AMERICAN COLLEGE OF PROSTHODONTISTS®

The Effect of Oral Submucous Fibrosis on Oral Stereognostic Ability. A Preliminary Study

Komal G. Ladha, BDS, MDS, & Mahesh Verma, BDS, MDS, MBA

Department of Prosthetic Dentistry, Maulana Azad Institute of Dental Sciences, New Delhi, India

Keywords
Tactile perception; trigeminal nerve; psychophysical techniques.

Correspondence
Komal G. Ladha, Maulana Azad Institute of Dental Sciences, Department of Prosthetic Dentistry, B.S.Z. Marg, New Delhi, Delhi 110002, India. E-mail: komalladha@yahoo.co.in

Previously presented as a paper at the 37th Indian Prosthodontic Society Conference, Thrissur, Kerala, India, November 2009

Accepted November 4, 2010

doi: 10.1111/j.1532-849X.2011.00737.x

Abstract

Purpose: This study aimed at evaluating the effect of oral submucous fibrosis (OSMF) on oral stereognostic ability.
Materials and Methods: The study group comprised 14 patients having OSMF with no tongue involvement or any restriction in tongue mobility; the control group comprised 15 patients free from any oral symptoms. All patients in both groups had at least 26 teeth present and were of ages 20 to 40 years. Oral stereognostic ability was evaluated on the basis of correct recognition responses to test pieces of 12 geometric forms made from raw carrot. Of the 12 test pieces, six were large, and six were small. Test pieces were placed on the dorsum of the tongue near the apex. The test was performed three times by each patient in both groups, and no time limit was set for the identification of the test pieces. Responses were recorded using the three-point scale method. Student's *t*-test was used to calculate significant differences between the means of the two groups. The level of statistical significance was set at 0.05.
Results: The mean of the total score was comparable between the study group and the control group, with no statistical significant difference observed. Test pieces with corners (mainly triangle) were recognized more correctly than those without corners.
Conclusion: The study indicated that the oral stereognostic ability of the study group did not significantly differ from that of the control group.

Oral stereognosis is the neurosensorial ability of the oral mucous membrane to recognize and discriminate the forms of objects in the oral cavity by using the sensation of touch.[1] Oral tactile information is conveyed through the trigeminal nerve to the brainstem.[2] The sensory functions of the trigeminal nerve can be affected by various systemic factors, for example Parkinsonism, cerebrovascular stroke,[3] or diabetic neuropathy, or by local factors, for example trauma, infection, or surgery.[4] To assess oral tactile function, various psychophysical techniques have been developed,[2] including oral stereognosis.

Grossman[5] was the first to use a stereognostic test orally to assess oral perception. Henkin conducted a study to evaluate the correlation between oral stereognosis and scleroderma.[6] He found that patients with scleroderma required significantly more time than normally required to perform oral localization tests. The histological features of scleroderma are closely similar to those of oral submucous fibrosis (OSMF)—a precancerous condition of the oral cavity, which is very common in the Indian subcontinent and is also known as idiopathic scleroderma of the mouth.[7]

OSMF is a chronic mucosal condition characterized by mucosal rigidity of varying intensity due to fibroepithelial transformation of the juxtaepithelial connective tissue layer. It is characterized by the progressive build-up of constricting bands of collagen in the cheeks and adjacent structures of the mouth, which can severely restrict mouth opening and tongue movement and cause problems with speech and swallowing. These changes might have an influence on the oral perception and in adapting to a prosthesis placed in the oral cavity.

A pilot study was planned under the hypothesis that subjects with OSMF might have decreased oral stereognostic ability when compared with normal subjects. Decreased oral stereognostic ability should indicate that the subject does not receive full and accurate information about the condition of his/her mouth. This might be associated with the patient's tolerance to minor mechanical errors in denture construction. Successful prosthetic therapy is dependent on appropriate sensory-motor relationships; therefore, patients with decreased oral perception might have difficulty in properly controlling their removable dentures in the oral cavity.

