Clinical Study on the Correlation Between Psychogenic Dental Prosthesis Incompatibility, Oral Stereognosis, and the Psychologic Diagnostic Tools SCL- 90-R and CES-D

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Purpose: The objective of this study was to use an oral stereognosis test to evaluate possible intraoral/sensorimotor causes in patients with a psychologic diagnosis of psychogenic prosthesis incompatibility, and to evaluate possible correlations between oral stereognosis and the psychologic diagnostic tools Symptom Checklist-90-R (SCL-90-R) and Center of Epidemiological Studies Depression Scale (CES-D). ***Materials and Methods:*** The study cohort comprised 83 patients with complete dentures fabricated according to a standardized protocol. Twelve patients diagnosed with psychogenic prosthesis incompatibility (11 women, 1 man) using the SCL-90-R and CES-D scales in a previous study and a group of 24 randomly selected control subjects (14 women, 10 men) underwent an oral stereognosis test with 10 neutral-tasting plastic test specimens with a maximum edge length of 8 mm in 2 test cycles. ***Results:*** The results revealed no significant differences in oral stereognostic ability between patients with diagnosed psychogenic dental prosthesis incompatibility and the control patients. The patients in the test group expressed clear dissatisfaction with their dentures. No correlation was found between oral stereognostic ability and the SCL-90-R or CES-D values. ***Conclusions:*** This study is the first to use oral stereognosis tests for patients with psychologically diagnosed psychogenic dental prosthesis incompatibility. The diagnosis of psychogenic prosthesis incompatibility by the SCL-90-R and CES-D scales is affirmed by the lack of correlations between the functional/anatomic aspects of oral stereognostic ability, psychologic diagnostic tools, and the clinical picture of psychogenic prosthesis incompatibility. Thus, psychogenic prosthesis incompatibility can be classified more explicitly as a psychosomatic disorder. *Int J Prosthodont 2007;20:538–545.*

Temporomandibular disorders and pain,[1,2] parafunctions such as bruxism,[2,3] dental fear,[4, 5] severe gagging,[1,6,7] burning sensations in the tongue and/or mouth,[8–10] and prosthesis incompatibility[1,11] are complaints in odontology that may be related to somatoform or psychologic disorders. In the recent past, the 5 diagnostic criteria for psychosomatic disorders described by Marxkors and Müller-Fahlbusch were the only diagnostic tools[12,13] available to evaluate the possible impact of psychologic factors (psychogenic) in dental prosthesis incompatibility. These criteria were *(1)* a clear discrepancy between clinical findings and the patient's condition; *(2)* a diagnosis ex non iuvantibus, ie, therapy procedures useful for disorders with organic causes are unsuccessful; *(3)* shifting complaints; *(4)* inclusion of personality (teeth or a dental prosthesis play an extremely important role in the everyday life of the patient); and *(5)* concordance of the complaints with situation and biography, eg, the outbreak of the disorder is associated with certain biographical events. A diagnosis requires concordance with at least 3 of the given criteria. Because this test is highly nonspecific, the diagnosis of psychogenic prosthesis incompatibility can only be assessed as an initial presumptive diagnosis.

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In 2005, psychologically validated and standardized questionnaires were used to evaluate psychogenic prosthesis incompatibility for the first time.[14] The study, based on the Symptom Check List–90-R (SCL-90-R) described by Derogatis et al[15–17] and the Center of Epidemiological Studies Depression Scale (CES-D),[18,19] demonstrated the clinical utility of these tests in diagnosing psychogenic prosthesis incompatibility. Patients with suspected psychogenic prosthesis incompatibility and nonadaption to their new prosthesis showed statistically significant differences in the CES-D cumulative value and in the values of the SCL-90-R Global Severity Index (GSI) and Positive Symptom Distress Index (PSDI) compared to controls who had adapted to their new prosthesis. No significant difference was found in the number of self-reported distress symptoms (positive symptom total [PST]) of the SCL-90-R.

