# ORAL STEREOGNOSITIC ABILITY OF EDENTULOUS PATIENTS BEFORE AND AFTER REHABILITATION WITH COMPLETE DENTURE

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### ABSTRACT

To determine mean change in oral stereognostic ability score & duration of time taken for sensory perception of edible objects before & after insertion of complete denture in completely edentulous non-denture wearer. The study was conducted at Department of Prosthodontics, Hamdard University Dental Hospital in Karachi-Pakistan. Thirty Patients were enrolled after explaining the procedure. The test was performed after medical, dental history, clinical examination where the subject was seated in an upright position. Test specimen were made from carrots with the help of nickel chromium punches available in six standardized shapes that are: circular, oval, triangle. Square, star and ellipse. For proportion of patients correctly identifying the shape of objects after denture insertion, there was a drastic improvement seen at one month in comparison to baseline for all shape types. Majority of the patients had improved oral stereognostic ability at one month of denture insertion with a signification p-value in all shape types (<0.001) in comparison to pre-scores at baseline. In older edentulous patients, oral stereognostic increases with denture provision. The overall increase in objects identification and masticatory performance takes time from one week to one month. It is recommended to have a denture prosthesis for all edentulous patients as early as the last tooth falls apart.

Key words: Oral stereognostic, edentulous. Removable prosthesis

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### INTRODUCTION

The number of older people in both developing and developed countries will increase over the coming decades.<sup>1</sup> Approximately 600 million people are aged 60 years and over, and this number will be doubled by 2025.<sup>2</sup> By 2050, it will be 2 million, 80% living

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in developing countries.<sup>3</sup> Thus, with the increasing number of elderly people and global increase in the life expectancy, edentulous arises as a chronic condition.<sup>4</sup> For the survival of living beings, special senses play significant role.<sup>5, 6</sup> However, these special senses in oral cavity are associated with the periodontal tissues and natural teeth provides sensory tactile inputs to the central nervous system.<sup>7</sup> The people with existing dentition sensory discrimination of objects is conducted via periodontal mechanoreceptors.8 The dental diseases resulting in loss of entire dentition or extraction of teeth lead to the breakdown of periodontal tissues whereas the small amount of periodontal mechanoreceptors remains within the bone.<sup>9</sup> These sensory abilities in human's reach to their optimal level in twenties and maintained for several years but decline gradually with distinct variations.<sup>10</sup>

Stereognosis is referred as a tactile discrimination of shape of an object with the help of manual palpation, without viewing the items.<sup>11</sup> Though, placing objects into the oral cavity and the identification of these objects via hand or oral manipulation without the assistance of vision by patients is known as "Oral

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Stereognosis".<sup>12</sup> The oral sensory or oral stereognosis ability is linked with various functional activities like mastication, swallowing and identification of taste, shape and size of food bolus.<sup>13</sup> Thus, declining in the oral stereognostic ability(OSA) of elderly is linked with the masticatory disorders.<sup>14</sup> The edentate patients with dental prosthesis, the oral sensory apparatus perceive it as a foreign object as it is placed on the edentulous residual alveolar ridge.<sup>4,15</sup> Moreover, the dental prosthesis acts as a barrier in between the mucosa and tongue that further hinders the oral stereognostic ability of patients.<sup>7, 16</sup> The individual ability to adapt complete denture prosthesis depends upon the structural sensory status the supports and surrounds the prosthesis.<sup>17</sup>

The 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. The success of prosthodontics treatment is dependent on sensorymotor relationships.<sup>18</sup> 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. The patient with high level of oral perception may be more responsive to clinical procedures.<sup>11</sup> One of the major concerns of denture wearer is adaptation to new or replacement dentures, regardless of their experience of wearing denture. The study had aim to investigate whether the pattern of changes in oral stereognosis ability is different in pre-and post-rehabilitation with complete dentures in non-experienced edentulous complete denture wearers. Such study would contribute to understand the nature of oral stereognostic ability in denture adaptation among elderly patients. Thus, increasing the oral stereognostic ability and perceiving sensation for identifying the specimen in the oral cavity. There exists no such study has been carried out in Pakistan to determine mean change oral stereognostic ability score & duration of time taken for sensory perception of edible objects before & after insertion of complete denture in completely edentulous non-denture wearer. The rationale of this study was to determine oral functioning and assess the outcome of oral therapy such as prosthesis and complete denture which help in dentistry about the possible outcome of the treatment as well as patient's behavior towards their treatment.

