

# A study to evaluate the effect of oral stereognosis in acceptance of fixed prosthesis

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## ABSTRACT

**Aims:** The aim of the study was to evaluate and compare the oral stereognostic ability and satisfaction for fixed prosthesis in human being.

**Materials and Methods:** The present study was carried out on 40 subjects, the purpose being to investigate the relation of oral perception to diagnostic and therapeutic procedures. Two types of cast metal crowns—one had morphology closely resembling original tooth and other one confirmed to ideal contours were constructed on endodontically treated posterior tooth. One cast metal crown was randomly selected from two cast metal crown and fitted on prepared tooth. Oral stereognostic score of subject was determined by correct response to questionnaire based on the recognition ability of subjects. Patient satisfaction level was checked by psychometric parameter Likert scale. Same procedure was repeated with other type of cast metal crown.

**Results:** Data obtained were compared by paired and unpaired two sample *t*-test. Oral stereognostic score and satisfaction score were found to be higher for cast metal crown with morphology resembling to original tooth due to recognition and discriminatory ability of subjects and recall-memory. Oral stereognostic level was found to be higher in younger than older subjects. The level of satisfaction was found to be higher in older subjects than younger subjects.

**Conclusion:** It was concluded that acceptance of fixed prosthesis is not only based on dentist's routine procedure of treatment and patient's judgment about oral health, function, and esthetics, but also depends upon patient's oral perception and discriminatory skill for external morphology of fixed prosthesis.

**Key words:** Fixed dental prosthesis, oral stereognosis, satisfaction score

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Oral stereognosis has got a special interest for the upcoming dentistry that deals with size, shape, and form of the objects through oral exploration. The ability of persons to judge the form of objects by oral perception may yield important insights into the nature of oral sensory mechanisms.

Various studies have been done by different workers in the past.<sup>[1,2]</sup> Common objects like keys, pens, coins, etc., were placed in the subject's hand to test stereognosis. For testing oral stereognosis, modification of the stimuli materials

and response modes were initiated. McDonald and Aungst stated that the development of oral stereognostic tests which permitted active exploration of the stimulus applied seemed to be the most promising method to evaluate oral sensorimotor function.<sup>[3]</sup> Research on oral stereognosis in complete denture, and tooth and implant supported over denture cases had been done in different ways to assess the impact of age, absence or presence of teeth, and different pathological conditions on level of oral perception and oral discriminatory skill.<sup>[4-6]</sup> Very few study has been reported to assess the oral stereognosis in relation to fixed dental prosthesis. Hence, this present study was conducted in fixed prosthodontic patients to evaluate the effect of oral stereognosis in acceptance of fixed prosthesis, the purpose being to investigate the relation of oral perception to diagnostic and therapeutic procedures.

## MATERIALS AND METHODS

This study was carried out on 40 subjects needing cast metal crowns on their endodontically treated teeth with preserved crown anatomy, which were in the region of

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non-esthetic zone [Figure 1]. The subjects were divided into two age groups of 20-30 years and 40-50 years, each group containing ten male and ten females. A short medical history was taken and a thorough oral examination was carried out to exclude the presence of local or systemic disorders. Two types of cast metal crowns, one had morphology closely resembling the original tooth and other one confirmed to ideal contours, were constructed on root canal-treated tooth of the subjects using standard technique. To determine the oral stereognostic score and satisfaction level, total subjects were divided into the following two groups:

### Group I

Control group that comprised the subjects in which cast metal crown with morphology closely resembling original tooth was inserted on the prepared tooth.

### Group II

Test group that comprised the subjects in which cast metal crown confirmed to the ideal contours was inserted on the prepared tooth.

Same subject was used for both, control as well as test group. Diagnostic impressions were made using alginate (Zelgan 2002, Dentsply, India) and were poured with type III dental stone (*Kalastone*; *Kalabhai* Karson Pvt Ltd, Mumbai, India) to make the diagnostic casts. A sectional impression of the arch at the site of desired tooth was made using putty impression material. After removal of sectional impression, the inner occlusal and axial surfaces of the impression of the desired tooth were coated with tooth-colored autopolymerizing acrylic resin (DPI, Mumbai, India), as shown in Figure 2, to fabricate a thin acrylic resin shell, which was a template of the original tooth. The desired tooth for a complete coverage cast metal crown was prepared with a chamfer margin following biomechanical principles of tooth preparation. A thin mix of autopolymerizing acrylic resin was allowed to flow into the template, and then placed it on the prepared tooth and ensured that the template had intimate contact with adjacent and opposite teeth in same manner as for original tooth [Figure 3]. Following polymerization, the relined template was removed from the tooth and reevaluated on the tooth. This template was used for fabricating cast metal crown with morphology closely resembling the original tooth. Two full arch impressions were taken by using Vinyl polysiloxane impression material (Exaflex, GC America, Inc.) to form Working cast - And - Die System. One Working cast - And - Die System was used to position the acrylic resin template on die of prepared tooth and margins of acrylic resin template were waxed. Second Working cast - And - Die System was used for wax pattern formation by step by step waxing technique using Inlay casting wax and Wax up instruments (PK Thomas pattern, API). Acrylic resin template and wax pattern, as shown in Figure 4, were invested and casted in Co- Cr- Ni alloy. The crowns fabricated were finished, polished, and