Initial adaptation problems are eliminated after a period of 6 months. Psychogenic prosthesis incompatibility was defined by Marxkors as the failure to adapt to a dental prosthesis 6 or more months after incorporation.[20] The phrase "adaptation to a dental prosthesis" refers to muscular synergy, habituation to the restoration, trainability, and stereognostic perception.[21]

Stereognostic perception, or the patients' 3-dimensional tactile intraoral differentiation capability, can be assessed with oral stereognosis tests. Stereognosis tests are performed using test specimens to determine the extent to which patients are able to distinguish shapes and surface structures. The maximum innervation density of mechanosensors can be found in the tongue, especially the tip of the tongue. This guarantees both overlapping innervation sites and good steric perception.[22] Two thirds of the mechanical receptors in the tongue are equivalent to rapidly adapting receptors, and one third have been identified as slowly adapting receptors. Tongue structures contain no Pacinian corpuscle receptors.[23] Oral stereognosis has been assessed in the context of dental prosthesis incompatibility in several studies examining a number of variables.[24–30]

In one study, 12 variously shaped test pieces milled from 1.5-mm- and 4-mm-thick acrylic plates were used.[27,28] The maximum edge length was 9 mm. For identification, the subjects received an illustration of 20 possible shapes, including the 12 test pieces, in random order. Comparable studies were performed by Landt and Fransson[31] and Litvak et al[26]; however, in contrast to the materials used in other studies, Litvak et al used metal alloy shapes. Smink[21] developed an oral stereognosis test using 8 different plastic specimens with an edge length of 8 mm. The specimens were presented to the subjects on a board enlarged 8-fold so that the test specimens did not have to be named or described. This procedure was used as the basis for the design of the present study.

The first aim of this clinical study was to evaluate the stereognostic abilities of patients who were psychologically diagnosed with psychogenic prosthesis incompatibility. The following hypotheses were tested: *(1)* the stereognostic ability of patients with diagnosed prosthesis incompatibility does not relate to the subjective experiences with their dentures (speaking, esthetics, chewing, and swallowing); *(2)* the stereognostic ability of patients with diagnosed prosthesis incompatibility is comparable to patients who adapt to their dentures; *(3)* learning effects do not affect stereognostic ability; and *(4)* the surface structure and shape of test specimens correlate with the stereognostic ability of patients with diagnosed prosthesis incompatibility. Test specimen surfaces and structures that are comparable to shortcomings in the surface/ structure of the dental prostheses (eg, polish) may be more easily identified by these patients than by "healthy" controls.

The second aim was to validate the psychologic tools SCL-90-R and CES-D by using oral stereognosis tests for patients with psychogenic prosthesis incompatibility. This was accomplished by continuing a previous study that validated the SCL-90-R and CES-D scales,[14] using exactly the same patients and limitations, and adding the parameter of oral stereognosis.

Materials and Methods

Subjects

Eighty-three completely edentulous patients provided with a complete denture in the maxilla and mandible according to a standardized protocol who took part in the previous study by Eitner et al[14] were included in this continuing investigation. The test group comprised 12 patients (11 women, 1 man; average age: 69.1 years) who had not adapted to their dentures after a 6-month period and were diagnosed as having psychogenic prosthesis incompatibility using the SCL-90-R and CES-D scales. Twenty-four of the remaining 71 patients who had adapted to their prostheses were randomly selected as the control group. For the comparison of possible gender-related differences, the control group was composed of a comparable number of "healthy" women and men; therefore, every third patient of the 71 "healthy" patients was selected for the control group (14 women, 10 men; average age: 68.2 years). The remaining 47 patients were not investigated. Parameters including appropriate function and esthetics of the prostheses and the absence of intraoral pathologic findings, health-related problems, or medications were the same as described in the previous study.[14]

Patients in the test group complained about discomfort resulting from lesions, burning of the oral mucosa, taste disorders, and pain and fulfilled at least 3 of

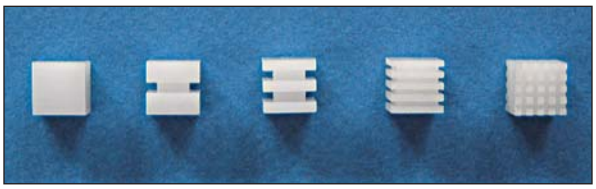

Fig 1 Test specimens: variation in surface.

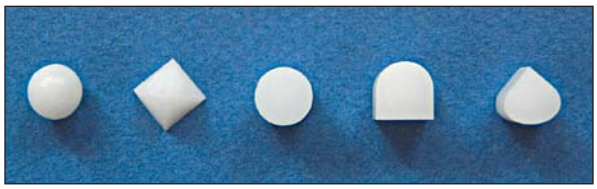

Fig 2 Test specimens: variation in shape.

