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Psychosocial correlates of temporomandibular joint pain and dysfunction

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Summary This study examines psychological differences between temporomandibular joint pain and dysfunction (TMJPD) patients, pain controls, and healthy controls. Two hundred and two patients were classified, according to the diagnostic criteria of Eversole and Machado, as either myogenic facial pain ($n = 42$), internal derangement type I ($n = 69$), internal derangement type II ($n = 85$), or internal derangement type III ($n = 6$). Patients completed the Basic Personality Inventory, the Illness Behavior Questionnaire, the Multidimensional Health Locus of Control, the Perceived Stress Scale, and the Ways of Coping Checklist. Subjects also answered questions pertaining to TMJPD symptomatology, including chronicity and severity. After conservative treatment with simple jaw exercise and ultrasound, patients were contacted again at 5 months to complete follow-up questionnaires similar to those previously completed. Comparison groups were comprised of 79 patients attending outpatient physiotherapy clinics for pain-related injuries not involving the temporomandibular joint and 71 pain-free, healthy students. Data were analyzed using multivariate statistics. The results indicate a significant relationship between pain intensity (and to some extent chronicity) and diverse measures of personality among the pain controls but not among the TMJPD patients. This calls into question the validity of assuming individual pain disorders are subsets of a larger, homogeneous pain disorder population. TMJPD patients and pain controls score higher on hypochondriasis and anxiety than the pain-free controls but these elevations are not clinically significant. The elevations decrease to normal levels in response to a positive treatment outcome. There were no differences between the TMJPD patients and the pain controls on any of the measures. These results suggest that TMJPD patients do not appear to be significantly different from other pain patients or healthy controls in personality type, response to illness, attitudes towards health care, or ways of coping with stress.

Key words: Pain; Personality; Temporomandibular joint pain and dysfunction

Introduction

Temporomandibular joint pain and dysfunction (TMJPD), also commonly referred to as myofascial pain dysfunction syndrome, 'is a condition in which pain, clicking of the temporomandibular joint, and limitation or deviation of jaw opening occur in association with tender-

ness of masticatory muscles' [30]. The purpose of this study is to examine the degree to which TMJPD patients differ from other pain patients and healthy controls along the dimensions of personality type, response to illness, attitudes towards health care, and ways of coping with stress.

Krantz and Hedges [16] elaborate on 3 ways in which traits may contribute to any disease process. First, traits may be viewed as factors which predispose the individual to developing an illness. This theory originated with Dunbar [5] and Alexander [1] and was later applied to TMJPD by Moulton [25] and others [11,17]. It argues that

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when conflict occurs in the individual's life, which is not resolvable because of the underlying personality structure, the unresolved conflict results in state changes which, in turn, lead to physiological changes. At this point, a feedback loop may be established between the onset of the illness and the state responses to the illness thereby further compromising the well-being of the individual.

Given this model, which is essentially a psychosomatic one, TMJPD patients might be expected to differ along sundry dimensions of trait personality from healthy individuals or from other pain patients whose pain is the result of trauma. The model, however, is less able to address the issue of state changes, as elevations on these scales may reflect the unresolved conflict, be a result of the disease process, or be a function of both.

A second way in which traits may play a role in the disease process is through coping styles. Here the emphasis is not so much on personality characteristics as it is on the ways in which individuals cope with stressful situations. Coping strategies may be used to alter the relationship between the individual and the environment or to control or minimize the stressful emotions or physiological arousal that have been elicited. Presumably, ineffective coping strategies result in adverse physiological and behavioural changes which have consequences for the individual's health [16].

A third way in which traits may contribute to disease has more to do with the end process of the disease than with factors associated with its onset. This is often referred to as illness behaviour [16,19]. It is estimated that only 5% of those with TMJPD signs and symptoms actually seek treatment [19,28]. Although a change in symptom severity may account for some of this, other factors may be responsible as well. These factors may include the degree to which the individual attends to his symptoms, their perceived meaning, attitudes towards health care, and accessibility to health care.

When the potential contribution of personality factors in TMJPD is considered within the context of this framework, the question is not as simple as whether personality factors play a causal role in the development of TMJPD or are consequences of it. Rather, we are presented with a series of questions about the role of diverse personality

variables in the onset, maintenance, and treatment outcome of the dysfunction. While not all of these questions can be addressed within a correlational study, particularly questions pertaining to the role of state variables as causal or resultant factors, it is possible to explore some of these relationships and evaluate their relative importance in TMJPD.