then evaluated and assessed intraorally for fit and occlusion [Figure 5].

A criterion was evolved for the comparative assessment of oral stereognostic score and satisfaction level. On given appointment, the subject was first oriented about the nature of experimental procedure. After removing provisional restoration, one of the cast metal crowns was randomly selected from two cast metal crowns and fitted on the prepared tooth. The crown was evaluated and assessed intraorally for fit and occlusion. Now, patient was instructed to move the tongue to touch the buccal, lingual, and occlusal surface of cast metal crown to recognize and percept these surfaces similar to surfaces of original tooth. Maximum time limit for identification of one surface was kept at 30 seconds. Individual stereognostic score for cast metal crown was calculated by response of patient to following questionnaire:

- Do you feel that shape of outer surface of tooth is just like to outer surface of your original tooth? Yes (1 score); No (0 score)
- Do you feel that shape of inner surface of tooth is just like to inner surface of your original tooth? Yes (1 score); No (0 score)
- Do you feel that shape of upper/lower surface of tooth is just like to upper/lower surface of your original tooth? Yes (1 score); No (0 score)

Patient satisfaction level was checked by psychometric parameter Likert scale. A Likert scale is a psychometric scale named after an American educator and psychologist Rensis Likert. Individual Satisfaction Score for cast metal crown was decided according to the following criteria:

- Highly satisfied 3 score
- Satisfied 2 score
- Partially satisfied 1 score
- Not satisfied 0 score

Now, this cast metal crown was removed from the prepared tooth and another cast metal crown was fitted to the same prepared tooth. Crown was evaluated and assessed intraorally for fit and occlusion and the same procedure described above was repeated.

## RESULTS

The oral stereognostic scores of control and test groups were summarized and analyzed as shown in Table 1 (a-d). Similarly, satisfaction scores of control and test groups were summarized and analyzed as shown in Table 2 (a-d).

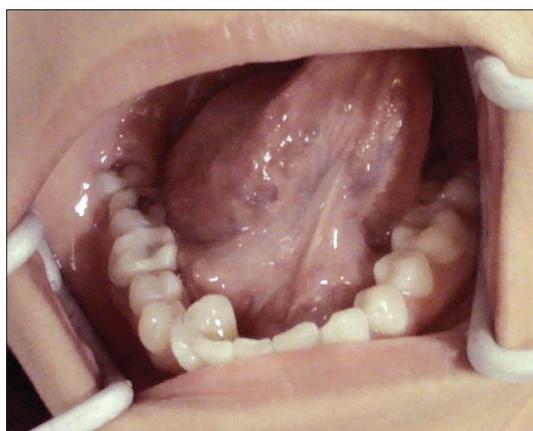
Result showed that oral stereognostic score and satisfaction level of subjects, for both control and test cast metal crowns at 1<sup>st</sup> reading and 2<sup>nd</sup> reading (recorded after 24 hours), did not differed significantly ( $\chi^2 = 1.42, P > 0.05$ ). The Tables 1 (b) and 2 (b) depicted that the mean oral stereognostic



**Figure 1:** Endodontically treated tooth needing cast metal crown



**Figure 2:** Tooth-colored autopolymerizing acrylic resin placed in impression of desired tooth



**Figure 3:** Intraoral view of acrylic resin template placed on prepared tooth



**Figure 4:** Wax pattern and acrylic resin template on die of prepared tooth



**Figure 5:** Cast metal crown placed on the desired tooth

score and satisfaction level of control group was found to be significantly higher than test group. It was depicted that the mean oral stereognostic scores of male and female in control group ( $t = 1.28, P > 0.05$ ) and in test group ( $t = 0.76, P > 0.05$ ) did not differ significantly ( $P > 0.05$ ). Similarly, the Table 2 (c) depicted that the mean satisfaction scores of male and female in control group ( $t = 0.00, P > 0.05$ ) and in test group ( $t = 0.32, P > 0.05$ ) did not differ significantly ( $P > 0.05$ ).

