ARTIGO

DEPRESSION AND NEUROPSYCHOLOGIC TESTING IN PATIENTS WITH TEMPOROMANDIBULAR DISORDERS

AVALIAÇÃO DA DEPRESSÃO E DE TESTES NEUROPSICOLÓGICOS EM PACIENTES COM DISFUNÇÃO TEMPOROMANDIBULAR

Selaimen, Caio*
Brilhante, Diego**
Grossi, Márcio Lima***

RESUMO

A fim de determinar se existem diferenças neuropsicológicas entre os grupos, o Teste de Aprendizado Verbal da Califórnia (CVLT) e o Teste do Trigrama de Consoantes de Brown-Peterson (CCC) foram usados. A depressão foi avaliada pelo Inventário de Depressão de Beck (BDI). Os testes neuropsicológicos usados não mostraram diferenças estatisticamente significativas entre os três grupos estudados, o que pode ser devido à baixa proporção de pacientes com educação pós-secundária (25%). Entretanto, o grupo experimental (Grupos I e II) mostrou índices de depressão mais elevados (p < 0,05) que o Grupo III. Adicionalmente, o Grupo II mostrou maiores índices de depressão (p < 0,01) que o Grupo I, e não foi encontrada diferença estatística entre os Grupos I e III. Em conjunto, estes resultados sugerem que testes de memória são altamente dependentes do nível educacional e que não podem ser utilizados em larga escala. Do mesmo modo, a depressão desempenha um papel importante não só na etiologia, como também na perpetuação da DTM.

UNITERMOS: temporomandibular disorders; neuropsychological tests; psychological tests; orofacial pain.

SUMMARY

This cross-sectional retrospective study was undertaken with the primary objective of finding if there were neuropsychological differences among responding TMD (Group I), non-responding TMD patients(Group II) as well as controls (Group III). The California Verbal Learning Test (CVLT) and the Brown-Peterson Consonant Trigram Auditory Memory Test (CCC) were used. Depression was assessed by the Beck Depression Inventory (BDI-Portuguese Version). The neuropsychological tests used did not show statistically significant differences among the three groups studied, which might have been due to the low proportion of patients with post-secondary education (20%). However, the experimental group (Groups I and II) showed higher scores on depression (p < 0.05) than Group III. In addition, Group II showed higher levels of depression (p < 0.01) than Groups I and III, and no statiscal differences were found between Groups I and III. Taken in combination, these results suggest that memory tests are highly dependable on the level of education of the participants and cannot be widespreadly used. Also, depression plays a role not only in the etiology, but also in the perpetuation of TMD.

UNITERMS: *disfunção temporomandibular; testes neuropsicológicos; testes psicossociais; dor orofacial.*

* DDS, MS. PUCRS Dental School, Assistant Professor, Department of Prosthodontics.
** DDS, MS. UFRGS Dental School, Assistant Professor, Department of Prosthodontics.
*** DDS, MS, PhD. PUCRS Dental School, Associate Professor, Department of Occlusion.

INTRODUCTION

Temporomandibular disorders (TMD) are characterized largely by facial pain, which is often exacerbated by jaw movements. The most prevalent orofacial pain conditions are musculoskeletal in origin, and of these, TMD are overwhelmingly the most common. Despite the high rate of treatment success, it appears that 2% to 30% of patients do not improve and may be in fact non-responsive to therapy, irrespective of the treatment modality used (Grossi et al.[12], 2001). Usually, this failure has been attributed to a combination of behavioral and psychosocial factors and their interactions with pathophysiologic factors associated with TMD. To date, there is somewhat limited information about those patients who are non-responsive to treatment; because, understandably, most investigations have focused on the development of successful symptom management or characterization of the TMD population (Dworkin et al.[7], 1994; Fricton et al.[8], 1996). However, a recent trend in the literature has been to identify and determine the prevalence of psychosocial factors that may be predictive of a TMD patient's response to treatment. Neuropsychologic testing (eg, attention, learning and memory, motor skills, verbal and non-verbal kills, comprehension, and expression of language) has been used in psychiatric and non-psychiatric populations for objective evaluation of performance for many years (Goldberg et al.[10], 1996; Grossi et al.[12], 2001). These tests have also been used to assess the need for cognitive rehabilitation, to predict the course of psychiatric and non-psychiatric illnesses, and to reduce diagnostic heterogeneity within disorders. A significantly increased prevalence of apparent neuropsychologic deficits (ie, memory, attention, and reaction time deficits) was found in patients whose TMD arose following a motor vehicle accident (MVA), in comparison to patients with non-traumatic or idiopathic TMD. It has also been demonstrated that there are more non-responders in this post-traumatic group(Goldberg et al.[10], 1996). Accordingly, it was suggested that neuropsychologic deficits may either play an integral role in mediating poor treatment outcome or at least may be predictors of poor treatment response in the post-traumatic TMD population (Grossi et al.[12], 2001).