Fig 3 Enlarged test specimens: variation in surface.

Fig 4 Enlarged test specimens: variation in shape.

the 5 diagnostic criteria for a psychosomatic disorder. The level of dissatisfaction with the dental prosthesis was evaluated with regard to speaking, esthetics, chewing, and swallowing. Independent experts (dental clinicians and dental technicians) who were not involved in the treatment of the 83 patients performed the investigations based on the above-mentioned parameters and a standardized evaluation/examination protocol.

The study protocol was approved by the Ethics Committee of Friedrich-Alexander-University of Erlangen-Nuremberg, Germany, and all patients gave written consent to participate in the study.

Oral Stereognosis

Ten different test specimens, all of which were formed from a basic cube shape with an edge length of 8 mm, were used to measure oral stereognosis ability. Five of these test specimens differed in surface structure, showing a smooth surface, 1, 2, or 4 circumferential grooves, or a chessboard pattern on 2 opposing sides (Fig 1). The other 5 test pieces differed in shape, showing one of the following designs: a ball, pyramid, cone, shape of a Romanesque window, or shape of a teardrop (Fig 2). For maximum precision, test specimens were industrially manufactured (Constructions, Jürgen Rahmstorf) from hardened plastic material to a degree of precision of 0.75 mm.

Specimen resistance to disinfectants was a prerequisite. To preclude the necessity for a verbal description of the test specimens for each patient, wooden replicas that were 5-fold larger but otherwise identical to the test specimens in shape and structure were presented to the patients for parallel identification (Figs 3 and 4).

Procedures

The subjects' task was to identify the test specimens in 2 independent test cycles. The sequence of the specimens was random. All test specimens were stored in an opaque glass and taken out (using tweezers) by the investigator without any chance of eye contact for the investigator or patient. At no time did the subjects have the opportunity to see the specimens used in the test or the sequence in which they were tested.

After placement of a specimen on the patient's tongue, the patient was asked to identify the specimen and point at the corresponding oversized wooden piece. The time it took for the patient to identify each specimen was measured. Once the test specimen was identified, it was placed in an opaque glass containing Sterilium (Bode Chemie) without the patient touching or seeing it. The patient was not informed of the results of his or her attempt to identify the piece.

Before the second test cycle (analogous to the first) was carried out, the specimens were rinsed under running water to obtain a neutral taste. In the test evaluation, a score was obtained for each patient. A patient's stereognosis score "S" was based on a single cycle and on the number of correctly identified specimens "N" (maximum of 10) divided by the time "T"(in seconds) needed for identification and multiplied by the factor "F" (100): $S = N \times F / T$" for each cycle. For example, a patient who identified 8 specimens in 137.5 seconds had a score of $(8 \times 100 / 137.5) = 5.8$. An average split of both scores generated the total score.

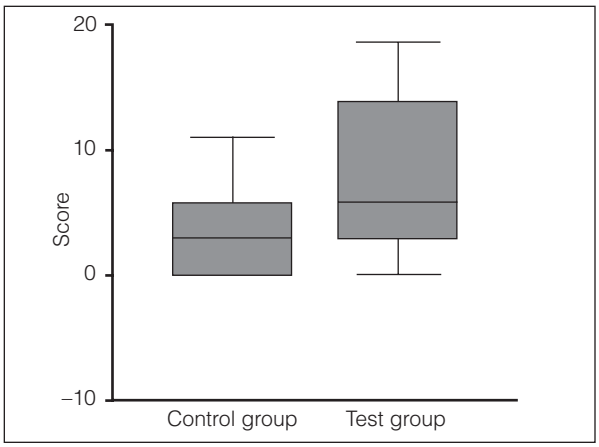

Fig 5 Stereognosis scores in the control and test groups for the cube with 4 grooves test object.

Table 1 Comparison of the Mean Stereognosis Test Scores for the Individual Specimens Between the Control and Test Groups

Test specimen	*P*
Ball	.753
Pyramid	.608
Cone	.753
Romanesque window	.804
Teardrop	.804
Cube	.987
Cube with 1 groove	.934
Cube with 2 grooves	.562
Cube with 4 grooves	.032
Cube with chessboard pattern	.156
Test 1 score	.146
Test 2 score	.436
Total score	.436

Data Evaluation

Along with descriptive statistics, the Mann-Whitney *U* test was used to compare different score values between the 2 groups, and the Spearman correlation coefficient (r_s) was applied. Results with a value of $P < .05$ were regarded as significant. A low correlation coefficient was defined by values up to 0.5, a medium correlation coefficient by values up to 0.7, and a high correlation coefficient by values up to 0.9. Values above 0.9 were considered to have a very high correlation.