Mean oral stereognostic score of younger in control group was found to be significantly ( $P < 0.01$ ) higher than the older ( $t = 3.45, P < 0.01$ ), while mean oral stereognostic score of younger was also found to be significantly ( $P < 0.05$ ) higher than older ( $t = 2.24, P < 0.05$ ) in test group. Satisfaction score for younger of control group were found to be significantly ( $P < 0.05$ ) lower than the older ( $t = 2.16, P < 0.05$ ), while in test group, it was also significantly ( $P < 0.05$ ) lower in younger than older ( $t = 2.44, P < 0.05$ ).

**Table 1 (a): Oral stereognostic score for control and test cast metal crowns**

Oral stereognostic score	Control (n = 20)			Test (n = 20)		
	1 <sup>st</sup> reading (%)	2 <sup>nd</sup> reading (at 24 hrs) (%)	$\chi^2$ value	1 <sup>st</sup> reading (%)	2 <sup>nd</sup> reading (at 24 hrs) (%)	$\chi^2$ value
0	1 (2.5)	0 (0.0)	1.42	7 (17.5)	2 (5.0)	4.79
1	4 (10.0)	3 (7.5)		5 (12.5)	9 (22.5)	
2	16 (40.0)	19 (47.5)	NS	13 (32.5)	17 (42.5)	NS
3	19 (47.5)	18 (45.0)		15 (37.5)	12 (30.0)	

NS - Non significant

## DISCUSSION

Oral stereognosis is dependent primarily on anterior surface of tongue. The tip of tongue is especially responsive to the contact threshold (10 mg), and two-point discrimination (1.7 mm).<sup>[7]</sup> The thresholds for detection of light touch are lowest on tip of tongue and hard palate. Ringel and Fletcher<sup>[8]</sup> pointed out that in normal subjects, the progression from maximal to minimal discrimination of two-point stimulation involved the tongue tip, finger tip, lip, soft palate, and alveolar ridge in that order, respectively. Satisfaction levels of subjects for cast metal crown were determined by Likert scale, a psychometric scale named after an American educator and psychologist Rensis Likert. It was supported by study of Anastassiadou *et al.*<sup>[9]</sup> who designed a semi-structured interview using a questionnaire based on Likert scale for satisfaction with complete dentures.

It was observed that oral stereognostic score and satisfaction score for cast metal crown resembling morphology of original tooth was found to be significantly higher than oral stereognostic score for cast metal crown with morphology confirmed to ideal contours. This may be explained by the fact that recognition of shape or stereognosis according to Wright (1963) involves the most elaborate function submersed by the parietal cortex. It necessitates perfect

reception of impulses set up by the stimuli from the object. The sensations produced are synthesized in the cortex and compared with previous sensory memories. This observation can also be explained by assuming recall memory which contributes to recognition memory to evaluate response correctness. According to the schema theory of Schmidt (1975), this motor sensory feedback will be stored in schema which in relearning may be compared with the new motor sensory reactions and which apparently in this test showed good resistance against forgetting.

Subjects accepted and were more satisfied with only those cast metal crowns which resembled to morphology of original teeth due to homostereognostic ability. Secondly, favored form always favors the function. Cast metal crown resembling morphology of original tooth will be more favorable than the cast metal crown confirmed to ideal contours during functional and parafunctional movements of jaws, because wax pattern of cast metal crown confirmed to ideal contours was fabricated by working casts on articulator that has own limitations in jaw relation records.

It was observed that oral stereognostic score for young age group was found to be significantly higher than older age group. McDonald and Aungst<sup>[3]</sup> in their studies showed that the ability to identify form in the mouth improved with age, remained stable in young adults, and deteriorated in old age. Muller *et al.*<sup>[10]</sup> in their study reported that the tactile sensibility was found to be impaired with age and diminished capability of adaptation. Oral stereognosis involves cortical function, memory and vision factors that are impaired in elderly.

The area of subject acceptance and satisfaction for their prosthesis showed some interesting trends. The results showed that young subjects who had more stereognostic ability reported low satisfaction level, but inverse relation was seen in older subjects. It was supported by results of the study of Berry and Mahood<sup>[2]</sup> who stated that successful denture patients would be more likely to have a low level of oral perception.

