

An Innovative Clinical Method of Functional Recording of The Closest Speaking Space in Patients: An In Vivo Study

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ABSTRACT

Background: The recording of closest speaking space (CSS) during the production of /s/ sound previously was complicated and expensive, this innovative technique using admixed material in dentulous and edentulous patients is simple and inexpensive.

Material and Methods: Admixed interocclusal registration material (7 parts of green stick and 3 parts of impression compound) was placed bilaterally on the occlusal surfaces of mandibular premolar and molar teeth in dentulous and edentulous patients, who were then asked to pronounce the marathi word "Tees" (thirty in English). The recorded CSS was measured in millimeters at minimum thickness on the occlusal records at the first premolar region with a caliper. The differences in CSS values among dentulous and edentulous patients were statistically analyzed with the unpaired t test. ($p < 0.001$).

Results: The differences in the CSS were significant among dentulous and edentulous patients. The differences in the CSS were only significant in dentulous patients on right and left side but not significant in edentulous patients between left and right side.

Conclusion: Within the limitations of this clinical study, it was found that closest speaking space usually incorporated in the dentures was on an average more than in dentulous patients, this decreases vertical dimension at occlusion but was within physiological range leading to better chewing comfort. This study gives an average values for dentulous and edentulous patients. These values can be used in the clinical determination of the occlusal vertical dimension in removable and fixed prosthetic treatments.

Keywords: Closest speaking space, admixed material.

INTRODUCTION

Mandibular movements are complex and vary in speaking, masticating, and swallowing. Speaking is helpful in the clinical determination of parameters such as occlusal vertical dimension (OVD), tooth position, and anterior guidance. In

speech, the production of sibilant sounds require a small space between the teeth.¹⁻⁸ When pronouncing these sounds, the occlusal surfaces and incisal edges of the mandibular and maxillary teeth are in their closest relation to each other; this is the closest speaking space (CSS)^{2,3,5,9,11}. The closest

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Fig 1: Admixed inter occlusal registration material placed bilaterally in dentulous patients.



Fig 2: Admixed inter occlusal registration material placed bilaterally on inserted complete dentures in edentulous patients.



Fig 3: The CSS was measured using a caliper.

speaking space (CSS) is the minimum distance between the anterior teeth that occurs during the pronunciation of words containing 'S', 'E' and 'I' sounds.¹²

The CSS is characterized by great individual variability, ranging from 0 to 10 mm.^{13,14} Burnett and Clifford demonstrated that the CSS could be determined by having subjects pronounce words containing a consonant defined by a hissing sound¹⁵. A clinical method has been used during denture construction that is based on observation of a 2-mm clearance at the premolars while the patient is pronouncing words containing a sibilant sound.^{15,16}

In this study, an innovative clinical method is proposed for recording CSS in dentulous and edentulous patients.

MATERIALS AND METHOD

The study was designed and ethical clearance was obtained from departmental protocol committee and university ethical committee. Informed consent was obtained from each patient as per prescribed proforma. Total of 160 patients were randomly selected, of which 80 were dentulous patients between the age group of 22 to 26 years (40 men, 40 women) and 80 were edentulous subjects between the age group of 46 to 76 years (40 men, 40 women). All edentulous patients wore complete dentures with adequate retention that had been fabricated in the Department of Prosthetic Dentistry, School of Dental Sciences, KIMS DU-Karad, Maharashtra. The complete dentures were fabricated by a single operator and processed by a single technician.

Inclusion Criteria

For dentulous - Presence of intact first and second premolars in occlusion.

For edentulous- There should be class1 ridge relationship.

Exclusion Criteria

Free from any speech defects, or masticatory system dysfunctions, tongue thrusting, lisping. The completely edentulous patients included in the study had been using the complete dentures for a period of 1 year, For each patient, the CSS was measured with a new clinical method- '**IRAM**'. **IRAM** stands for interocclusal record with admixed material[(7 parts of green stick (DPI pinnacle tracing sticks, Dental products of India,

Mumbai. Maharashtra state. India) and 3 parts of impression compound(Y-DENTS impression compound, Dental products of India, Mumbai. Maharashtra state. India)].

Recording of CSS

The patients were comfortably seated in a dental chair and the recording procedures were fully explained. Before recordings, patients were trained to repeat the Marathi word “*Tees*”(thirty in English). Training included repetition of the word “*Tees*” aloud, at a normal conversational pace until they were familiar with it while an observer confirmed the accuracy of their pronunciation. Patients were instructed to sit in an upright position with their heads unsupported. The observer placed approximately 1cm of admixed interocclusal

registration material bilaterally on the occlusal surfaces of mandibular premolar and molar teeth in dentulous patients. (Fig-1) and edentulous patients. (Fig-2). Then the patients were instructed to close their lips, swallow, and repeat the word ‘*Tees*’ - 10 times and then remain stationary and avoid closing or moving the mandible till the material hardened.

The record material was not placed on the anterior teeth, so as to avoid interference with the pronunciation of /s/ sound and to determine that the patient’s pronunciations were accurate. After they had hardened, the interocclusal records were removed from the mouth and identified as left or right sided records. The recorded CSS were measured. The minimum thickness of the occlusal records at the first premolar region was measured with a caliper (ETN Germany SS). (Fig-3)

RESULTS

Table 1: Showing mean std. deviation range, minimum and maximum value of CSS for right and left side for dentulous and edentulous patients.