Results

Patients with psychogenic prosthesis incompatibility found their dental prostheses ill functioning and were dissatisfied with their speaking (40%), chewing (61%), and swallowing ability (38%). Of this group, 26% of the subjects stated that their prosthesis was inadequate in terms of shape, color, and position.

Comparing the mean stereognosis test scores for the individual specimens between the control and test groups, the only significant difference ($P = .032$) was found in the identification of the cube with 4 grooves test specimen (Fig 5). The other 9 test specimens were identified equally well by the control and test groups (Table 1).

Independent of grouping, the test results were evaluated in an attempt to determine a correlation between the identification of individual figures. A correlation between 8 specimens and the cone specimen was found: 7 specimens with a Spearman coefficient above 0.5 and 1 just below 0.5. No correlation was found between the cube with 2 grooves and cone specimens.

Whether or not a learning effect occurs during the stereognosis test was assessed through the 2 test cycles. In the test group, a mean stereognosis score of 6.92 was obtained in the first cycle. In the second cycle, a score of 7.14 was achieved. Patients in the control group achieved a score of 5.57 in the first cycle and 6.5 in the second cycle. The scatter diagram in Fig 6 clearly shows that those who faired well in the first test cycle were capable of doing as well in the second test cycle ($r_s = 0.888$). A greater learning effect was found in the control group than in the test group, and the control group performed better in the second test cycle.

No statistical correlation was found between the stereognosis ability of the patients and their subjective feelings regarding their prostheses in terms of speaking, chewing, and swallowing ability, or the subjective prosthesis qualities of shape, color, and position. The oral stereognosis abilities were also independent of gender.

In the Eitner et al study,[14] which included the same patient sample, statistically significant differences for the GSI (0.024) and PSDI (0.049) on the SCL-90-R scale and the CES-D cumulative value (0.015) were found between the test and control groups. Based on these significant differences, a scatter diagram was drawn for each category to demonstrate possible correlations between the stereognosis scores on the first and second test cycles and the CES-D cumulative value, GSI (psychogenic distress level), and PSDI (intensity of symptoms). No correlation was found for the CES-D cumulative value expressing the depressive distress level and oral stereognosis scores ($r_s = 0.126$) (Fig 7).

The same is true for the GSI and PSDI of the SCL-90-R ($r_s = 0.136$ and 0.204, respectively). The corresponding scatter diagrams showed that no correlation could be found between the oral perception ability (stereognosis scores) and GSI (Fig 8) or the oral perception ability and PSDI (Fig 9).

In the Eitner et al study,[14] no significant difference between the test and control groups for the PST of the

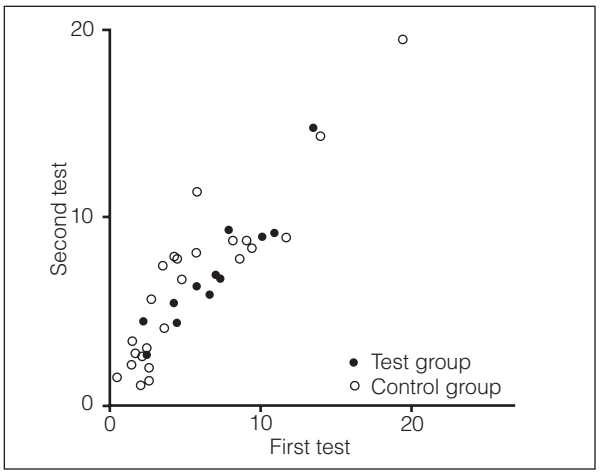

Fig 6 Correlation between the stereognosis scores in the first and second test cycles.

