Acta Odontologica Scandinavica, 2006; 64: 300–305

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ORIGINAL ARTICLE

Psychological factors and responses to artificial interferences in subjects with and without a history of temporomandibular disorders

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Abstract

Objective. It has often been suggested that psychological factors play a role in temporomandibular disorders (TMD). However, reports on psychological factors in TMD patients and controls have been equivocal. In a previous double-blind randomized controlled study, subjects with a TMD history showed more clinical signs and subjective symptoms and adapted less well to the artificial interferences than subjects without an earlier TMD history. In the present study, we analyzed the associations of psychological factors with symptom responses and adaptation to interferences. ***Material and Methods.*** Before the intervention, the subjects filled in questionnaires dealing with personality traits, level of psychological and somatic stress symptoms, coping strategies, and health beliefs. Every day during the 2-week follow-up period, the subjects rated the intensity of their symptoms on 9 modified visual analog scales (VAS). ***Results.*** Health hardiness, positive socialization history and inhibition of aggression were associated with weaker symptom responses and better adaptation to true artificial interferences. Some personality characteristics in subjects with an earlier TMD history tended to associate with higher symptom reporting despite the type of intervention. ***Conclusions.*** Psychological factors appeared significant for the symptom responses to artificial interferences, and they seem to play a different role in responses in subjects with an earlier TMD history compared to those without.

Key Words: *Artificial interferences, psychological factors, temporomandibular disorders*

Introduction

The role of occlusal interferences and psychological factors in the etiology of temporomandibular disorders (TMD) has been the focus of intensive research and debate [1–6]. Both earlier [7] and more recent studies, e.g. by Michelotti et al. [8], on artificial interferences in subjects without a TMD history have shown adaptation to the interferences within a fairly short time. Accordingly, the role of occlusal factors in the etiology of TMD has been questioned [4,7]. TMD patients often demonstrate emotional vulnerability, psychosomatic problems, and a positive relationship between psychological disturbances and physical disorders [6,9–11]. While psychological factors seem to be important in treatment outcome [12] and in chronic TMD pain [13], the evidence on psychosocial disturbances in TMD patients [14] is equivocal. Some studies indicate a similarity to chronic pain patients [15], while others offer no evidence of consistent differences in TMD patients and controls [10,15–17]. Furthermore, study designs often leave the direction of possible causation open [3,6,14,18].

Stress, as well as perception, interpretation and reporting of various symptoms, has received growing attention in the TMD literature [11,16,19–22]. TMD patients tend to report more of all kinds of symptoms. Accordingly, somatization and hypochondria have been suggested to lie behind TMD [14,23–25]. Difficulties in habituating to stress and increased vigilance for physical stimulation [22,26] are associated with somatization, and, accordingly, lower pain thresholds, greater sensitivity to experimental pain [27], and heightened disease conviction [18] have also been found in TMD patients. Somatization also predicts higher pain levels in treated TMD patients [28].

"Negative stress coping" also seems to be characteristic of TMD patients [2,11,18,20–22,29–33]. Catastrofizing – exaggerating the severity of a

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(Received 24 February 2006; accepted 22 May 2006)

ISSN 0001-6357 print/ISSN 1502-3850 online
DOI: 10.1080/00016350600825344

stressor – is associated with depression, activity interference and perceived jaw interference [33], higher level of pain [34], symptom severity, and failure of treatment [12]. Severe TMD disturbances also associate with perception of pain outside one's control [30,33], while beliefs about personal control, e.g. personality hardiness [35] and self-efficacy, may facilitate adjustment to stress and pain, and may also result in better treatment outcome [11,18,20,30,32,36]. To conclude, biopsychosocial factors probably act in a complex interaction, and rather than a specific personality profile, a range of profiles [1,13,15,29] is likely to be found in TMD. Psychosocial factors may have a different role in different subgroups of TMD patients, and they may have different effects in symptom perception, monitoring, interpretation, and adaptation [6,11].