	N (Number of Patients)	Range	Minimum	Maximum	Mean	Std. Deviation
RIGHT SIDE DENTULOUS	N _{DR} =80	1.60	.50	2.10	1.1800	.47824
LEFT SIDE DENULOUS	N _{DL} =80	1.70	.60	2.30	1.2725	.50037
RIGHTT EDENTULOUS	N _{ER} =80	1.50	1.50	3.00	2.2737	.49446
LEFT SIDE EDENTUOLUS	N _{EL} =80	1.40	1.60	3.00	2.2575	.49087

NDR-number of right side dentulous patients , NDL-number of left side dentulous patients, NER-number of right side edentulous patients, NEL-number of left side edentulous patients

Table 2: Comparisons between CSS value of dentulous and edentulous patient for the average (left and right side) values (Students’ unpaired ‘t’ test)

	GROUP	N	Mean	Std. Deviation	Std. Error Mean	Mean difference	t value	P value
Right and left side average	DENTULO US	80 (N _{DR} + N _{DL})	1.2262	.48692	.05444	-1.039	-13.441	<0.001
	EDENTUL OUS	80 (N _{ER} + N _{EL})	2.2656	.49116	.05491			

**** STATASTICALLY SIGNIFICANT, N-number of patients**

NDR-number of right side dentulous patients , NDL-number of left side dentulous patients, NER-number of right side edentulous patients, NEL-number of left side edentulous patients

The comparison of CSS value among two groups (dentulous (n=80) and edentulous (n=80)) is done by unpaired 't' test. It was found to be **statistically significant**($p < 0.001$) with mean difference (-1.039) and (t= -13.441).

Table 3: Showing mean std. deviation minimum and maximum value for right and left side for dentulous and edentulous patients.

GROUP		N	Minimum	Maximum	Mean	Std. Deviation
DENTULOUS	Right and left side average	80	.55	2.20	1.2262	.48692
EDENTULOUS	Right and left side average	80	1.55	3.00	2.2656	.49116

N-number of patients

The mean CSS values for Dentulous patients (n=80) was (1.2262±0.4869) with minimum value 0.55 and maximum value 2.20, while the mean CSS value for Edentulous patients (n=80) was (2.2656±0.4912) with minimum value 1.55 and maximum value 3.00.

DISCUSSION

This clinical study aimed to record the amount of CSS among dentulous and edentulous patients. The clinical implication of this study is that the recorded CSS values can serve as one of the methods to determine OVD and also enhance the phonetics for the respective patients. Rizzatti¹⁴ previously recommended the use of vinyl polysiloxane interocclusal registration material over the kinesiographic method to determine the CSS because it is simple and less complicated.

In the present study, admixed material was used as an interocclusal registration material instead of the recommended use of vinyl polysiloxane interocclusal registration material because PVS although is accurate in recording the details, it does not set to form rigid record and is quite resilient in nature. On contrary, admix material which is prepared by using green stick and impression compound in 7:3 ratio to take advantage of the flow properties of green stick and viscosity and self – supporting property of impression compound such that this composition sets to form a rigid record, which is more economical and easy to handle.¹⁷

Most clinical research on the CSS have been performed by using English words containing sibilants to register the /s/ sound, for example , *Mississippi*, *sixty-six*, and *yes*¹⁵ and non-English words such as *sessantasei*¹⁴ and *seis*^{18,19,20} or complete sentences²²⁻²⁷. It was observed that the majority of patients in the present study easily pronounced the Marathi word *Tees* with the interocclusal registration material between the posterior teeth as compared to *Mississippi*, *sixty-six* etc which aided in performing the study better since patients could co-operate better.

As opposed to our initial assumption of CSS values being same in right and left side of dentulous and edentulous patients, but according to table-1 the CSS values were statistically different amongst right and left side of dentulous and edentulous patients. The lower mean value of right side depict the early contact between right side premolars indicating that right side being the dominant chewing side amongst dentulous patients. In edentulous patients since the mean values of right and left side are comparable and not significantly different, it can be inferred that they are bilateral chewers. Thus these values show that the patients could implement the operator's instructions regarding altering their chewing method with dentures viz., bilateral chewing thereby aiding in enhanced denture stability.

Table-2&3 shows that the difference in the mean values between dentulous and edentulous patients indicates the increase in closest speaking space among edentulous patients. Increased closest

speaking space decreases the vertical dimension at occlusion within the physiologic limit, this in turn decreases the masticatory load with equal distribution of forces on the underlying residual ridge, hence less post-operative problems.

The average range of Closest speaking space 0.5 to 2mm in dentulous and 1to3mm edentulous patients was obtained in the present study. The word *Tees* was chosen as a test for evaluating the CSS values because translated in English the word 'Thirty' is easily understood by the patients. Also, its (*Tees*) pronunciation produces /s/ sound which helps to record CSS. Thus use of the Marathi word "*Tees*" was appropriate for registering the closest speaking space in native Marathi speakers. Similar vernacular words ending with /s/ sound can be used to record vertical dimension of native population instead of English word *Mississippi*, etc.

CONCLUSION

Within the limitations of this clinical study, it was found that closest speaking space usually incorporated in the dentures was on an average more than usually found in dentulous patients, this decreases vertical dimension at occlusion but was within physiological range leading to better chewing comfort.

This study gives an average values for dentulous and edentulous patients. These values can be used in the clinical determination of the occlusal vertical dimension in removable and fixed prosthetic treatments.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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