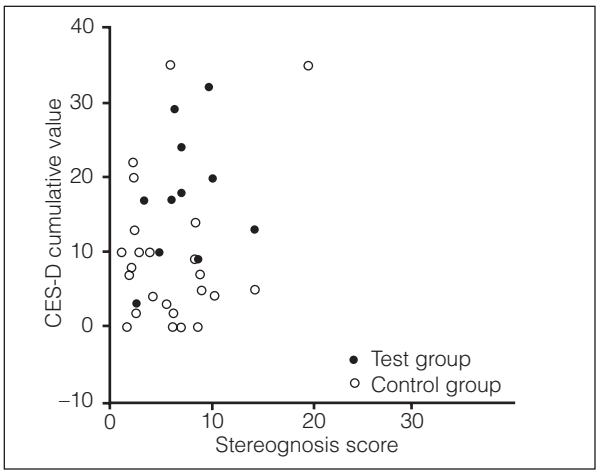

Fig 7 Possible causal connection between the CES-D cumulative value and the stereognosis scores of the first and second test cycles.

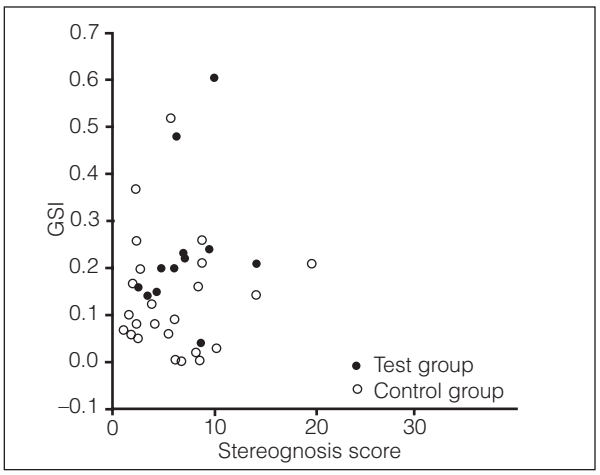

Fig 8 Possible causal connection between the GSI value and the stereognosis scores of the first and second test cycles.

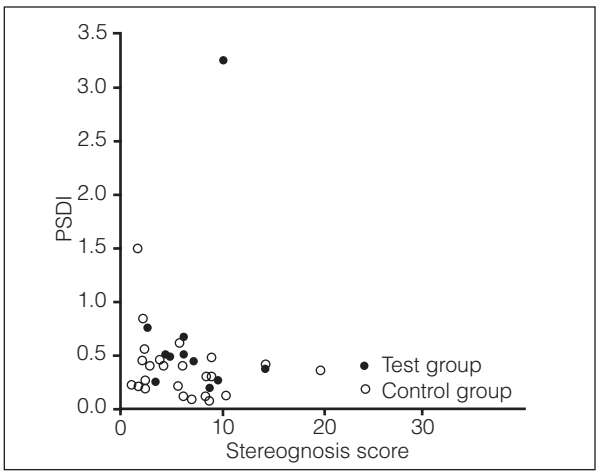

Fig 9 Possible causal connection between the PSDI value and the stereognosis scores of the first and second test cycles.

SCL-90-R was found. Because of this lack of significance, no correlation could be expected between the oral stereognosis scores in the first and second test cycles and the PST. A correlation coefficient of 0.128 affirms this anticipation.

Discussion

Eitner et al[14] demonstrated for the first time that the psychologic questionnaires SCL-90-R and CES-D may be appropriate tools for diagnosing psychogenic prosthesis incompatibility. The present investigation is a continuation of the Eitner et al study. In the present study, the effectiveness and practicability of the SCL-90-R and the CES-D to diagnose psychogenic prosthesis incompatibility were evaluated using an oral stereognosis test. No difference in oral stereognosis ability was found between patients with psychogenic dental prosthesis incompatibility and patients who had adapted to their dental prostheses. The same was true for patients of different gender.

None of the patients in the current study had difficulties with the stereognosis test itself. In spite of this result, the patients with psychogenic dental prosthesis incompatibility felt somewhat restricted in their chewing, speaking, and swallowing, even though their results in the stereognosis test were nearly identical to those of the control group. Patients in the control and test groups identified almost the same number of specimens in the same amount of time. The time required

for specimen identification was included in the present stereognostic score[32,33] because the score is influenced by the fit and design of the prosthesis. Both fit and design can reduce the mobility of the tongue, thereby reducing oral perception abilities and increasing the identification time.