In light of the foregoing, the primary objective of this study was to determine the clinical utility of neuropsychologic tests as predictors of treatment outcome in subjects with idiopathic muscle-related TMD (i.e., no history of trauma). This might allow the assessment of TMD patients prior to management in order to predict those patients where good outcomes might be expected (responding TMD patients, rTMD) versus those where a poor treatment outcome might occur (non-responding TMD patients, nrTMD). Our secondary objective was to determine whether the traditional signs and symptoms of TMD, as well as other relevant psychosocial factors (i.e., depression), could also be used as predictors of treatment outcome in the population.

MATERIALS AND METHODOS

Study Design

The present study is retrospective (case-control) study to assess if neuropsychological differences and depression are risk factors for the development and perpetuation of TMD in a Brazilian population, treated for the condition with reversible treatments for a period of time ranging from 6 months to 3 years.

Population

The patient population was comprised by 33 women, age range from 16 to 60 years-old, who have systematically looked for treatment of TMD in the Occlusion Clinic at the Faculty of Dentistry, Catholic University of Rio Grande do Sul (PUCRS), Brazil. The age- and sex-matched control group was comprised by individuals who were pain-free and were looking for esthetic or restorative treatment at the Faculty of Dentistry. Patients were recalled based on a chart review of previous diagnosis and treatment in the Occlusion Clinic for TMD after a period ranging from 6 months to 3 years. Based on their case histories and clinical examination, patients were selected following the diagnostic criteria set forth by the Research Diagnostic Criteria for TMD (RDC/TMD) (Dworkin & LeResche[6], 1992).

Inclusion and Exclusion Criteria

In the experimental group, to be considered for inclusion in this study, subjects had to fulfill the following criteria: a) women between the ages of 15 and 60 years-old; b) chief complaint of pain (at least 4 times/week for at least 4 weeks) in the temporomandibular joint and/or facial muscle region; and c) tenderness to palpation of at least 3 sites in the masticatory muscles and/or the temporomandibular joint region and/or limitation

in mandibular movement (interincisal opening less than 40 mm) (Dworkin & LeResche[6], 1992; Dao et al.[4], 1994; Grossi et al.[12], 2001). Patients were excluded from consideration for the study if their pain was the result of an arthritic condition (osteoarthritis/rheumatoid arthritis), or their primary pain complaint came about in association with a traumatic injury. In addition, patients who had been or were currently under treatment for a TMD were excluded from the study group. As well, those with metabolic disorders (diabetes, hyperthyroidism), neurologic disorders, vascular disease (migraine, hypertension), neoplasia, or a history of psychiatric/drug-abuse conditions were not considered for the study.

Confounders

Age, gender, marital status, educational level, occupation, employment status, and income level were controlled at the analysis stage. In addition, specific confounders which has been shown in the literature to affect neuropsychological factors and depression, such as information regarding the patient's lifestyle were also included for assessment in the analysis stage.

Pain Assessment and Treatment Outcome Measures

Pain intensity levels of pain were assessed using 100 mm numeric visual scales (NS), which provide a valid and reliable method of patient's pain perception regarding "success" or "failure" of treatment result (Conti et al.[2],2001). The NS consists of a 100 mm line, where the patient reads in the left end "no pain" and "worst possible pain or discomfort" in the right end. In addition, a verbal categorical scale (better, the same, worse) was used for comparison with the NS. The major shortcoming of verbal scales is that because they are categorical, it is difficult to specify the size of each category and whether the categories are of equal spacing. This comparison was made in order to assess if there were major discrepancies between verbal and non-verbal scales (Grossi et al. [12], 2001) in order to increase the validity of the results when comparing them to patient's self assessment.