### **MATERIAL & METHOD**

The design of the study was Quasi experimental. The target population for the current study was edentulous elderly patients visiting the dental tertiary care hospital located in Karachi, Pakistan; from *January* 2019 to *June* 2019. Convenient purposive sampling

was used to include the edentulous patients presenting first time for complete denture with the age limit is between 40 to 65 years. However, patient with any experience of previous complete denture and with known oral symptoms examples, pathologies and temporomandibular disorders through history and clinically diagnosed patient, non-cooperative patients identified through Morse<sup>19</sup> classification and diagnosed neurological disorder in which the patient was unable to judge shape, size, and taste such as Alzheimer's, Amnesia, Epilepsy, Neuropathy, Parkinson's disease, Paresthesia, Stroke were excluded. The study was conducted at Department of Prosthodontics, Dental OPD Hamdard University Dental Hospital in Karachi, Pakistan. HUDH is a tertiary care dental hospital which caters all the dental specialty. Sample size was calculated by Openepi software version 3.0. Total sample size was 30 with 95% of confidence level and the power of the study was 80%. Out of 30 patients, the study was performed on 27 patients as three patients were excluded during the study due to serious medical health issues. Patient were selected as per inclusion criteria. Study procedure was explained to the patients after medical, dental history, and clinical examination. Later, verbal inform consent was obtaining for their participation. During the testing, the subjects were asked to be seated in an upright position. Test specimen were made from carrots with the help of nickel chromium punches with the six standardized shapes that are circular, oval, triangle, square, star and ellipse. The dimensions of carrot were 5mm thick with 10mm diameter. The test items were placed on mid dorsum of tongue and the subjects were allowed to freely manipulate the specimen to feel and identify it. The subject indicated the identification by pointing out at the appropriate thermopile shape replica which was larger in size in comparison to the test specimen. The sixth specimen were presented randomly, the time taken for recognizing the shape was noted in seconds with the help of stop watch, as soon as the subject recognized the object placed intra orally, time was recorded according to the stop watch reading. Moreover, the scoring system for OSA scores was according to Smith and McCord.<sup>20</sup> This test was done before insertion of complete denture, after provision of complete denture and after one month of complete denture insertion and then the results were compared. Data was analyzed using SPSS version 23. Repeated measures ANOVA test was applied to see the difference in oral stereognostic ability score and duration at before insertion of complete denture, after one week and one-month insertion of complete denture keeping p-value < 0.05 as significant.

## RESULTS

Oral stereognosis ability score was calculated in terms of mean and standard deviation and for all quali-

# TABLE 1: DEMOGRAPHIC CHARACTERISTICSOF PATIENTS (N=27)

Demographic Characteristics	<b>Point estimates</b>
Mean Age	$69.5 \pm 8.12$
Gender	
Male	7(25.9)
Female	20~(74.1)
Occupation	
Business	5 (18.5)
Housewife	2(7.4)
Job	5 (18.5)
Retired	7 (26.0)
Other	8 (25.6)
Education	
Graduation	13 (48.1)
No Education	4 (14.8)
Primary	6 (22.2)
Secondary	4 (14.8)
Marital status	
Married	19 (70.3)
Unmarried	5 (18.5)
Widow	3 (11.1)
Smoking	
Yes	8 (29.6)
No	19 (70.4)

Results are presented as mean  $\pm$  standard deviation and frequency (%).

tative variables like gender, education, ethnicity, social economic status, and smoking shown by frequency and percentage.

Repeated measures ANOVA test was applied to see the difference in oral stereognosis ability score and duration before insertion of the complete denture, after one-week One-month insertion of complete denture keeping p-value < 0.05 as significant.

Among the total 27 patients, there were female (n=20, 74.1%) and male (n=7, 25.9%). Overall, the mean age was  $69.5 \pm 8.12$ . The majority of the patients were older with a retired occupational lifestyle (n=7; 26.0%). However, (n=13, 48.1%) had attained higher education. A total of (n=19, 70.3%) patients were married and majority of them didn't smoke (n=19, 70.4%). Table 1.

The mean OSA Time score value before denture insertion was found to be 14.5 and it decreased to 9.2 after 1 month of denture fabrication (Table 2). The comparison of OSA scores before denture insertion

### TABLE 2: MEAN SD TIME IN SECONDS TO IDENTIFY OBJECTS AT BASELINE, ONE WEEK, WAS ONE MONTH AFTER DENTURE

T i m e - line ac- cording to iden- tifica- tion by shapes	Base- line	At one week	At one month	p-val- ues*
Circle	$\begin{array}{c} 14.5 \\ \pm 6.1 \end{array}$	$10\pm 3.5$	$9.2 \pm 2.4$	< 0.001
Triangle	14.8± 6.8	$\begin{array}{c} 10.1 \pm \\ 3.4 \end{array}$	$9.1 \pm 3.5$	< 0.001
Square	$\begin{array}{c} 17.6 \\ \pm 8.0 \end{array}$	$\begin{array}{c} 12.6 \\ \pm 5.0 \end{array}$	11.0± 3.9	< 0.001
Stars	14.4± 4.9	$\begin{array}{c} 10.6 \\ \pm 4.0 \end{array}$	$9.3 \pm 3.6$	< 0.001
Ellipse	$\begin{array}{c} 13.7 \\ \pm 4.5 \end{array}$	$10.6\pm$ 4.1	$\begin{array}{c} 10.2 \pm \\ 4.2 \end{array}$	< 0.001
oval	17.2± 6.5	$\begin{array}{c} 12.8 \\ \pm 5.1 \end{array}$	11.2± 4.3	< 0.001

