Oral Stereognosis Related to the Use of Complete Dentures: A Literature Review

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Abstract
Oral stereognosis is the neurosensorial ability of the oral mucous membrane to recognize and discriminate the forms of objects in the oral cavity. The sensorial ability of the tongue, lips, thumbs and index fingers is greater than that of other parts of the body. Therefore, a dentist’s understanding of oral stereognosis is important to understand the expectations of patients during complete denture treatment. A MEDLINE literature search within the periods of 1944 to 2003 and with the keywords “oral” “stereognosis” “complete” and “dentures” found twenty articles. Articles concerning sensory function, test type, oral-motor diseases, dentate status (including osseointegrated implants) and patient satisfaction with complete dentures were considered. After reviewing the literature, we have reached a number of conclusions: 1) A lack of standardization exists in stereognostic testing; 2) Stereognostic ability diminishes with age (number of correct responses and longer times for recognition); 3) Stereognosis can improve with training; 4) Degree of satisfaction is not related to a high or low oral perception level; 5) The use of complete dentures during the rehabilitation of patients with neuromotor disorders enhances oral sensation; 6) and implant-supported prosthesis provides stereognostic levels near that of natural dentition.

Introduction
Oral stereognosis (OS) is the neurosensorial ability of the oral mucous membrane to recognize and discriminate the forms of objects in the oral cavity. It can be classified according to the following(1):

general stereognosis: overall capacity to recognize the shape of the objects;

homostereognosis: self body recognizing capacity, like teeth, tongue and palate;

organ stereognosis: capacity to recognize muscular units as target areas, concomitant to conscious projection of organism in environment (position of limbs to execute routine tasks);

heterostereognosis: capacity to recognize foreign body inside oral cavity (glass particles or wood stick).

The oral phenomenon known as stereognosis involves elaborate functions of the parietal cortex. Received sensations are synthesized in the cortex and compared with previous sensorial memories. Part of the somatosensorial cortex(2) is composed of Broadmann areas (3a, 3b, 1, 2). Sensorial input of muscle and articulations are conducted to 3a, whereas skin sensorial input is conducted to 3b and processed in area 1, combined with other information in area 2. The S-I area projects the signal to other locations of the parietal lobe, where the somatosensorial impulses are used for the learning of new discriminatory sensations. The sensorial area for the tongue, lips, thumbs and index fingers is greater than other sensorial parts for the rest of the body.

Tests to Verify Oral Stereognosis Level
Testing one’s OS level can involve some motor activity and manipulation of test pieces inserted into the oral cavity and their interactions with lips, tongue, and teeth. OS testing can also measure recognition times, surface texture of objects, and sensibility thresholds.

The following parameters (3) apply to the recognition of forms: 1) pieces must not have sharp angles; 2) a length of 2 to 3mm is adequate; 3) metallic pieces are not tolerated, and flexible forms are not correctly identified; 4) form must be defined in a simple way (square, round, triangle); 5) a small number of pieces must be used. Although a protocol for evaluation (4) has been long established, not only can a variety of forms and numbers of test pieces be found in the literature (5) but also different OS scores which can lead to
several interpretations (6). Regardless of an object’s shape, identification of particle size (7) is the aim of current studies since it has direct implication on bolus formation and swallowing.

**OS and Patient Satisfaction**

Patient satisfaction is a subjective experience, and OS studies have reported different results. It is of great value to verify sensorial perception even before the initiation of therapy with complete dentures in order to advise the patient about further complications (8).

In a study of 105 denture wearers, half were dissatisfied with their prosthetics treatment (5). Another study concluded that oral stereognosis cannot be related to patient satisfaction degree (unsatisfied patients with higher perception levels) (7). Denture technical aspects were verified in groups with superior and inferior prosthesis rated good (22 patients-group II) and in groups with superior and inferior prosthesis rated bad (12 patients-group I). From group I, 5 satisfied subjects were chosen, and from group II 5 unsatisfied subjects were chosen, too. After the tests, results showed that perception level was similar for both groups.