Improvement Criteria

Thirty percent reduction as a percentage of the baseline assessment in pain at rest (100 mm Numeric Scale) was used as the criteria for improvement. This cut off point was used, because in one study approximately seventy percent of patients had a 30% or more reduction in pain at rest (Dao et al.[4], 1994); which was consistent with the available literature on TMD treatment success rate (60-90%). In addition, this level of improvement in VAS scores (30%) could not be explained only by variation in measurement variability (Grossi et al. [12], 2001). Two NS scales were given to the patients regarding facial (temporomandibular joint and masticatory muscle pain areas) pain at rest and pain on chewing. The results were then divided into three categories: i) 0 to 39 mm, low-intensity pain; ii) 40 to 69 mm, medium-intensity pain; and iii) 70 to 100 mm, high-intensity pain. Due to the fact that NS baseline records were not available, a pain self-assessment categorical scale on the treatment result (better, worse or the same) was also included. The average pain intensity at rest in patients with TMD has been reported in the literature as being of medium intensity after a six-month treatment (average 6 on a ten-point scale) (Turp et al.[27], 1998). Patients who had low-intensity pain levels, in both scales (pain at rest or pain on chewing), for the last month, independently of percentage improvement, were included in group I (responding TMD or rTMD). Those who had medium – or high-intensity pain levels in the last month were included in Group II (non-responding TMD or nrTMD).

Neuropsychologic Testing

California Verbal Learning Test

This test is a 16-item, 4-category "shopping list" that can be used to assess a subject's immediate, short-term, and long-term memory capacity. This test also assesses the subject's ability to categorize lists, thereby probing the memory strategies of the individual. Therefore, variables such as semantic clustering, perseveration, intrusions, and interference with short-term and long-term recall were tested.

Peterson-Peterson Consonant Trigram (CCC)

This test assesses immediate memory recall during "interference". Subjects were asked to repeat 3 consonants presented after being challenged with a continuous mathematical subtraction problem for 3, 9, or 18 seconds. The total number of correct consonants repeated were scored, regardless the order in which the subjects repeated them.

Beck Depression Inventory (BDI)

The BDI is a self-completed symptomatic scale, with 21 items, each having multiple choices, with

three choices related to the increasing levels of depression, in which scores ranging from 0 to 3 are attributed. The sum of the scores of individual items provide a total score corresponding to the level of depression, which can be classified as minimal, light, moderate or severe. In this matter, the questionnaire is intended to evaluate the intensity of depression, replacing clinical judgments for a cost-saving, standardized, and consistent numeric score of depression.

Clinical Examination

In order to assess the clinical signs and symptoms involved in TMD, one experienced clinician in the area of orofacial pain was sufficient. A single examiner was chosen, because the intra-examiner Kappa index had been shown to be similar or higher than the inter-examiner reliability (0.62) (Dworkin & LeResche[6], 1992). Palpation of the temporomandibular joint and masticatory muscles were included due to the fact that these variables have been included in almost every study of temporomandibular disorders and are part of the standard examination procedure for TMD (Dworkin & LeResche[6], 1992). The extra oral examination included palpation of the masseter, temporalis and sternocleidomastoid muscles, as well as palpation of the TMJ itself by one examiner. The extra oral muscle palpation reliability (kappa = 0.47 to 0.65) indicated acceptable agreement with calibrated examiners in both symptomatic and asymptomatic populations, and the TMJ palpation achieves moderate standards (kappa = 0.47 to 0.52). The intraoral muscle reliability is lower than the extra oral (kappa = 0.27 to 0.61), and because of that, intraoral muscle palpation was not performed.

All scores assigned were based on the patient's responses when the sites were palpated (i.e., evoked pain reaction). A scale of 0 to III was established (0 meaning no pain response). A grade I pain response was considered a mild observance that discomfort was present in that the patient had to be asked whether pain was felt. A grade II was assigned when changes in facial expression connoting a pain reaction (or verbal pain reaction) were produced (i.e., the patient did not have to be asked). A grade of III was scored when definite avoidance to palpation was observed or when normal palpation force was abated before the patient reacted too violently. In order to increase our reliability and for analytical purposes, scores were recoded into two groups: grade 0-I was considered as a negative pain reaction score; and grade II-III was considered as a positive reaction score.

