal plane is one of the important steps in prosthodontic rehabilitation of edentulous patients.[4] In 1890, Ferdinand Graf Von Spee, defined line of occlusion by using skulls with abraded teeth which is now known as curve of Spee.[5] Curve of Spee is defined "as the anatomic curve established by the occlusal alignment of the teeth. It begins from the cusp tip of the mandibular canine and following the buccal cusp tips of the premolar and molar teeth, continuing through the anterior border of the mandibular ramus and ending at the anterior-most portion of the mandibular condyle".[6] It is viewed from lateral aspect, and it is a curved line that is convex in the maxillary arch and concave in the mandibular arch.[7] The Curve of Spee, exists in the natural dentition, allows harmony to exist between the anterior tooth and condylar guidance. Clinically, the curve of Spee can be determined distally from the marginal ridges of posterior teeth and the incisal edges of the incisors that determine the curve of Spee.[8]

For restoring the natural dentition prosthodontically, the treatment objective is a mutually protected occlusion or canine guided occlusion, whereby the posterior teeth disocclude during eccentric functional movements.[9] The curve of Spee, along with anterior guidance, condylar inclination, and posterior cusp height, plays an important role in the development of the desired occlusal scheme.[10]It may be extremely altered in situations resulting from

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Received: March 04, 2024; Revised: June 08, 2024
Accepted: June 11, 2024

https://doi.org/10.57234/jiimc.june24.2018

rotation, tipping, and extrusion or intrusion of teeth. Andrews described six keys to normal occlusion and stated curve of Spee as the sixth key to normal occlusion that ranges from mild to flat curve.[11] A study reported that, once established in adolescence, the curve of Spee appears to be relatively stable.[12]

In other studies, curve of Spee, when seen in most of the cases, showed a mean radius of approximately 106.4 ± 7.6 mm in the maxillary arch and 83.4 ± 5.2 mm in the mandibular arch. Radii of the curves of Spee in the maxillary arch were significantly larger than those in the mandibular arch (P<.0001).

It had a mean depth of approximately 1.6 ± 0.4 mm in the maxillary arch and 1.9 ± 0.5 mm in the mandibular arch. The depth of the curve of Spee in the mandibular arch was significantly deeper than that in the maxillary arch.[13]

The current study was designed to assess and determine the depth of curve of Spee in mandibular arches in men and women in local population. As no local data is published and studies on global population are also not widely available, this study will help us to generate baseline data and the results of the study will aid the clinician in developing occlusion in the sagittal plane which would be useful when providing prosthetic rehabilitation for patients with edentulous arch or occlusal derangement. The objective of this study was to determine the depth of COS in healthy permanent dentition for its application in complete denture wearers.

Materials and Methods

A cross-sectional study was carried out at department of Prosthodontics, Lahore medical and dental college for a period of 6 months from 20th April to 20th October 2023. The present research was conducted by following all ethical principles. Foremost, Ethical Committee Approval was sought, which works as an Institutional Review Board (IRB) LMDC/FD/4950/23 Nonprobability consecutive sampling technique was used. Informed consent was taken from the patients. The inclusion criteria were all patients aged 18-32, either gender, complete permanent dentition, including the second molars (at least 28 teeth), bilateral Angle class 1 molar and canine relation. Exclusion criteria were patients with caries, malocclusion, history of orthodontic treatment, history of temporomandibular disorders, patients with cleft lip and cleft palate were recorded in a pre-designed questionnaire that included variables regarding socio-demographic features, questions regarding depth of COS in lower arch.

A total of 200 subjects meeting inclusion criteria were taken. The sample size was calculated using expected mean of depth of curve in mandible as 1.9 ± 0.5 mm.[6] We used 95% confidence level, and 5% margin of error. Basic demographic information (name, age, gender) and contact details was taken. Mandibular casts were obtained from irreversible hydrocolloid impression in modified stock trays for each subject. In order to measure the depth of curve of Spee, a rigid acrylic template was positioned in such a way, that it touches the lower incisal edges and mesio buccal cusp of 1st molar and curve of Spee was measured with the help of periodontal probe from deepest cusp at the 2nd premolar area. All cases were assessed for the measurement of depth of curve of Spee with the help of acrylic template in healthy permanent dentition. All data was entered and analyzed using SPSS version 25. Frequency and percentages were used for qualitative data like gender. Mean ± Standard deviation was applied for quantitative data like age and measurement of depth curve of Spee in healthy permanent dentition. Data was stratified for age, gender, to control the effect of modifiers. Post stratified independent sample t-test was applied to determine curve of spee in healthy permanent dentition and its application in complete denture wearers taking p-value ≤ 0.05 as significant.