Hence, it is advisable that both dentist and laboratory technician should make combined effort to provide fixed prosthesis to the patients with morphology closely resembling to the morphology of original teeth to get best possible results.

**Table 1 (b): Mean oral stereognostic scores of two groups**

	Group I (n = 40)	Group II (n = 40)	t value	P value
Mean ± SD	2.35 ± 0.10	1.94 ± 0.15	2.33	<0.05 S

S - Significant

**Table 1 (c): Sex-wise mean oral stereognostic scores of two groups**

Groups	Female (n = 20)	Male (n = 20)	t value	P value
Group I	2.48 ± 0.15	2.23 ± 0.12	1.28 NS	>0.05
Group II	1.83 ± 0.25	2.05 ± 0.15	0.76 NS	>0.05
t value	2.19	0.91		
	P < 0.05 S	P > 0.05 NS		

S - Significant; NS - non significant

**Table 1 (d): Mean oral stereognostic scores of two groups depending on age**

Groups	Age 20-30 yrs	Age 40-50 yrs	t value	P value
Group I	2.65 ± 0.09	2.05 ± 0.15	3.45 S	<0.01
Group II	2.25 ± 0.19	1.63 ± 0.14	2.24 S	<0.05
t value	1.90	1.68		
	(P > 0.05) NS	(P > 0.05) NS		

S - significant; NS - non significant

**Table 2 (a): Satisfaction level of control and test cast metal crown**

Satisfaction level	Control			Test		
	1 <sup>st</sup> reading (%)	2 <sup>nd</sup> reading (at 24 hrs) (%)	χ <sup>2</sup> value	1 <sup>st</sup> reading (%)	2 <sup>nd</sup> reading (at 24 hrs) (%)	χ <sup>2</sup> value
0	3 (7.5)	1 (2.5)		6 (15.0)	5 (12.5)	
1	2 (5.0)	5 (12.5)	3.46	7 (17.5)	5 (12.5)	1.39
2	13 (32.5)	17 (42.5)	NS	13 (32.5)	18 (45.0)	NS
3	22 (55.0)	17 (42.5)		14 (35.0)	12 (30.0)	

NS (P > 0.05)-non significant

**Table 2 (b): Mean satisfaction scores of two groups**

Groups	Group I	Group II	t value	P value
Mean ± SD	2.30 ± 0.12	1.90 ± 0.15	2.06	<0.05 S

S - Significant

**Table 2 (c): Sex-wise mean satisfaction scores of two groups**

Groups	Female (n = 20)	Male (n = 20)	t value	P value
Group I	2.30 ± 0.17	2.30 ± 0.18	0.00 NS	>0.05
Group II	1.95 ± 0.23	1.85 ± 0.21	0.32 NS	>0.05
t value	1.23 NS	1.65 NS		

NS (P &gt; 0.05) - non significant

**Table 2 (d): Age-wise mean satisfaction scores of two groups**

Groups	Age 20-30 yrs	Age 40-50 yrs	t value	P value
Group I	2.05 ± 0.20	2.55 ± 0.12	2.16 S	<0.05
Group II	1.55 ± 0.21	2.25 ± 0.19	2.44 S	<0.05
t value	1.71 NS	1.33 NS		

S - Significant; NS (P &gt; 0.05) - non significant

## CONCLUSIONS

On the basis of findings and within the limitations of the present study, following conclusions were drawn:

- The difference in oral stereognostic scores recorded at one-day interval for both type of cast metal crowns was found to be insignificant in all subjects.
- The difference in satisfaction level recorded at one-day interval for both type of cast metal crown was found to be insignificant in all subjects.
- Oral stereognostic score of cast metal crown resembling original tooth was found to be significantly higher than oral stereognostic score for cast metal crown with morphology confirmed to ideal contours.
- Satisfaction level of subjects for cast metal crown with morphology resembling original tooth was found to be significantly higher than satisfaction level for cast metal crown with morphology confirmed to ideal contours.
- Oral stereognostic score and satisfaction score were found to be higher for cast metal crown with morphology resembling to original tooth due to recognition and discriminatory ability of subjects and recall-memory.
- There was no significant difference in oral perception and satisfaction level between male and female.

- The level of oral perception and discrimination was found to be higher in younger subjects, while it decreased in older subject age group.
- The level of satisfaction was found to be higher in older subject than younger subjects.

Therefore, it was concluded that acceptance of fixed prosthesis is not only based on dentist's routine procedure of treatment and patient's judgment about oral health, function, and esthetics, but also depends upon patient's oral perception and discriminatory skill for external morphology of fixed prosthesis.

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