On the basis of this review, the following research questions are proposed: First, what is the nature of the relationship, if any, between the chronicity, pain intensity, and perceived severity of the TMJ dysfunction, as one set of variables, and diverse facets of personality, as another set? Second, does the same type of relationship occur among other non-TMJ pain-related disorders? Third, are there any general or specific differences in personality type or style between TMJPD patients or TMJPD subgroups, non-TMJ pain patients, and pain-free, healthy subjects? Fourth, if there are differences between TMJPD patients and the control groups, do these differences decrease in response to a positive treatment outcome?

Method

Subjects

A total of 356 subjects were used in the study. The first group was comprised of 206 consecutive referrals to the Facial Pain Clinic at the University of Western Ontario. Patients meeting the TMJPD criteria outlined by Eversole and Machado [6] were categorized as either myogenic facial pain ($n = 42$), internal derangement type I ($n = 69$), internal derangement type II ($n = 85$), or internal derangement type III ($n = 6$). An additional 3 patients were diagnosed as degenerative joint disease and 1 as symptomless click. The mean age for the dental group was 28.3 years (S.D. = 10.6) with 87.4% of the subjects female. The mean age and sex ratio are comparable to those reported elsewhere [2,12,29].

The second group, a pain control group ($n = 79$), was comprised of consecutive referrals attending outpatient physiotherapy clinics for the treatment of painful conditions arising from knee in-

juries (13), tendinitis (8), bursitis (6), fractures and sprains (5), surgery (3), shoulder injuries (11), whiplash and other neck injuries (7), back pain (12), and other sports injuries, accident, and minor injuries. Patients were selected for inclusion in the study by their physiotherapist with the proviso that the patients were not being treated for TMJPD or disorders of unknown, organic aetiology. The mean age was 33.0 years (S.D. = 11.1) and 69.2% of the subjects were female.

The third group was a pain-free, healthy control group ($n = 71$) comprised of upper year psychology students. The subjects were from a class and volunteered to be in the study. Subjects with chronic disease and/or pain were excluded. The mean age was 29.7 years (S.D. = 8.4) with 76.1% of these female.

Materials

Questionnaire

A 30 page questionnaire was developed for the study. In addition to items pertaining to the onset and chronicity of the presenting problems, and to the age and sex of the subject, the questionnaire contained the following major measures:

(a) *Temporomandibular joint pain and dysfunction index (dysfunction index)*. The temporomandibular joint pain and dysfunction index was comprised of 10 items formatted on a 6-point Likert scale, anchored by 'never' and 'always.' These items, which dealt with such variables as pain, limited mobility, clicking, and grinding, were culled from the dental literature and are symptoms commonly reported by TMJPD patients. The sum of these items, which can range from 0 to 50, was used to represent an overall subjective measure of the involvement of the dysfunction. *

(b) *Visual analogue scale (VAS)*. A numbered visual analogue scale was used to rate average pain intensity. Values ranged from 0 to 6 with the end-points anchored by 'no pain at all' and 'as intense as I can possibly imagine.'

(c) *Basic Personality Inventory (BPI)* [14]. The BPI is a 12-scale, 240-item, true or false questionnaire which measures components of psychopathology similar to those measured by the MMPI [13]. The BPI was chosen over the MMPI because the latter has been considered inappropriate for the use with pain patients [23,33]. The BPI contains fewer pain-related items than the MMPI and its scales are relatively independent, with no item overlap, allowing for greater discriminatory power. Each scale contains 20 separate items. The 12 scales include hypochondriasis, depression, denial, interpersonal problems, alienation, persecutory ideas, anxiety, thinking disorder, impulse expression, social introversion, self-depreciation, and deviation. Four of these scales (alienation, persecutory ideas, thinking disorder, and deviation) were not used in the present study as the subjects were unlikely to exhibit marked signs of psychopathology.

(d) *Multidimensional Health Locus of Control (MHLC)* [37]. The MHLC scale is a 3-dimensional, 18-item, Likert scale questionnaire designed to measure the extent to which an individual believes his health is or is not controlled or determined by his own behaviour [37].

(e) *Illness Behavior Questionnaire (IBQ)* [27]. The Illness Behavior Questionnaire is a 7-scale, 62-item, yes-no format questionnaire which measures various aspects of a patient's attitudes and feelings towards his illness, as well as his perception of how others react to his illness, and his view of his current psychosocial situation [34].