Protocol

The patients underwent the tests in the following order: a) reading and signature of the informed consent form, b) social and demographic questionnaires, c) clinical pain questionnaires, d) neuropsychologic testing and e) clinical examination. Clinical examination was performed last, because the pain exacerbation after examination could have influenced our test results.

RESULTS

Population

The final sample was comprised by 63 subjects, divided into three groups. In the experimental group, patients who improved after treatment were included in Group I (rTMD, n = 18, 28.6%); while those who did not improve were included in Group II (nrTMD, n = 15, 23.8%). The control group, Group III (n = 10, 47.6%) was comprised by pain-free subjects. There was no statiscally significant difference (Kruskal-Wallis, N.S.) in age among the sample after grouping, being 35.3 years-old (± 13.11) for Group I, 36.5 y.o. (± 11.10) for Group II, and 38.7 y.o. (± 13.4) for Group III. Regarding educational level, the majority of Group I (72.2%) and Group II (66.6%) as well as the control group (70%) had only up to high school education and were considered with low-level of education. Regarding marital status, 44.4% of Group I was married; against 71.4% in Group II, and 60% in Group III. No individual in all groups was divorced, but 14.3% in Group II, or widowed. The majority of Groups I and III was employed (64.7% and 70%, respectively); on the other hand, 66.7% of Group II was unemployed. Similarly, a greater percentage (52.9%) of Group I was considered of high-income level for our national standards (greater than 5 minimum wages per family); when compared to Groups II and III (13.3% and 30%, respectively). Regarding social variables, 66.6% of Group I reported low-level of physical activity (exercising less than two times a week), similar to Groups II and III (66.6% and 70%, respectively). Conversely, Groups I, II and III have reported moderate social activity (72.2%, 53.4% and 60%, respectively). Caffeine consumption has been reported by patients as low (2 cups or less

per day) in Groups I, II and III alike (83.3%, 86.6% and 90%, respectively). Alcohol consumption has also been reported as none or occasionally (less than 1 drink per day) by all three groups (100%). Similarly, cigarette smoking has also been reported as none or occasionally (less than 1 pack per day) by Groups I, II and III (100%, 86.6% and 70%, respectively).

Results of the Kruskal-Wallis Test for Comparison of Pain on Palpation Among Groups

In the comparison of pain on muscle palpation in the groups studied, using the Kruskal-Wallis, it was verified that statistically significant differences between Group III versus the other two groups (experimental) were found in the right (p = 0,013) and left (p = 0,014) TMJ palpation sensitivity, in the right (p = 0,006) and left (p = 0,014) temporal muscle palpation sensitivity; as well as in the right (p = 0,007) sternocleidomastoid muscle. Nevertheless, Groups I and II did not differ between them.

Comparisons Between Pain Scores and Risk Factors

Comparison between pain scores and risk factors, using the Mann-Whitney non-parametric test, have demonstrated that there were no statistically significant differences between the pain and physical activity. Nevertheless, it was verified that there were significant statiscally differences between pain level and alcohol consumption, social activity and income level. It was observed that patients who do not drink alcohol have higher pain levels in the right TMJ (p = 0.01), left TMJ (p = 0.01), right temporalis muscle (p = 0.05), and right sternocleidomastoid muscle (p = 0.01). Besides that, it was shown that patients who reported to have low or no social activity had superior pain level in the right (p = 0.02) and left masseter muscle (p = 0.02). In addition, patients who had a family income level up to 5 minimum wages had superior pain levels in the right (p = 0.043) and left (p = 0.05) TMJ, as well as in the left masseters (p = 0.021). The remaining tests did not show statistically significant differences. Statistically significant were verified in relation to alcohol (p = 0.04) and cigarette (p = 0.04) consumption among the three groups studied. It was observed in the control group (Group III) a greater frequency of alcohol and cigarette consumption.

There were no significant differences in the other variables.