(n=27) \*p-value from Repeated measures ANOVA

TABLE 3: DATA SHOWS IDENTIFICATION PAT-TERN OF THE PATIENTS AFTER ONE WEEK AND ONE MONTH

	Base- line	At one week	At one month	p-val- ue*
No iden- tify	25.93	3.7	3.7	< 0.001
Incorrect	62.96	51.85	11.11	< 0.001
Correct	11.11	44.44	85.19	< 0.001

and after denture insertion was found to be statistically highly significant It was seen that the majority of patients had improved oral stereognosis ability at one month of denture insertion with a signification p-value in all shape types (<0.001) in comparison to pre-scores at baseline i.e. for circular, round, triangle, star, square and ellipse.

Results of the Chi-square test showed that the percentage of identification of shapes before denture insertion was 25.93 for circular objects, after insertion of dentures decreased The findings suggested that there was a significant improvement in the OSA denture wearers after wearing new dentures for 1-month proportion of correct identification for different objects was increased. For circle 11.11% to 85.19 %, triangle from 7.41% to 81.48 %, square from 7.41% to 62.96 %, star from 14.81% to 62.96 %, ellipse objects from 11.11 % to 88.89 %.

There was a drastic improvement with a decrease in time required to identify an object at one week and one month from baseline for all object shapes with a p-value of <0.001. The shortest time required to identify an object was found for triangles shapes i.e.  $9.1\pm 3.5$ followed by circles i.e.  $9.2\pm 2.4$  and stars i.e.  $9.3\pm 3.6$ respectively.

# DISCUSSION

The uptake of oral dentures in previously edentulous patients help in increased sensory and stereognostic capability over a month as compared to the baseline. One of the huge patient-related factor is the capacity of the specific tangible mucosal indicators to caution the mucosa of hurtful improvements. This natural capacity additionally enables a similar mucosa to recognize the imperfection assuming any if present in the prosthesis. The higher the oral sensory capacity of a specific patient, the lesser the edge of blunder making with respect to the dental specialist. Principle intra oral site for discovery of a substance or bolus isn't between the teeth rather it is in between the tongue and the palate. Our study demonstrated the improvement in the overall stereognostic capability of oral cavity through denture administration in elderly patients who were previously edentulous.

There were some important findings in the study. The most commonly identified object shape was ellipse in our study at one month i.e. (n=88.9%), which is similar to another study reported by Vishwadeepak, et al.<sup>21</sup> This is an important finding since the haptic investigation through tongue and mucosa is, naturally, exploratory and uncontrolled. In this manner, the exact article highlights, and mechanoreceptors used to see oral item structure stay vague, as highlighted in previous studies. For edentulous patients, a dental prosthesis is perceived by the oral sensory apparatus as a foreign body once it is placed on edentulous residual alveolar ridges.

Aging has a detrimental effect on muscular structure and physiology as a result time required to identify an object increase. It has been observed that younger age patients have proportionately higher oral stereognosis score compared to the older counterparts. As indicated by Kawagishi et al<sup>22</sup> or al stereognosis improves with age, stabilizes in young adults and then starts deteriorating in older age. Muller et al<sup>23</sup> reported in their study that tactile sensation and adaptation capability tend to decrement with age. The ellipse objects were correctly identified in 88.9% proportion at one month and this was highest among all form objects in our study. It was 8 times higher compared to baseline i.e. is without dentures. Similar findings were reported by Litvak et al.<sup>24</sup> and Mantecchini.<sup>25</sup> It also affirms that tongue can better sense the boundaries of a test object with hard surfaces. In contrast, with the findings by Park JH<sup>26</sup> who reported 94 % correct answer proportion for the circular objects. Ikebe et al.<sup>27</sup> has also hypothesized that tongue has far greater ability and importance in oral stereognosis when compared to palatal receptors. They also proposed that appropriate arch forms and vertical dimensions of dentures keep the tongue in normal shape thus facilitating the identification of test objects.