**Age**

Age is a contributing factor to decrease OS levels only when previous training is not accomplished since the “learnt discrimination ability” (9) can be retained through the years. Oral stereognosis involves cortical function, memory, and vision, factors that are impaired in elderly. When manipulation of models was allowed at the same time of the tested procedure (8), the oral perception levels were higher for young dentate individuals and lower in the elderly. Differences were not observed in dentate and edentulous subjects between 50 to 60 years of age. Complaints were more common from patients who had higher levels of oral stereognosis. Another study found that older people needed 80% more time to identify pieces than younger ones: after three repetitions, recognition time decreased 22% in the younger group and 5% in the older. Identification errors were reduced 54% in the former and 16% in the latter (10). Muscular ability test revealed that time for setting of the pieces was 2.5 times greater for the first group. Similarly, a negative correlation was observed between patient age and the number of correctly identified forms (11) with or without dentures. The loss of stereognostic ability related to age may correlate with the willingness of elderly subjects to swallow larger food boluses, implying that they cannot accurately estimate bolus size (12).

**Dentate Status**

Patients with palatal fissure (13) did not show differences when compared with the control group for the time and the number of correct responses in the stereognostic tests applied; however, the extension of defects and type of treatment (surgical or prosthetic) were not considered. When the effects of palatal coverage were assessed (14) in dentate and edentulous subjects (with and without dentures), palatal coverage per se did not interfere with recognition of forms (although older subjects identified fewer forms than the younger ones). Oral perception levels were similar either in dentate or edentulous subjects without relationship between oral stereognosis and masticatory ability (15) although dentate individuals had correctly identified test forms more often and in a shorter time when compared with individuals who had no natural teeth (16).

The OS ability of edentulous patients with osseointegrated implants (fixed prosthesis, overdenture) or complete dentures was similar to that of totally dentate subjects though the latter did have a slightly higher ability (17). The hypothesis was that other receptor groups could compensate for the absence of periodontal ligament receptors in edentulous patients rehabilitated with osseointegrated implant-supported prosthesis. Even with tooth loss the adaptability of the neuromuscular system in maintaining this subjective interpretive skill appears to be remarkable (18).

**Gender**

Studies that have examined gender and OS were few and inconclusive (8,13,17,19,20).

**Denture Experience**

The correlation between duration of edentulism and OS levels with new dentures in patients who had been edentulous for 8 years resulted in poor values (r= -0.01) (11). When patients had been denture wearers for 11.5 years, OS levels did not affect the patient’s adaptive capacity with new dentures (r= 0.23). The correct extension of denture
borders can improve retention and stability, but its association with a high or low level of OS remains an interesting issue to be investigated since some patients do not adapt to the denture border extension that the clinician desires.

**OS and Oral Motor Diseases**

One study has found that oral perception and oral motor ability in edentulous subjects with stroke and Parkinson’s disease can improve if dentures are worn during rehabilitation with no statistically significant differences between the two affected groups (20).

**Discussion**

The phenomena comprising oral stereognosis (stimulus, signaling and input processing by somatosensory cortex area) have been difficult to understand. Some factors discussed in the literature need more standardization, such as more restricted age groups, the patient’s previous time experience with dentures, test protocol (previous ability to recognize forms or not) and type of form used (simple or complex). From a sensorial point, oral stereognosis constitutes the highest level of learning because it can only be applied after sensitization and orientation of objects in the oral cavity. The recognition process can be hypothesized in the following sequence: after the completion of organ stereognosis, heterostereognosis suffers a transition period, adapts and identifies the foreign body, weighing particle size. This means that the tongue “can see”, and its ability to perceive can only be enhanced through recognition exercises (1).

Some studies that have tried to link the degree of satisfaction of denture wearers with a high or low oral stereognostic level have had dissimilar results. It is important to point out that previous frustration of denture wearers is one of the multiple factors that influence oral perception indexes. Since aging decreases muscular ability and increases the time needed for the recognition of forms (16), a special training program for perioral musculature and complete dentures (being implant-supported or not) may benefit patients. Although the tongue and palate constitute more than one third of the somatosensory cortex area (21), further studies with immunohistochemical and magnetic resonance imaging techniques are necessary to determine the role of gingival exteroceptors, since most of the treatment modalities are conceived in the form of implant-supported or implant-retained overdentures. Thus, the role of oral stereognosis cannot be underestimated.

**Conclusion**

This review of the literature indicates the following:

1. A lack of standardization exists in tests for the shape of objects and recognition of forms. In addition, future examinations should examine the role of particle size;
2. Stereognostic ability diminishes with age (number of correct responses and longer times for recognition);
3. Stereognosis can improve with training;
4. Degree of satisfaction is not related to a high or low oral perception level;
5. The use of complete dentures during the rehabilitation of oral-motor disorders enhances oral sensation;
6. Implant-supported prosthesis provides stereognostic levels near that of natural dentition.

**References**

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