Neuropsychologic Testing

The Spearman's correlation coefficient was used to correlate the test results. The variables which had statistically significant correlations were: CVLT-CR *versus* CVLT-*CL (p = 0.001), CVLT-CR *versus* CCC-AL (p = 0.002), CVLT-CR *versus* CCC-CR (p = 0.001), CVLT-CL *versus* CCC-AL (p = 0.034), CVLT-CR *versus* CCC-CR (p = 0.001), and CCC-AL *versus* CCC-CR (p = 0.001). In all significant results, a positive correlation was disclosed; that is, the larger the score in one test, the larger will be the score in all tests.

Depression Scores Among Groups I, II and III

Significant test results in the BDI (Table 2), using the Mann-Whitney U Test, were found between the experimental and the control groups. Patients in the experimental group had significantly higher depression scores in the BDI than controls (p = 0,028). Notwithstanding, other test results did not show significant results. When comparing Groups I, II and III, using the Kruskal-Wallis test (Table1), it was verified that the BDI also showed statistically significant difference among the three groups, where Group II differed also statistically from the other two (p = 0,002); while groups I and III were non-significant.

TABLE 1 – Results of the Kruskal-Wallis test for comparison of the Beck Depression Inventory (BDI).

Group	Mean Score	Standard Deviation	Mean Rank	P
BDI				
Group I	6.22^A	5.72	18.81	0.002*
Group II	12.00^B	6.16	30.90	
Group III	4.30^A	3.95	14.40	

Mean scores followed by the same letter do not differ significantly between them (P < 0.01).

TABLE 2 – Results of the non-parametric Mann-Whitney test for the comparison of the Beck Depression Inventory (BDI) scores among groups.

Groups	Mean Score	Standard Deviation	Mean Rank	P
BDI				
Experimental	8.85	6.52	24.30	0,028*
Control	4.30	6.95	14.40	

Correlation Between Muscle-Articular Pain and Beck Depression Inventory Scores (BDI)

The Spearman correlation was used to verify the correlation between pain to joint and muscle palpation and depression scores. It was shown a correlation between pain level in the left TMJs (p = 0.004), right TMJs (p = 0.013), in the left (p = 0.006) and right (p = 0.009) sternocleido-mastoid and in the left (p = 0.004) and right (p = 0.047) temporalis muscles with the BDI scores. In all significant results, it was observed a positive correlation, that is, the greater the pain level, the greater the depression score.

DISCUSSION

Currently, TMD is considered a multifactorial disorder, in which a number of mechanical, neuro-physiologic and psychologic factors may influence as predisposing, initiating and perpetuating factors (Dworking et al.[7], 1994; Suvinen et al.[25],1995; Grossi et al.[12], 2001). Very little is still known about the relationship between TMD with their neurophysiologic etiology (Tenenbaum et al.[26], 2001). The way in which TMD relates to depression and in which way depression might influence their beginning and perpetuation has not been eluci-dated yet (Suvinen et al.[25],1995). This fact justifies more profound studies about the relationship between TMD and depression as well as about TMD as a whole.

This study was controlled by age (16 to 60 years of age) and gender (women only) in order to increase our internal validity for a factor which could influence our results (Grossi et al.[12], 2001), as well as keeping a good external validity, con-sidering that previous studies have demonstrated a larger percentage of women with TMD than men: Fricton et al.[8], 1987 with 74,9%; Lipton et al.[15], 1984 with 76.5%.

Our final sample of 43 subjects were divided into three groups: a) Group I (n = 18, 41.9%), comprised by TMD patients who improved after treatment; b) Group II (n = 15, 34.9%), formed by TMD patients who did not improved after treatment, and c) Group III (n = 10, 23.2%), our pain-free group. Groups I and II were classified as the experimental group, while Group III, as the control group. The inclusion and exclusion criteria were set forth in the materials and methods section.

The sample mean age was 30 years old; 35.3 y.o. (SD = 13.11) for Group I, 36.5 y.o. for Group II (SD = 11.1), and 29.4 y.o. for Group III (SD = 10.8). These numbers are similar to previous studies, like Grossi et al.[12], 2001 (mean = 28.3 y.o.) and Fricton et al.[8], 1996 (mean = 36.6 y.o.). The present study also confirms the results of Greene et al.[11], 1983 who found an increase in TMD signs and symptoms from the second to the third decade of life.

