

Stereognosis in Prosthodontics

Jyoti Beniwal^{1*} Himani Chaudhary² Trishala Ajit Patel³ Neeta N Salunkhe⁴

¹PG Student, Department of Prosthodontics and Crown and Bridge, Daswani Dental College and Research Center, Kota, Rajasthan, India.

²PG Student, Department of Prosthodontics and Crown and Bridge, Daswani Dental College and Research Center, Kota, Rajasthan, India.

³PG Student, Department of Prosthodontics and Crown and Bridge, Daswani Dental College and Research Center, Kota, Rajasthan, India.

⁴PG Student, Department of Prosthodontics and Crown and Bridge, Daswani Dental College and Research Center, Kota, Rajasthan, India.

ABSTRACT

Background: The efficiency and success of complete dentures are difficult to measure objectively. Hence, 'Stereognosis' term was introduced which is the ability to recognise and discriminate form of an object by using the sense of touch. Oral stereognosis is the ability to recognize the form or shape of objects placed in the oral cavity without use of vision. Oral stereognosis may be used as one of the clinical aids in predicting patient's performance to a prosthesis. With this source of information, the dentist may educate the patient about the prognosis of the prosthesis so that the patient is mentally prepared about its limitation.

Keywords: Prosthodontics, stereognosis, dentistry.

INTRODUCTION

The chief purpose of fitting oral prostheses is to enable the patients to recover their oral function.¹ Therefore, to diagnose the effectiveness of the prosthesis, it is important to evaluate the oral function.² Oral sensory function can be examined by different methods that include two-point discrimination, oral stereognosis, vibro-tactile detection, somesthetic sensitivity, proprioception and thermal sensitivity.³⁻⁶ Tactile discrimination of the shape of an object by means of manual palpation, without the use of the eye-sight, is known as stereognosis.³ Stereognosis involves the identity of forms without the aid of vision through hand or oral manipulation. This definition refers to manual exploration of objects, it is also possible to extend the tactile perception of objects intra orally which is referred to as Oral stereognosis (OS).⁷ This term was first introduced by Berry and Mahood in 1966.⁸ OS is the neurosensorial ability of the oral mucosa to recognize and discriminate the forms of objects in the oral cavity.⁹⁻¹² It involves placing the object into the mouth and having the patient identify the

forms of objects without the aid of vision by hand or oral manipulation.¹ Hence, Stereognosis is the ability to perceive the form of an object by using the sense of touch and OS is the ability to recognize the form or shape of objects placed in the oral cavity without use of vision.¹³⁻¹⁵

Review of Oral Stereognosis Test (OST)

Berry and Mahood introduced the OST and tried to develop a standardised test procedure (e.g. shape, size, number, material).⁸ The National Institute of Dental Research has developed a range of 20 shapes and suggested to use test forms within this range for the assessment of OS.¹⁶

Receptors and Mechanism involved in Oral Stereognosis

Stereognostic testing is designed to assess overall sensory ability and oral motor ability, not specific groups of sensory receptors. OST has been employed to evaluate oral perception.³ To assess stereognostic ability, test pieces are inserted in the oral cavity and in most experimental set-ups free

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*Correspondence Dr. Jyoti Beniwal.

Department of Prosthodontics and Crown and Bridge, Daswani Dental College and Research Center, Kota, Rajasthan, India.

Email: jyotibenawal.jb@gmail.com

manipulation of the test pieces is allowed. The latter implies activation of a large number of receptor groups (periodontal, mucosal, muscular, articular). Since the tip of the tongue is one of the most densely innervated areas of the human body, it plays an important role in stereognosis of objects inserted in the mouth. OST's give different results according to the location of the test pieces; between the tongue and the hard palate, between the tongue and the teeth or between the tongue and the lips. Major role is being played by three groups of receptors, the tongue mucosa, the palate and, to a lesser extent, by the teeth with their periodontal ligament. Receptors mainly involved in oral stereognostic ability being located in various oral structures and form perception resulting from an association of more than one group of receptors.¹⁷ Engelen reported that combination of sensory inputs from the tongue and palate had a core role in oral perception of size.¹⁸

The mechanism of OS is determined by a variety of neural receptors belonging to many oral structures and by the functioning of higher coordination centres.¹⁷ OS involves some motor activity and manipulation of test pieces inserted into the oral cavity and their interactions with lips, tongue and teeth.⁷ The oral exploration phenomenon involves elaborate functions of the parietal cortex. Received sensations are synthesized in the cortex and compared with previous sensorial memories.¹⁹ Oral cavity has a very high ratio of sensory innervations—through trigeminal nerve and its innervations in the oral cavity has a very large representation in the cerebrum compared to the innervations of body peripheral areas.²⁰ The receptors present in the dentofacial region send information to CNS through afferent pathways, which could be information regarding the consistency of food to be masticated. Efferent impulses from CNS are conveyed to the muscles of mastication to bring about motor response—masticatory activity in a co-ordinated manner.²¹ A fundamental concern of sensory motor function coupled with a general interest in oral sensation and perception has led investigators to extend the exploration of tactile perception of form intra orally—which is oral stereognosis.⁷