The only object identified far better by the test group than by the control group was the cube with 4 grooves. Thus, patients with psychogenic dental prosthesis incompatibility were able to perceive tiny grooves with a width of 0.8 mm better than the patients from the control group. Relative to a dental prosthesis, these 0.8-mm-wide grooves are comparable to the transition from the acrylic base of a denture to the prosthetic tooth or the surface finish. For the other 9 test specimens, no difference in oral perceptiveness was found between the test and control groups. These results are in accordance with the findings of Müller et al,[28] Müller and Hasse-Sander,[30] Smink,[21] and van Aken et al.[34,35] However, the tests in those studies were performed within weeks following delivery of the prosthesis,[21,28,30] and thus cannot be directly compared with the present study, which allowed a 6-month adaptation period.

Marxkors et al[20] defined the 6-month period after incorporation of a dental prosthesis as the earliest time point at which a diagnosis of failure to adapt to a dental prosthesis could be determined. The intention was to rule out functional, esthetic, and even psychogenic adaptation difficulties in the initial phase. One criterion for adaptation to restorations is the patient's stereognostic ability.[21] The patients in this study continued to have problems with muscular synergy, habituation to the prosthesis, trainability, and prosthesis adaptation.[21] Thus, a stereognostic test should only be performed 6 or more months after incorporation of the prosthesis. Time has not been addressed in other studies on (psychogenic) dental prosthesis incompatibility. In the present study, this important criterion for psychogenic dental prosthesis incompatibility was used to compare the stereognostis ability of patients with and without psychogenic dental prosthesis incompatibility. Marxkors and Müller-Fahlbusch[12] found that the number of patients with psychogenic prosthesis incompatibility at university departments of odontology is high. The majority of these patients are female (82%). Results from the present study (90% women) and from Lesse[36] demonstrate comparable female-to-male ratio imbalances, which cannot be explained by the results of the present study due to the lack of gender-related differences in oral stereognosis abilities. The strongest representation of psychogenic prosthesis incompatibility (75%) was found in patients aged 60 to 80 years. Denture wearers tend to be older patients, who are known to have reduced oral stereognosis ability compared to younger age groups.[37]

The present results disagree with those of Berry and Mahood,[29] Litvak et al,[26] and Chauvin and Bessette,[38] who showed that patients with dental prosthesis incompatibility have increased oral sensitivity compared to subjects in "healthy" control groups. However, these studies were performed less than 6 months after incorporation of dentures, and thus comparison of their results with those of the present study is limited. The patients in the present study did not show adaptation problems within the first 6 months after incorporation, modified neuroanatomy, physiology that affected oral stereognosis, or ill-functioning prostheses. However, these patients did fulfill at least 3 diagnostic criteria for prosthesis incompatibility, and were successfully diagnosed with the SCL-90-R and CES-D to suffer from psychogenic prosthesis incompatibility. Therefore, these patients should be regarded as psychosomatically ill.

The present study revealed a significant correlation between the results of the first and second stereognosis test cycles, as did the study by Smink,[21] in that no further learning took place. For future studies, the cone test specimen may be removed due to the correlation with the other specimens. This would slightly reduce the test time. In contradiction of Litvak et al,[26] who used test specimens made of metal alloy, the authors of the present study used and recommend a plastic material with a neutral taste.

The patients with a psychosomatic disorder reported far greater dissatisfaction with their dentures than those in the control group. The dissatisfaction related mainly to chewing and phonation, "symptoms" that a dental clinician is likely to regard initially as functional defects rather than psychogenic disorders. Eitner et al[14] demonstrated a statistical correlation between the scales "somatization," "obsessiveness," and "tentativeness in social contact" of the SCL-90-R and the subjective dissatisfaction symptoms "chewing" and "phonation ability." Such correlations were not found between these subjective dissatisfaction symptoms and the stereognosis scores evaluated in this study.

Also, no interaction could be found between a distinctive depressive distress level, expressed as a high CES-D cumulative value, and a low or high stereognosis score. The test group was not affected by the depressive distress in the identification of the test specimens, ie, stereognostic abilities do not influence the CES-D and therefore do not influence psychogenic prosthesis incompatibility. The same is true for the GSI, PSDI, and PST of the SCL-90-R.

Conclusions

In reference to the initial aims and hypotheses, it can be summarized that dental causes for prosthesis incompatibility were ruled out as much as possible using oral stereognosis tests. Patients diagnosed with psy-

chogenic prosthesis incompatibility by the SCL-90-R and CES-D had similar stereognosis abilities and scores to the control group.