Regarding educational level, our sample showed similar values among the three groups. Approxi-mately, 25% of subjects had completed elementary school; around 50%, had completed high school, and close to 25% had post-secondary education. When the experimental TMD sample was analyzed (Groups I and II), approximately 70% did not have post-secondary education, which characterizes a low level of education, contrasting with previous studies (Grossi et al.[12], 2001; Fricton et al.[8], 1996) who showed a majority of individuals with higher education.

Regarding family income, approximately 50% of our study group earned from 2 to 5 minimum wages, which is a low-income in our country. Indeed, 15% had a very low-income, ranging from 0 to 1 minimum wage. Only 10% of our sample had a income higher than 11 minimum wages. These numbers allowed us to concluded that this was predominantly low-income group (70%), earning from 0 to 5 minimum-wages. Grossi et al.[12], 2001, in a Canadian sample, has shown that the majority of the sample (57%) had high-income, contrasting with the present study. Cross-cultural comparisons between a North-American and a Brazilian samples are difficult, due to the obvious social and economic differences between the two.

Social and demographic variables, such as age, income, marital status and employment were not statistically different (Chi Square test) between the experimental and the control groups. In the overall, the demographic analysis was similar to previous studies found in the TMD literature.

Exercise, social activity and coffee consumption was not significantly different between experimen-tal and control groups. Regarding alcohol con-sumption, the experimental group had a signi-ficantly lower level of intake (Chi Square test, p = 0.044) when compared to controls. Cigarette consumption also disclosed a significant difference when compared to controls (p = 0.04). The lite-rature has found no relationship between TMD and patients life style; therefore, our findings related to cigarette and alcohol consumption were sur-

prising. In theory, the results should be similar or even higher for the experimental group; because it has a disorder which involves psychosocial factors, which stimulates alcohol and cigarette consumption. One explanation might be the fact that patients tend to hide personal information on drugs, alcohol and cigarette abuse fearful of discrimiation.

The clinical procedures used in this study were based on the RDC/TMD guidelines (Dworkin & LeReche.[6], 1992). Palpation of the TMD and masticatory muscles were included, due to the fact that these variables are included in the majority of TMD studies and are part of a standardized evaluation procedure. Extra-oral muscle palpation offers reproducibility when performed by calibrated examiners, both in symptomatic as well as in asymptomatic populations (Kappa = 0,47 a 0,65).

In the comparison of pain on muscle palpation in the groups studied using the Kruskal-Wallis, it was verified that statistically significantly differences between Group III versus the other two groups (experimental) were found in the right (p = 0,013) and left (p = 0,014) TMJ palpation sensitivity, in the right (p = 0,006) and left (p = 0,014) temporal muscle palpation sensitivity; as well as in the right (p = 0,007) sternocleidomastoid muscle. Nevertheless, Groups I and II did not differ between them.

Comparison of the pain level among the groups has shown that statistically significantly differences between Group III versus the other two groups (experimental) were found in the right (p = 0,013) and left (p = 0,014) TMJ, in the right (p = 0,006) and left (p = 0,014) temporal muscle, as well as in the right (p = 0,007) sternocleidomastoid. Nevertheless, Groups I and II did not differ between them.

This also contrast with a previous study (Grossi et al.[12], 2001), where it was not possible to distinguish between responding versus non-responding TMD patients by means of palpation of the TMJ and masticatory muscles.

The fact that at least 20% of TMD patients are non-responding to treatment and that these patients share similar characteristics with other types of chronic pain syndromes, (Goldberg et al.[10], 1996; Grossi et al.[12], 2001;Tenenbaum et al.[26], 2001) led us to study and analyze the neuropsychologic aspects of these patients. According to Stuss et al., 1989, with the right use of neuropsychologic tests, we will have an objective description of what areas of behavior and cognition might or not be associated to non-responding chronic pain treatment. Goldberg et al.[10], 1996,

comparing idiopathic versus post-traumatic TMD patients, showed statistically significant differences in the neuropsychologic tests used: a) CVLT-CR (p < 0.05) and CCC (p < 0.001). Grossi et al.[12], 2001, studying responding versus non-responding idiopathic TMD populations had also significant results between them in some neuropsychologic tests: a) CVLR-CL (p < 0.01), CVLT-CR (p < 0.05) e CCC (p< 0.01).