The Oral Stereognosis Test

In stereognostic ability tests, pieces are mostly manipulated inside the mouth and seldom kept between two antagonistic teeth, which frequently excludes the need for a mouth opening of 5 mm or even more. The OST consists of placing objects into the mouth without being seen by the patient and having the patient identify the form.¹ A correct identification of the form of the object is recorded as a score.^{22,23} it has been documented that the level of oral stereognostic score demonstrates a definite relationship with denture performance, that is, patients with high scores were found to have more complaints in the post-insertion phase, whereas, patients with low scores had fewer or no complaints.²⁴⁻²⁷ Furthermore, a high score in oral stereognostic test indicates that the patient is receiving accurate information from his sensory feedback mechanism with which to identify shapes explored in the mouth.²⁸

Oral versus manual stereognosis

In manual stereognosis, identification times are generally shorter and identification errors lower than in oral stereognosis. The correlation between identification errors and identification times is moderate in oral and absent in manual tests. In general, there is no clear relationship between manual and oral stereognosis.²⁹ An oral stereognostic ability test cannot be regarded as a measure of stereognostic ability in general. A learning effect is obvious for most test pieces regarding identification time and for about half of the test pieces regarding identification errors.¹⁷

Two important parameters for evaluating stereognostic ability are the time consumed for identification of the pieces and the accuracy of the responses. The experimental design of the test is of primary importance as both the method used and the material applied may influence the results dramatically.¹⁷ The form, size and surface characteristics of the test piece, the presentation order, subject-related factors and the method of scoring all have their effect on the results. With regard to subject-related factors, ageing has a negative influence on stereognostic ability; gender is considered of no importance. Another influencing factor is dental status. A healthy natural dentition offers a very good oral stereognostic ability. Edentulous subjects usually show a decreased oral

stereognostic ability, depending on the rehabilitation form.¹⁷ However, a study by Van Aken et al concerning the relationship between oral stereognosis and satisfaction with complete dentures demonstrated no such correlation.³⁰ Thus, controversy still exists in relation to oral stereognosis and prediction of denture acceptance.³¹ McDonald and Aungst stated that the development of OST's which permitted active exploration of the stimulus applied seemed to be the most promising method to evaluate oral sensorimotor function.³² After this pioneering work by Berry and Mahood, oral stereognostic ability, also denoted as oral form recognition, received further attention in the literature and has been performed in different ways with a different outcomes.³³

Clinical Implications

Stereognosis is a more complex process than the simple detection of tactile stimuli and involves different components.¹⁷ Manual stereognosis is used in neurology, neuropsychology and hand therapy to evaluate the functional performance of the hand. It has also been employed to evaluate the integrity of sensory feedback and is used in neurological evaluation of the central nervous system.^{17,34,35}

Oral stereognosis ability has been studied in several researches to evaluate the oral perception. It can be applied as a measure of oral functioning. This test can be used especially to test oral dysfunction or to evaluate the effect of therapy.¹⁷ Oral stereognostic ability has been investigated in relation to other oral functions to measure impairments due to the presence of general or local pathology (e.g. speech pathology, blindness, deafness, cleft lip and palate, temporary sensory ablations).¹⁷

Various researchers have documented that oral perception, evaluated through the oral stereognosis test, might play a role in the complex process of incorporating and accepting rehabilitation with complete removable dentures. Research on OS 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. Very few studies have been reported to assess the oral stereognosis in relation to fixed dental prosthesis.³⁶⁻³⁹ McDonald and Aungst 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.⁴⁰ Muller et al. in their study reported that the tactile sensibility was found to be impaired with age and diminished capability of adaptation.⁴¹ S. Meenakshi et al. reported that subjects with high scores in the stereognosis test presumably receive more complete and accurate sensorial data about objects inside their mouth, and in consequence have a better ability to appreciate the functional limitations imposed by the presence of a complete removable denture, as well as noticing more clearly any defects in the artifact, compared to subjects with lower stereognostic ability indicating that the oral stereognosis test is a valid aid in predicting adaptability to complete removable dentures and their acceptance by the patient.⁷ Furthermore, it has been documented that covering the palatal mucosa with a denture does not reduce oral stereognostic ability; OST is a reliable test to measure patients' oral stereognostic perception—which would enable the patient to appreciate the functional limitations of the denture. The dentist can be more aware of what he/she can expect in the form of patient response during and after treatment.⁷

CONCLUSION

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. Moreover, the success of prosthodontic treatment is dependent on sensory-motor relationships. The critical evaluation of prosthesis should not only include dentist's objective skills of treatment and the patient's subjective judgment about oral health, function and esthetics but also the patient's oral perceptive skills. The clinician must consider the learning skill of training the patient to wear the dentures. Patient performance could be improved by giving transitional appliances which may serve as a training device to improve oral manipulative and perceptive skills.

CONFLICT OF INTEREST

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

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