Some observations suggest that a less optimal socialization history may be found behind TMD [25], and this could perhaps explain problems of coping with stress, emotional dysregulation, fatalism, helplessness, depression, aggressive behaviour, and interpersonal conflicts found in some TMD patients [1,10,30]. Furthermore, the impact of a previous TMD history and contacts with dental and medical practitioners should also be taken into account [30,34,37–39]. In our earlier studies [37,38], we found that subjects with TMD histories showed stronger symptoms to artificial interferences than those without TMD history. Furthermore, both groups of subjects, one with and the other without TMD history, reacted with a significant increase in symptoms to true artificial interferences. This suggested that the true artificial interferences may serve as a psychological and somatic microstressor and may trigger and precipitate somatic stress responses, affect symptom perceptions, and challenge the coping and adaptation resources of an individual.

Aims of the study

We aimed to identify those psychological factors that associate with the level of symptom responses and with the adaptation to the true artificial and placebo interferences in subjects with (TMD group) and without (non-TMD group) an earlier history of temporomandibular disorder during a 2-week intervention period. The present study aimed: 1) to analyze whether personality characteristics, coping strategies, health beliefs (i.e. health hardiness), level of somatic and psychological stress symptoms associate with the mean level of symptoms in response to artificial interference during the intervention; 2) to analyze which of these psychological factors associate with the magnitude of change in response over time, i.e. adaptation to intervention; 3) to explore whether psychological factors associate differently with the symptom responses in two groups of subjects, the TMD group and the non-TMD group, in two types of intervention, true interference and placebo.

Subjects and methods

Healthy women with no history of TMD (non-TMD group: $n=26$, mean age 24 years) as well as women with an earlier, myogeneous TMD history (TMD group: $n=21$, mean age 32 years) participated in the study [37]. The subjects with a TMD history had earlier been successfully treated according to departmental routines. At the onset of intervention, all subjects felt healthy compared to the situation when they had sought treatment [37]. Both groups were randomly divided into true and placebo interference groups. Artificial interferences were introduced in the true interference groups and simulated in the placebo groups. The subjects were followed for 2 weeks, after which time the interferences were removed [37]. The study plan was approved by the Ethics Committee of the Medical Faculty of the University of Turku.

Psychological questionnaires

Before the intervention, the subjects filled in questionnaires dealing with the level of psychological and somatic stress symptoms, coping strategies, personality characteristics, and health beliefs.

The *Beck Depression Inventory*, the *Beck Anxiety Inventory* and the *Symptoms of Stress Scale*, derived from the Cornell Medical Index [23,40], were used to measure psychological and somatic symptoms. Two composite scores of the Symptoms of Stress Scale were used: psychological symptoms (Cronbach's alpha $=0.875$) and somatic symptoms (Cronbach's alpha $=0.834$).

The *Karolinska Scales of Personality* were used to measure personality traits on several scales [41]: Somatic Anxiety, Psychic Anxiety, Muscular Tension, Social Desirability, Impulsiveness, Monotony Avoidance, Detachment, Psychasthenia, Socialization, and Aggression: indirect and verbal aggression, irritability, suspicion, guilt, and inhibition of aggression. The *Self-Performance Survey* (Shorter Version, Wallston, unpubl. comm.) was used to measure self-perceived personal ability to accomplish things that one undertakes or that are important to one's self. It significantly predicts a health-promoting lifestyle [42] and is similar to the concept of "self-efficacy".

Health-related personality hardiness was measured by the *Health Hardiness Inventory* developed by Abraham [43] and Wallston (unpubl. comm.). It consists of three components: control, i.e. the belief that one can control or influence one's health, commitment, i.e. the ability to feel deeply involved in and committed to self-care of health, and challenge,

i.e. anticipation of change and viewing personal health care as a challenge. Coping strategies in stressful events were measured using the *COPE Inventory* [44], which consists of 13 subscales, some measuring adaptive and active coping strategies (e.g. active coping and planning), others more passive, even maladaptive coping (e.g. denial, mental disengagement).