Results

The mean age of subjects was 25.19 ± 3.529 with minimum and maximum age as 18 and 32 years. Table -I. The mean age in male was 25.10 ± 3.650 and in female was 25.27 ± 3.420. The maximum and minimum value of depth of curve of Spee in both male and female subjects was 3.5 mm and 1.0 mm. Table -II. The curve of Spee of P-value is 0.380, t= -1.540 for both males and females. Table -III. The mean ± SD depth of curve of Spee in age group 18 – 25 years is 2.08 ± 1.08 and for age group 26 – 32 years is 1.99 ± 0.64. The depth of curve of Spee P- value is 0.481. Table -IV.

Discussion

One of the key clinical steps in the rehabilitation of multiple long span posterior restorations is the re-establishment of occlusual plane.[14] The restoration

https://doi.org/10.57234/jiimc.june24.2018

Table I: Descriptive Statistics of Age (Years)

Age(Years)	
Mean	25.19
Std. Deviation	3.529
Range	14
Minimum	18
Maximum	32

Table II: Descriptive Statistics of the Study Sample by Gender

	Gender									
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Mean		Std. Deviation		Std. Error Mean		Minimum		Maximum	
Age	25.1	25.2	3.65	3.42	0.36	0.34	18	20	32	32
Depth (mm)	1.92	2.05	0.601	0.629	0.060	0.062	1.0	1.0	3.5	3.5

Table III: Mean Depth of Curve of Spee between Females and Males

Depth	Gender	Independent Sample T test	P - Value
	Male	-1.540	0.380
	Female	-1.540	

Table-IV: Stratification of Depth of Curve of Spee with Respect to Age N=200

	Age groups	Mean	Std. Deviation	P- value
Depth	18-25 years	2.082	1.0802	0.481
	26-32 years	1.994	0.6422	

of compensating curves forms the basis for ideal teeth arrangement.[15] This study was conducted to investigate the curve of Spee in healthy permanent dentition and its implications for complete denture wearers. The mean age of the subjects was 25.19 ± 3.529 years. The maximum and minimum values of the curve of Spee depth were 3.5 mm and 1.0 mm, respectively, for both males and females. The results show no significant difference in the depth of the curve of Spee with respect to age and gender, consistent with several previous studies.[16]

In the current study, our findings indicate that the depth of the curve of Spee does not vary significantly with age. This observation aligns with the results of Paes-Souza et al., who reported no correlation between the curve's depth and age.[17]However, Karani J. found a significant increase in the depth of the curve of Spee with age, suggesting a possible difference in methodology or sample population.[18] This discrepancy highlights the need for standardized measurement protocols in future research.

Similarly, we observed no significant difference in the depth of the curve of Spee between males and females. This result supports the findings of Marshall et al., who also reported no gender-based differences.[7,19] This uniformity across genders simplifies clinical applications, as gender-specific adjustments to the curve of Spee may not be necessary.

The method of measuring the curve of Spee varies among studies, contributing to inconsistent findings. In this study, it was measured from the deepest cusp at the 2nd premolar area. While Veli et al. and another study indicated the deepest point at the mesiobuccal cusp of the first molar, Hasan et al. reported it at the buccal cusp of the second premolar.[8,20] These variations underscore the importance of developing a universally accepted measurement technique to ensure comparability across studies.

Clinically, maintaining the curve of Spee is crucial for functional occlusion and patient satisfaction in complete denture wearers.[21,22] Our study suggests that deviations from the natural curve may lead to interferences during mandibular movements, impacting the masticatory system's health. Therefore, clinicians should carefully consider the curve of Spee during denture fabrication to avoid such complications.

Limitations of Study

One limitation of our study is the narrow age range of 18 to 32 years, which may not fully capture age-related changes in the curve of Spee. Additionally, our study does not account for skeletal morphology, dental arch form, or occlusal relationships, which could influence the curve's depth.

Future research should incorporate a broader age range and additional variables such as skeletal morphology, dental arch form, and occlusal relationships.

Conclusion

In conclusion, the present study contributes to the understanding of the curve of Spee in healthy permanent dentition and its implications for complete denture wearers. The depth of the curve does not significantly differ by age or gender, suggesting uniformity that can simplify clinical applications. However, measurement variability among studies highlights the need for standardization. Clinicians must maintain the natural curve of Spee in denture fabrication to ensure functional occlusion and patient satisfaction.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors have declared no specific grant for this research from any funding agency in public, commercial or nonprofit sector.

DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.