The response time with dentures at 1-month interval was significantly lower for all forms of objects when compared to without denture oral stereognosis. Findings from Grasso et al.<sup>28</sup> did not show significant time difference before and after denture placement i.e. 9.6 versus 9.5 seconds. However, it has been postulated through two different studies that maximum sensitivity of the oral is reached after 5 weeks of placement of complete dentures. Similar to this, previous studies have explored the phenomena comprising oral stereognosis (stimulus, signaling and input processing by somatosensorial cortex area) but were not able to compute the neural pathways for each masticatory areas. It was concluded that the success of prosthodontics treatment is dependent on sensory-motor relationships. 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.

A comparative study between edentulous (group I) and dentulous (group II) was conducted by Khajuria<sup>29</sup> on 100 selected patients. Four different shapes (star, circle, rectangle and triangle) were used for assessment of oral stereognosis. One minute was provided to each patient for assessment of object shape. It was concluded that oral stereognosis ability in edentulous group was lower compared to dentulous group. The oral stereognostic ability in men did not differ from women in dentulous group but significant difference was observed in edentulous patients.

For proportion of patients correctly identifying the shape of objects after denture insertion, there was a drastic improvement seen at one month in comparison to baseline for all shape types Oral stereognosis score is a good indicator of the denture quality. In a study by Lerra  $S^{30}$  concluded that dissatisfied patients having good dentures (as assessed by qualified prosthodontist) have high oral stereognosis compared to satisfied patients with poor dentures.

On the other hand, Parasad<sup>31</sup> reported high negative correlation (p-value < 0.05) between oral stereognosis ability and denture satisfaction. It indicated that as oral stereognostic ability increased the level of satisfaction decreased. Especially in the edentate patients with

dental prosthesis, the oral sensory apparatus perceives it as a foreign object as it is placed on the edentulous residual alveolar ridge. Moreover, the dental prosthesis acts as a barrier in between the mucosa and tongue that further hinders the oral stereognostic ability of patients. The individual ability to adapt complete denture prosthesis depends upon the structural sensory status the supports and surrounds the prosthesis.

Qureshi et. al.<sup>15</sup> concluded that oral stereognosis of edentulous subjects was relatively lower in comparison to what has been observed in dentate subjects in the literature. Choudhary et al.<sup>32</sup> summarized that age, gender and mental attitude affect the success of dentures. They reported that males had higher satisfaction with dentures compared to females, older age group were more satisfied with their dentures compared to younger group and also reported that philosophical and indifferent patients were found to be more statistically satisfied with their complete denture than exacting and hysterical patients. The response time with dentures at 1-month interval was significantly lower for all forms of objects when compared to without denture oral stereognosis. Findings from Grasso et al.<sup>28</sup> did not show significant time difference before and after denture placement i.e. 9.6 versus 9.5 seconds respectively. However, it has been postulated through two different studies that maximum sensitivity of the oral is reached after 5 weeks of placement of complete dentures. Similar to this, earlier readings have explored the phenomena comprising oral stereognosis but were not able to compute the neural pathways for each masticatory areas. It was however, concluded that the success of prosthodontics treatment is dependent on sensory-motor relationships. 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 and hence stereognosis testing may come in handy as indicator of overall sensory ability of the patient. This is however important to mention that patients with variation in normal oral characteristics such as palatal fissure may react differently to these scores and hence may pose to different results.

Clinicians' orientation on oral musculature of edentulous patients and oral stereognostic satisfaction would result in a higher performance and acceptance of denture appliance and mental acceptance. This would not only increase the longevity of dental prosthetic apparatus, but better oral stereognostic satisfaction would also result in overall lifestyle of the patient hence would improve the quality of life.

The study paves way to address improvement in stereognostic properties in edentulous patients

of older age group. This would not only relate to the improvement in patient's satisfaction level but also improves clinician understanding of patients tailored to individual patients. The future implications of the study call for development of standardized tests to have a uniform assessment of oral stereognosis in the region across different patient characteristics, age groups and implication of various dental prosthesis i.e. with cast partial dentures, old denture wearers, dentures with other accessories and materials etc. The need for tests development would also be required to test various shapes, accounting for variation in mucosal surface areas and to assess which of the combination may give near natural experience to the patient. Other than these, patient response related factors such as standardized questionnaires and tools are required so as to minimize individual variability.

### CONCLUSION

In older edentulous patients, oral stereognosis increases with complete denture insertion. It is recommended to have a complete denture insertion in total edentulous patients. We can conclude that oral stereognostic ability improves with time, which might be due to adaptation to the denture. As adaptation towards denture improves masticatory efficiency improves as well. There might be a weak association between oral stereognosis and masticatory efficiency but these can be assessed through multiple longitudinal studies focusing on muscular adaptation of edentulous patients with time. In our study, the presence of a prosthetic restoration was a determinant in improving oral stereognostic ability.

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3 Abdur Rehman:	Data collection, Literature review.
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