Daily diary of symptoms

We monitored the level of symptoms on several scales instead of taking the outcome as a whole, and performed repeated measures because symptoms may be quite variable in nature, large individual variation within and between days may occur, and there may be differences in reports of different TMD-related symptoms [21,34]. During the 2-week follow-up period, the subjects rated the intensity of 9 symptoms on a modified visual analog scale (VAS): occlusal discomfort, chewing difficulties, sensitivity of teeth, fatigue of the jaw, headache, facial pain, opening difficulty, bruxism, and ear symptoms. The subjects were instructed to mark every morning after awakening on a solid line (10 cm) the number that best corresponded to their current condition (0 = not at all, 10 = intolerable). A composite score of the 9 symptoms was also computed (Cronbach's alpha scores, computed separately for each of the 14 days; varied between 0.634 and 0.918). Analyses were done for the composite score and three separate scales: occlusal discomfort, chewing difficulties, and sensitivity of teeth, which were the prominent separate symptoms in response to true artificial interference [38].

Data analyses and statistical methods

TMD and non-TMD subjects were compared with regard to *psychological factors before the intervention* using two-way analysis of variance with interaction. In addition, we analyzed whether psychological factors associated with the baseline level of symptoms before the onset of intervention in order to evaluate their possible impact on group differences in the trial. These analyses were performed using cumulative logistic regression analysis (separate symptoms) and analysis of covariance (composite score) of two factors (TMD history and type of intervention) and one psychological factor as a covariate. There were no statistically significant differences in psychological characteristics according to TMD history nor according to type of intervention except in indirect ($p = 0.0003$) and verbal aggression ($p = 0.0143$), where TMD subjects in true interference and non-TMD subjects in the placebo condition scored lower. Although the TMD subjects were older ($p < 0.001$) than the non-TMD subjects, there was no significant difference in age between the groups according to the type of intervention (true vs. placebo), nor were there any consistent correlations between age and psychological variables. Some psychological factors showed a trend to associate with the *baseline levels of symptoms* but usually in a similar way in all four groups. Those few differences in the associations detected between the subgroups were small and inconsistent.

The changes in response over time (change n = day n-baseline, n = 1, . . ., 14), i.e. regarding the composite score of symptoms as well as separate symptoms of the four groups were analyzed using a repeated measures model of three factors (TMD history, type of intervention, and time) with psychological factors (one at a time) and baseline values used as covariates. *The mean level of the response* regarding the composite score of symptoms as well as separate symptoms of the four groups during the intervention period was analyzed using a general linear model of two factors (TMD history, type of intervention). Psychological factors (one at a time) and baseline values were again used as covariates. Three interaction effects of psychological factors were also tested: 1) TMD history*type of intervention*psychological factor, 2) TMD history*psychological factor, and 3) type of intervention*psychological factor. These interaction effects were the main interest of the study. The analyses were performed using SAS Statistical Software version 8.2. (SAS Institute Inc., Cary, NC, USA).

Results

In the *true interference group*, high scores of health hardiness associated the most consistently with lower *mean level of symptom response*. Positive socialization history and disposition to psychasthenia, psychic anxiety and inhibition of aggression were also associated with lower symptom levels on some scales, while verbal aggressiveness was linked with a higher symptom level. Strong health hardiness, positive socialization history, support-seeking in stress, disposition to inhibit aggression and to experience psychic anxiety and psychasthenia were associated with smaller *change in response over time*, i.e. with better *adaptation* to the true interference while verbal aggressiveness was linked with poorer adaptation. There were no significant associations between psychological factors and symptom responses in the placebo group.

In TMD subjects, impulsiveness and, to a lesser extent, aggressive irritability, detachment and mental disengagement associated with a high *mean level* of symptoms, while support seeking was linked with a low one. Accordingly, aggressive irritability, detachment, social desirability, and mental disengagement tended to associate with stronger *symptom change*, while strong health hardiness and positive

socialization history resulted in a smaller change, i.e. in better adaptation.