No data were available from the Indian subcontinent to validate this hypothesis. Because of limitations in time and availability of patients who would meet the specific inclusion criteria of the study, it was proposed to carry out this study with a minimum of 15 patients in each group.

The present case-control study aimed at evaluating the effect of OSMF on oral stereognostic ability.

Materials and methods

Selection of patients

For the study group, 14 volunteer patients with OSMF who reported in the Outpatient Department of Oral Medicine and Radiology Department, Maulana Azad Institute of Dental Sciences, New Delhi, India, were selected. The control group comprised 15 patients free from any oral symptoms. Informed written consent was obtained from all patients prior to the commencement of the test procedure, and the protocol was approved by the Institutional Ethical Committee of the Maulana Azad Institute of Dental Sciences, New Delhi, India. All 29 subjects were between the ages of 20 and 40 years and included men and women. They had no neuromuscular problems or any other precancerous lesions and exhibited 26 or more contiguous teeth.

The OSMF patients in this study presented with the symptoms of burning sensation, presence of palpable fibrotic bands in buccal mucosa, retromolar pad areas, and soft palate and had mouth opening of $\geq$15 mm with a maximum of 38 mm; however, no tongue involvement was present. The patient's history and the presence of palpable fibrotic bands were considered as clinical diagnostic criteria for this condition. Biopsy was subsequently performed to confirm the diagnosis of OSMF. The test procedure was carried out after healing of the biopsy site and prior to the commencement of treatment of the patient.

Design of test pieces

The oral stereognostic ability tests were conducted according to the method suggested by Hirano et al.[8] Twelve test pieces of various shapes were used, including circles, ellipses, semicircles, squares, rectangles, and triangles of both large ($12 \times 12 \times 3$ mm^3) and small ($8 \times 8 \times 2$ mm^3) sizes. The six shapes for the respective sizes were grouped into three pairs of similar forms, that is circles and ellipses, squares and rectangles, and triangles and semicircles. The test pieces were made of raw carrot[9] instead of acrylic resin or metal to permit free oral manipulation without any discomfort and to avoid the risk of test piece aspiration. The different test pieces were prepared with an acrylic sheet in which the shapes were cut using a computerized laser machine. Each patient was informed of the nature of the experimental procedure, and a chart showing the enlarged forms of the 12 test pieces was used as an aid for identification.

Method of testing

The test was carried out in a quiet environment where the patient was seated comfortably in an upright position. All stimuli to be used orally were out of the patient's view at all times, with no information about the shapes or the number of test pieces. The test pieces were presented in a random order. The same order was maintained for all patients. During the testing session, the patients were first asked to close their eyes; the examiner then placed the stimulus on the patient's tongue and instructed him/her to manipulate it freely in the oral cavity. The patients pointed to the matching picture on the chart as soon as they recognized the shape. No time limit was set for the identification of the test pieces. The test was performed three times by each patient in both groups.

Scoring

Different procedures are followed for recording stereognostic ability. In general, three types are reported: a three-point scale, average identification of errors, and average identification time. For the present study, the three-point scale method was used. This method consists of classifying the responses as correct, partially correct, or incorrect.

A correct response was given a score of 2; an incorrect response within the same group of geometric forms was given a score of 1, that is, a partially correct response; and an incorrect response of a dissimilar form was given a score of 0.[10] For example, when a circle form was presented, the correct answer of 'circle' was given a score of 2, that of an 'ellipse' was given a score of 1 (same group), and the other four answers were given a score of 0.

For each patient, a score was calculated for each set and as a total. The possible range for each set of stimuli was 0 (all incorrect) to 24 (all correct). The total score was calculated as the sum of the scores for the three sets with a possible range of 0 (all incorrect) to 72 (all correct)

Statistical analysis

The distributions of age and gender for the study and control groups were compared using chi-square test. The total scores in the two groups were compared using an unpaired *t*-test, since the data were normally distributed and satisfied the assumption of homoscedascity. The level of statistical significance was set at 0.05.