Contrasting with the studies by Goldberg et al.[10], 1996; Grossi et al.[12], 2001; the present study significant results were not found between responding and non-responding TMD in our sample in all neuropsychologic tests used (CVLT-CR, CVLT-CL, CCC-AL e CCC-CR). Nevertheless, it was observed a positive correlation between the neuropsychologic tests used, showing a similar results among the different groups. Therefore, it is not true to state that non-responding TMD patients have neuropsychologic deficits. This fact might be related to the level of education of our sample, where 70% of them did not have post-secondary education. Based on these results, it can be concluded that some of these tests, particularly those involving cognition, might not adequate to be applied in a population with low level of education, contrasting with a well-educated North American population. New studies in a well-educated Brazilian Population are needed.

Based on the biopsychosocial model, TMD must be understood as the result of a complex interaction among biologic, psychologic and social variables (Dworking et al.[7], 1994). It is also known that depression is present in a great proportion of TMD patients; nevertheless, a cause and effect relationship cannot be established at this time, considering that both chronic pain and depression share similar pathophysiologic basis (Romano et al.[22], 1985). Indeed, statistically significant difference (Mann-Whitney U test, p = 0.028) in the BDI between the experimental and control groups have been found in this study, with TMD patients showing higher depression scores than asymptomatic subjects. When comparing responding versus non-responding TMD patients and controls (Groups I, II and III), it was found that Group II differed significantly from the other two groups (the Kruskal-Wallis test, p = 0.002), indicating that depression might be playing a role as a perpetuating factor. A positive correlation was actually found between BDI scores and pain on palpation levels at the TMJ, temporalis and sternocleidomastoid on both sides, the latest with the highest association. These results clearly indicated that

depression might have influenced the treatment outcome in Group II. However, further studies must be carried out to elucidate this association. It is also important that once the patients score high on the BDI, they must be referred to the appropriate physician for treatment, because depression has a major impact on the patient's quality of life and can be in some cases life-threatening (Korszun et al.[14], 1997).

Based on our data, it can be concluded that TMD is a multifactorial disorder, in which psycho-social factors do play an important role in the initiation and perpetuation of the related sings and symptoms. In this way, reversible therapies and multidisciplinary teams should be employed, particularly in non-responding TMD patients.

CONCLUSIONS

The results of this study allow us to conclude that the majority of the neuropsychologic tests used did not demonstrate statistically different results in the populations studied. However, BDI scores which measure depression, have shown statistically significant differences between the experimental (TMD) and control groups. There were also significant differences in depression scores between non-responding TMD patients versus responding-TMD patients and asymptomatic subjects (controls). However, no statistically significant difference was found in the BDI between responding-TMD patients and controls. Therefore, depression does play a role as a initiating factor in all TMD patients, and as a perpetuating factor in non-responding TMD patients.