Some interactions were also found in regard to TMD history and type of intervention, both in the mean level of symptoms and in symptom change. These findings should, however, be taken as tentative, because of the small number of cases in the four subgroups. In subjects with *true interference and a TMD history*, strong health hardiness, positive socialization history, and inhibition of aggression associated with a lower symptom level, but social desirability with a higher level. In TMD subjects with true interferences, inhibition of aggression and seeking support in stressful situations associated with better adaptation to stress caused by the true interferences, while social desirability, verbal aggressiveness, and impulsiveness seemed to result in a poorer outcome.

Discussion

The present study aimed to analyze whether psychological factors associate with symptom responses and with adaptation to true artificial and placebo interferences in subjects with and without a history of temporomandibular disorders. Before the onset of the intervention, TMD and non-TMD groups did not systematically differ in their psychological make-up. The few associations found between the psychosocial factors and the baseline levels of symptoms were similar in the four subgroups. This is consistent with the notion that no specific personality profile can be found behind TMD [10,15–17]. The lack of significant group differences in psychological characteristics and in baseline symptom levels on VAS scales [38] offered a basis for analyzing how psychological factors associate with symptom responses and their changes during the intervention.

Randomized trials with artificial interferences on subjects with and without a TMD history, and studies also exploring the impact of psychological factors on symptom responses, are rare. Trials consisting of only healthy subjects are biased in the sense that the impact of the psychological factors more characteristic of TMD subjects is automatically omitted from the analyses when subjects with a TMD history are excluded from a study. In our randomized controlled trial, true artificial interferences served as somatic and psychological microstressors for both TMD and non-TMD subjects [38] and therefore offered a solid basis for the analyses of responses. Furthermore, we conducted comprehensive psychological assessments and repeated daily measures of several symptoms over a 2-week period.

Our findings suggest that psychological factors play a different role in subjective responses to intervention in subjects with a TMD history compared to those without. In accordance with Faucett & Levine [10] and Dahlström [1], our results suggest that impulsiveness, aggressive irritability and less positive relation to other people, e.g. detachment and less social support in stress, may dispose to stronger symptom responses in TMD subjects than in non-TMD subjects, irrespective of the nature of the intervention. This suggests that experimental, even placebo, manipulation including some dental procedures in a dental context may serve as a trigger for symptom detection in subjects with both psychological disposition and "TMD history disposition" [30,34]. Patients with this kind of personality make-up may be more vulnerable in stressful situations in general [30]. Repeated episodes of pain or dental contacts may give impetus to greater sensitivity to monitor and report somatic symptoms [18,21,24,27,39].

Our results are also in line with earlier concepts on the significant role of personal control beliefs or health hardiness [35,45] in the overall level of symptom responses and adaptation to the stress caused by the interference [12,20,36]. When disposed to a micro-stressor, i.e. true interference, all subjects demonstrated a lower level of symptoms and adapted better if they held strong control beliefs on health matters. "Health hardiness" more clearly predicted symptom responses than general stress-coping strategies or general self-perceived competence, which is in line with the observations by Litt et al. [34] but contrary to those of Schnurr et al. [19]. Of the various coping strategies, only social support-seeking and mental disengagement showed moderate links to symptom responses. Our findings also suggested a potential buffering effect of positive developmental history and inhibition of aggression on symptom responses. In all, these observations are in accordance with the earlier ones on socialization history, supportive social relations and expression of emotions in TMD [11,25,31].

To conclude, the present study pointed out that subjects with an earlier history of TMD and a disposition to impulsiveness, aggressive irritability or less positive interpersonal relations seemed to react with stronger subjective symptoms, irrespective of the type of intervention. Health hardiness, a positive socialization history, social support-seeking, and inhibition of aggression seemed to result in lower symptom responses and better adaptation to true artificial interferences in all subjects.

Acknowledgments

Financial support from Finska Läkaresällskapet is gratefully acknowledged. We thank Ms Liisa Stenvall and Ms Sirpa Laakso for their skilful technical assistance.

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