The stereognostic ability of patients diagnosed with prosthesis incompatibility does not relate to subjective denture experiences, is not affected by learning effects, and could only be correlated with the surface structure and shape of test specimens (and prostheses) regarding tiny grooves. These results support that the CES-D and SCL-90-R scales are suitable for diagnosing psychogenic prosthesis incompatibility.

Considering the results of this study and the previous study,[14] the following checklist can be recommended for evaluating patients with suspected (psychogenic) prosthesis incompatibility: *(1)* careful radiologic and clinical examinations of the craniomandibular area, including the muscles, teeth, and hard and soft tissues; *(2)* examination of the prosthesis, especially the grooves and edges and the surface polish; and *(3)* assessment of the patient's general health and medications, because systemic disorders must be treated by specialists.

When pathologic diagnostic findings can be excluded and the restoration is both functionally and esthetically adequate, the following procedures can be initiated 6 months after incorporation of the prosthesis: *(1)* assessment of the 5 diagnostic criteria for psychosomatic disorders[12,13]; *(2)* in reference to the correlation between the CES-D with the GSI and PSDI of the SCL-90-R, use of the CES-D is recommended for diagnosing psychogenic prosthesis incompatibility; *(3)* when all observations and physical examinations suggest a psychosomatic disorder, consultation or cooperation with a psychotherapist may be recommended; and *(4)* the dental clinician should avoid complying with unnecessary requests to repeatedly "fix" a supposedly ill-functioning prosthesis.

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References

1. Newton AV. The psychosomatic component in prosthodontics. J Prosthet Dent 1984;52:871–874.
2. Winocur E, Emodi-Perlman A, Finkelstein T, Sharabi-Ventura Y, Gavish A. Do temporomandibular disorders really exist [in Hebrew]? Refuat Hapeh Vehashinayim 2003;20:62–68, 82.
3. Shapiro S, Shanon J. Bruxism as an emotional reactive disturbance. Psychosomatics 1965;6:427–430.
4. McGrath C, Bedi R. The association between dental anxiety and oral health–related quality of life in Britain. Community Dent Oral Epidemiol 2004;32:67–72.
5. Shipp JR. Psychosomatics and the fear of dentistry. J Mass Dent Soc 1971;20:101–102.
6. Conny DJ, Tedesco LA. The gagging problem in prosthodontic treatment. Part I: Description and causes. J Prosthet Dent 1983;49:601–606.
7. Neumann JK, McCarty GA. Behavioral approaches to reduce hypersensitive gag response. J Prosthet Dent 2001;85:305.
8. Trikkas G. Further psychiatric considerations of glossodynia. Psychosomatics 1998;39:85–87.
9. Femiano F. Damage to taste system and oral pain: Burning mouth syndrome. Minerva Stomatol 2004;53:471–478.
10. Al Quran FA. Psychological profile in burning mouth syndrome. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2004;97:339–344.
11. Golebiewska M, Sierpinska T, Namiot D, Likeman PR. Affective state and acceptance of dentures in elderly patients. Gerodontol 1998;15:87–92.
12. Marxkors R, Müller-Fahlbusch H. Diagnosis of psychosomatic disorders in dentistry [in German]. Dtsch Zahnarztl Z 1981;36:787–790.
13. Müller-Fahlbusch H. Psychopathologische und psychosomatische Aspekte bei der Begutachtung in der Prothetik. In: Der Psychopathologische Fall in der Zahnärztlichen Beratung und Behandlung. Berlin: Quintessenz, 1990:81–85.
14. Eitner S, Wichmann M, Holst S. Pilot study on the psychological evaluation of prosthesis incompatibility using the SCL-90-R scale and CES-D scale. Int J Prosthodont 2006;19:482–490.
15. Derogatis LR, Savitz KL. The SCL-90-R and Brief Symptom Inventory (BSI) in primary care. In: Maurish ME (ed). Handbook of Psychological Assessment in Primary Care Settings. Mahwah: Lawrence Erlbaum Associates, 2000:297–334.
16. Derogatis LR. SCL-90-R: Symptom Checklist-90-R: Administration, Scoring and Procedures Manual. Minneapolis: National Computer Systems, 1994.
17. Derogatis LR, Lipman RS, Rickels K. The Hopkins Symptom Checklist (HSCL): A measure of primary symptom dimensions. In: Pichot P (ed). Psychological Measurements in Psychopharmacology. Basel: Karger, 1974:79–110.
18. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Psychological Measurement 1977;1:385–401.
19. Hautzinger M. The CES-D Scale: A depression-rating scale for research in the general population [in German]. Diagnostica 1988;34:167–173.
20. Marxkors R, Müller-Fahlbusch H, Figgener L. Psychosomatic related prosthesis incompatibility and oral complaints [in German]. Dtsch Zahnarztl Z 1993;48:149–158.
21. Smink L. Tests for oral stereognosis and for oral muscular coordination [in German]. Dtsch Zahnarztl Z 1985;40:842–844.
22. Capra NF. Mechanisms of oral sensation. Dysphagia 1995;10:235–247.
23. Trulsson M, Essick G. Low-threshold mechanoreceptive afferents in the human lingual nerve. J Neurophysiol 1997;77:737–748.
24. Jacobs R, Bou Serhal C, van Steenberghe D. Oral stereognosis: A review of the literature. Clin Oral Investig 1998;2:3–10.
25. Grasso JE, Catalanatto FA. The effects of age and full palatal coverage on oral stereognostic ability. J Prosthet Dent 1979;41:215–219.
26. Litvak H, Silverman S, Garfinkel L. Oral stereognosis in dentulous and edentulous subjects. J Prosthet Dent 1971;25:139–151.
27. Müller F, Hasse-Sandner I, Huplauf L. Studies on adaptation to complete dentures. Part I: Oral and manual ability. J Oral Rehabil 1995;22:501–507.
28. Müller F, Link I, Fuhr K, Utz KH. Studies on adaptation to complete dentures. Part II: Oral stereognosis and tactile sensibility. J Oral Rehabil 1995;22:759–767.