Results

The sex-specific distribution was comparable between the two groups ($p = 0.122$). There was no significant difference ($p = 0.521$) in age distribution, and the mean age was also comparable ($p = 0.157$) between the two groups.

Errors in test piece identification

Tables 1 and 2 show the errors in test piece identification in the study and control groups. In both groups, the ellipse was the most often incorrectly identified piece [study group, 28 (33%); control group, 20 (22%)]. Triangle was never incorrectly identified in the study group and only once in the control group, indicating that test pieces with corners were easier to identify or perceive than those without corners.

Oral stereognostic ability score

Table 3 shows the mean of total score and the mean scores of sets (1st/2nd/3rd) in the study and control groups. There was no statistically significant difference in the total score ($p = 0.142$) between the two groups. Since there was no significant difference between the total scores, the mean scores of the two groups for the separate sets of stimuli were not compared.

Table 1 Errors in test piece identification in the study group

Actual test piece	Identified as						Total mis-identifications (outside the pair)	Total (14 patients × 3 times × 2 sizes)
	Rectangle	Square	Ellipse	Circle	Semicircle	Triangle		
Rectangle	70 (83%)	9 (11%)	1	0	1	3	5 (6%)	84
Square	7 (8%)	69 (82%)	0	4	2	2	8 (10%)	84
Ellipse	4	2	56 (67%)	0 (0%)	21	1	28 (33%)	84
Circle	0	1	8 (9.5%)	71 (84.5%)	4	0	5 (6%)	84
Semicircle	7	0	1	0	73 (87%)	3 (3.5%)	8 (9.5%)	84
Triangle	0	0	0	0	0 (0%)	84 (100%)	0	84

Percentages in parentheses were calculated based on the actual test pieces.

Table 2 Errors in test piece identification in the control group

Actual test piece	Identified as						Total mis-identifications (outside the pair)	Total (15 patients × 3 times × 2 sizes)
	Rectangle	Square	Ellipse	Circle	Semicircle	Triangle		
Rectangle	87 (97%)	0 (0%)	0	0	2	1	3 (3%)	90
Square	1 (1%)	80 (89%)	0	0	0	9	9 (10%)	90
Ellipse	1	1	69 (77%)	1 (1%)	18	0	20 (22%)	90
Circle	0	2	4 (4%)	80 (89%)	2	2	6 (7%)	90
Semicircle	1	0	1	0	87 (97%)	1 (1%)	2 (2%)	90
Triangle	1	0	0	0	0 (0%)	89 (99%)	1 (1%)	90

(Percentages in parentheses were calculated based on the actual test pieces)

Table 3 Mean scores of the study and the control group

Score	Oral submucous fibrosis (study) group N = 14 Mean ± Std. Deviation	Control group N = 15 Mean ± Std. Deviation	*p*-value
Total	62.21 ± 7.2	65.93 ± 5.9	0.142
1st set	19.36 ± 3.1	21.00 ± 2.6	
2nd set	21.36 ± 3.1	22.60 ± 1.6	
3rd set	21.50 ± 2.5	22.33 ± 2.5	

To summarize the results:

- Only one subject (control group) identified all the test pieces correctly, while no subject failed completely, suggesting that the difficulty of the test was appropriate.
- Test pieces with corners (mainly triangle) were recognized more correctly than those without corners.

Discussion

The purpose of this study was to evaluate the levels of oral perception in patients with OSMF and to relate this method to clinical implications in the treatment of prosthetic patients. All investigators in the field of oral sensation and perception agree that the most promising method of evaluation is the oral stereognostic test.

The present study results showed that the difference in oral stereognostic ability between the study and control groups was not statistically significant, indicating that patients with OSMF could perceive test pieces as well as the patients in the control group. This suggests that although the study group average total score was lower than the control by 3.7 units, this difference was not statistically different from zero.