REFERENCES

1. Beck AT, Rush AJ, Shaw BF, Emeri G. Terapia cognitiva da depressão. Rio de Janeiro: Zahad; 1982.
2. Conti PCR, Azevedo LR de, Souza FV de. Pain measurement in TMD patients: evaluation of precision and sensitivity of different scales. J Oral Rehabilitation. 2001;28:534-9.
3. Cunha JA, Prieb RG, Goulart PM, Lemes RB. O uso do inventário de Beck para avaliar depressão em universitários. Psico. 1996;27(1):107-15.
4. Dao TT, Lund JP, Lavigne, GJ. Comparison of pain and quality of life in bruxers and patients with myofacial pain of the mastigatory muscles. J Orofacial Pain. 1994;8:350-356, 1994.
5. Delis D, Kramer JH, Freeland J, Kaplan E. Integrating clinical assessment with cognitive neuroscience: construct validation of California Verbal Learning Test. J Consult Clin Psychol. 1988;56(1):123-30.
6. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders. J Craniomand Disord Facial Oral Pain. 1992;6(4):301-55.
7. Dworkin, SF, Massoth DL. Temporomandibular disorders and chronic pain: disease or illness? J Prosth Dent. 1994;72(1):29-38.
8. Fricton JR, Olsen T. Predictors of outcome for treatment of temporomandibular disorders. J Orofacial Pain. 1996;10:54-65.
9. Galankyer I, Harvey PD. Neuropsychological screening in the Psychiatric Emergency Room. Compr Psychiatry. 1992;33:291-5.
10. Goldberg MB, Mock D, Ichise M., Proulx G, Gordon A, Shandling M, Tsai S, Tenenbaum HC. Neuropsychologic deficits and clinical features of post-traumatic temporomandibular disorders. J Orofac Pain. 1996;10(2):126-40.
11. Greene CS, Laskin DM. Long-term evaluation of treatment of myofascial pain-dysfunction syndrome: a comparative analysis. J Am Dent Assoc. 1983;07:235-8.
12. Grossi ML, Goldberg MB, Locker D, Tenenbaum HC. Reduced neuropsychologic measures as predictors of treatment outcome in patients with temporomandibular disorders. J Orofac Pain. 2001;15(4):329-39.
13. Kampe T, Edman G, Bader G, Tagdae T, Karlsson S. Personality traits in a group of subjects with long-standing bruxing behaviour. J Oral Rehabilitation. 1997;24:588-93.
14. Korszun A, Ship JA. Diagnosing depression in patients with chronic facial pain. J Am Dent Assoc. 1997;128(12):1680-6.
15. Lipton JA, Marbach JJ. Predictors of treatment in patients with myofascial pain-dysfunction syndrome end organic temporomandibular joint disorders. J Prosth Dent. 1984;51:387-95.
16. Magnusson T, List T, Helkimo M. Self-assessment of pain and disconfort in patients with temporomandibular disorders: a comparison of five different scales with respect to their precision and sensitivity as well as their capacity to register memory of pain and discomfort. J Oral Rehab. 1995;22:549-56.
17. McCreary CP, Clark GT, Oakley ME, Flack V. Predicting response to treatment for temporomandibular disorders. J Craniomand Disord facial Oral Pain. 1992;6(3):161-9.
18. McNeill C. Management of temporomandibular disorders: concepts and controversies. J Prosthet Dent. 1997;77:510-22.
19. Peterson LR, Peterson MJ. Short-term retention of individual verbal items. J Experimental Psychology. 1959;58(3):193-226.
20. Rasmussen CO. Clinical findings during the course of temporomandibular arthropathy. Scand J Dent Res. 1981;89:283-8.
21. Romanelli GG, Mock D, Tenenbaum HC. Characteristics and response to treatment of post-traumatic TMD: a retrospective study. Clin J Pain. 1992;8:6-17.
22. Romano JM, Turner JA. Chronic pain and depression: does the evidence support a relationship? Psychological Bulletin. 1985;97(1):18-34.

23. Rosenbaum RS, Gross SG, Pertes RA, Ashan LM, Kreisberg MK. The scope of TMD/Orofacial Pain (Head and Neck Pain Management) in contemporary dental practice. J Orofacial Pain. 1997;11(1):78-82.

24. Stuss DT, Stethem LL, Hugenholtz H. reaction time after head injury: fatigue, divided and focused attention, and consistency of performance. J Neurol Neurosurg Psychiat. 1989;52:742-8.

25. Suvinen TI, Reade PC. Temporomandibular disorders: a critical review of the nature of pain and its assessment. J Orofacial Pain. 1995;9(4):317-39.

26. Tenenbaum HC, Mock D, Gordon AS, Goldberg MB, Grossi ML, Locker D, Davis KD. Sensory and affective components of orofacial pain: is it all in your brain? Crit Rev Oral Biol Med. 2001;12(6):455-68. Review.

27. Turk DC, Okifuji A, Scharff L. Chronic pain and depression: role of perceived impact and perceived control in different age cohorts. Pain. 1995;60:93-101.

28. Türp JC, Kowalski CJ, Stholer CD. Treatment-seeking patterns of facial pain patients: many possibilities, limited satisfaction. J Orofacial Pain. 1998;12:61-6.

Adress correspondence to:
CAIO MARCELO PANITZ SELAIMEN
Rua Alameda Sebastião de Brito, 12 – Boa Vista
CEP 91340-460, Porto Alegre, RS, Brasil
E-mail: selaimen@terra.com.br