29. Berry DC, Mahood M. Oral stereognosis and oral ability in relation to prosthetic treatment. Br Dent J 1966;120:179–185.
30. Müller F, Hasse-Sander I. Experimental studies of adaptation to complete dentures related to ageing. Gerodontol 1993;10:23–27.
31. Landt H, Fransson B. Oral ability to recognize forms and oral muscular coordination ability in dentulous young and elderly adults. J Oral Rehabil 1975;2:125–138.
32. Landt H. Oral and manual recognition of forms. Part I. Test results based on the test pieces. Swed Dent J 1976;69:15–23.
33. Landt H. Oral and manual recognition of forms. Part II. Test results based on the subjects. Swed Dent J 1976;69:69–77.
34. Van Aken A, Van Waas MA, Kalk W, Van Rossum GM. Differences in oral stereognosis between complete denture wearers. Int J Prosthodont 1991;4:75–79.
35. Van Aken A, De Baat C, Van Rossum GM, Mulder J, Kalk W. Adjustment of complete dentures. Have oral stereognosis and denture quality a predictable value [in Dutch]? Ned Tijdschr Tandheelkd 1996;103:122–124.
36. Lesse S. Atypical facial pain of psychogenic origin. In: Lesse S, Aronson J (eds): Masked Depression. New York: Jason Aronson, 1974.
37. Mantecchini G, Bassi F, Pera P, Preti G. Oral stereognosis in edentulous subjects rehabilitated with complete removable dentures. J Oral Rehabil 1998;25:185–189.
38. Chauvin JO, Bessette RW. Oral stereognosis as a clinical index. N Y State Dent J 1974;40:543–546.

Literature Abstract

Randomized effectiveness study of four therapeutic strategies for TMJ closed lock

This randomized effectiveness study assessed interventions used in the management of individuals with temporomandibular joint (TMJ) disc displacement without reduction with limited mouth opening (closed lock). In a single-blind trial, 106 individuals with TMJ closed lock were randomized among medical management, rehabilitation, arthroscopic surgery with postoperative rehabilitation, or arthroplasty with postoperative rehabilitation. Evaluations at baseline and 3, 6, 12, 18, 24, and 60 months used the Craniomandibular Index (CMI) and Symptom Severity Index (SSI) for jaw function and TMJ pain, respectively. Using an intention-to-treat analysis, no between-group differences at any follow-up period for CMI ($P \geq .33$) or SSI ($P \geq .08$) were observed. Both outcomes showed within-group improvement ($P < .0001$) for all groups. The findings of this study support the authors' strategy of treatment for this group of patients: a protocol beginning with medical management and utilizing more invasive methods only if deemed necessary.

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