The OSMF patients in this study had no involvement of the tongue or any restriction in tongue movement. Receptors in the tongue mucosa play a primary role in oral perception, which could be the likely reason for the result obtained.[11] Further studies are suggested in patients having advanced OSMF with tongue involvement. The buccal mucosa did not seem to have a substantial role in oral perception because, despite the presence of fibrotic bands, the oral stereognostic scores were not significantly affected.

The present study results also showed that test pieces with corners were identified with much ease in both groups; however, test pieces with rounded corners, especially ellipses, were most often incorrectly identified (as semicircle) in both groups. Therefore, it is suggested that sharp corners and abrupt changes in the contours must be avoided in prostheses, as they would be easily perceived by and cause discomfort to the patient.

The use of carrot as test piece material in the study was advantageous because it did not create any feeling of a foreign object, and the risk of accidental aspiration by the patient was also avoided. Dentulous patients were selected for this study, because previous studies have concluded that teeth play an important role in oral stereognosis, and that oral perception is reduced in edentulous patients as compared to dentulous patients.[12]

Hence, from the present study findings, we can conclude the following:

- The sensory ability of the OSMF patients (without involvement of the tongue) in this study was not compromised when compared with the control group.
- The buccal mucosa does not seem to have a substantial role in oral perception because, despite the presence of fibrotic bands, the oral stereognostic scores were not significantly affected.
- Sharp corners and abrupt changes in contours must be avoided in prostheses, as they would be easily perceived by the patient, causing discomfort.

Conclusion

A pilot study with 15 patients each in the study and control groups was proposed to test the hypothesis that the study group (OSMF) might have decreased oral stereognostic ability when compared with the control group; however, the total number of patients included in the study was only 29 (15 control group patients, 14 study group patients). On the basis of the findings of this pilot study, a further study with an increased sample size should be carried out to validate the findings of this study.

References

1. Rossetti PHO, Bonachela WC, Nunes LMO: Oral stereognosis related to the use of complete dentures. Int J Oral-Med Sci 2004;2:57-60
2. Jacobs R, Serhal CB, van Steenberge D: Oral stereognosis: a review of the literature. Clin Oral Investig 1998;2:3-10
3. Pow EH, Leung KC, McMillan AS, et al: Oral stereognosis in stroke and Parkinson's disease: a comparison of partially dentate and edentulous individuals. Clin Oral Investig 2001;5:112-117
4. Ahmed B, Hussain M, Yazdanie N: Oral stereognostic ability: a test of oral perception. J Coll Physicians Surg Pak 2006;16:794-798
5. Grossman RC: Methods for evaluating oral surface sensation. J Dent Res 1964;43:301
6. Henkin RI: Manual and oral stereognosis in normal volunteers and patients with various abnormalities of taste and olfaction. In Bosma JF (ed): Second Symposium on Oral Sensation and Perception. Springfield, IL, Charles C Thomas, Publisher, 1970
7. Ghom AG: Oral premalignant lesions and conditions. In Ghom AG (ed): A Textbook of Oral Medicine (ed 1). New Delhi, Jaypee Brothers Medical Publishers, 2005, pp. 179-186
8. Hirano K, Hirano S, Hayakawa I: The role of oral sensorimotor function in masticatory ability. J Oral Rehabil 2004;31:199-205
9. Garrett NR, Kapur KK, Jochen DG: Oral stereognostic ability and masticatory performance in denture wearers. Int J Prosthodont 1994;7:567-573
10. Siirila H, Laine P: The relation of periodontal sensory appreciation to oral stereognosis and oral motor ability. Suom Hammaslaak Toim 1967;63:207-211
11. Kawamura Y: Recent concepts in physiology of mastication. In Staple PW (ed): Advances in Oral Biology, Vol 1, New York, Academic Press, Inc, 1964
12. Litvak H, Silverman SI, Garfinkel L: Oral stereognosis in dentulous and edentulous subjects. J Prosthet Dent 1971;25:139-151