(f) *Perceived Stress Scale (PPS)* [4]. The Perceived Stress Scale is a 14-item, 5-point Likert scale questionnaire designed to measure the extent to which situations in the subject's life are perceived as stressful. A general measure of self-reported stress is obtained by summing across the 14 items.

(g) *Ways of Coping (Revised)*. The Ways of Coping (Revised) scale [8,9] is an 8-factor, 66-item, 4-point Likert scale questionnaire designed to sample a wide variety of thoughts and acts people use to deal with stressful situations. In the present study, the subjects were told that people have many different ways of coping with stressful events. They were instructed to select those

* A copy of this index is available from the authors upon request.

strategies listed in the questionnaire that they might use in dealing with stressful situations.

Procedure

The 206 patients were seen by R.I.B. and diagnosed according to the criteria outlined by Eversole and Machado [6]. A diagnosis of myogenic facial pain (MFP) was made in patients whose main complaint was pain in the absence of any joint sounds on opening and closing the mouth. If limited opening was present, it could be attributed to myospasm and not to any structural limitation in the joint. A diagnosis of internal derangement type I was made in subjects who experienced an opening click with or without a closing or reciprocal click. Deviation of the jaw on opening did not preclude a diagnosis of internal derangement type I. The criterion for a diagnosis of internal derangement type II was met if subjects reported a history of transitory closed lock. The patient's jaw would occasionally lock while opening; however, this difficulty could be readily overcome if the patient put the mandible through lateral excursions or pushed manually on the joint. If the closed lock condition (less than a 25 mm opening) could not be readily overcome and no clicking joint sounds were audible, a diagnosis of internal derangement type III was made. Joint sounds may or may not be present in this condition [6]. Of the patients diagnosed as suffering from internal derangements types I, II, or III, 88.2% were experiencing pain at time of assessment; the others had experienced intermittent pain.

Following dental assessment and diagnosis by R.I.B., the patients were asked to complete the questionnaires either in the clinic or at home. This task took approximately 45 min. The patients were prescribed simple jaw exercises to conduct at home and were referred for ultrasound at a physiotherapy clinic. These conservative and non-invasive forms of treatment have been shown to be effective [2,32] and are generally used before more radical treatment is attempted.

At a 5 month follow-up, the TMJPD patients were contacted by mail and asked to evaluate their pain and symptoms and to complete and return a

questionnaire battery similar to that originally completed. Of those contacted, 99 returned the questionnaires. Responses were nearly evenly distributed among those indicating that treatment was not very effective, moderately effective, and very effective.

Results

Patient characteristics

The length of time the individual reported having the problem (chronicity) was based on a 7-point category scale with the lowest value represented by 'less than 1 month' and the highest value by 'more than 5 years.' The length of time the TMJPD patients reported having the problem was slightly negatively skewed with 52.5% indicating that they had had the problem more than 1 year. The length of time that the pain controls reported the problem was more positively skewed with 67.1% reporting less than 12 months (Table I).

Clenching and grinding were considered present if the subject indicated that he or she was aware of engaging in these behaviours at least sometimes. In the present study, 58.7% of the

TABLE I
TMJPD, PAIN CONTROLS, AND PAIN-FREE, HEALTHY CONTROLS WHO PARTICIPATED IN THE STUDY

	TMJPD (S.D.)	Pain controls (S.D.)	Healthy controls (S.D.)
Number	202	79	71
% female	87.1	68.4	76.1
Mean age	28.0 (10.4)	33.0 (11.1)	29.2 (8.4)
Chronicity (mode in months)	12-24	1-3	-
TMJ dysfunction index	24.3 (7.7)	6.6 (5.7)	5.7 (5.7)
Pain intensity	3.0 (1.7)	3.5 (1.6)	-

TMJPD subjects reported that they clenched their teeth. This was significantly different ($\chi^2(2) = 9.42$; $P = 0.009$) from that reported by the pain control sample (43.6%) and the healthy controls (40.6%). Whether or not clenching is indicative of stress, it would appear that it is more common for TMJPD patients to clench their teeth than it is for other groups.

The number of TMJPD patients who actually attribute the onset of their problem to a specific stressful event is relatively low (9.0%). It is almost as common for them to attribute it to dental work (6.5%) or an accident or illness (11.5%). Although the number of patients who report that the condition is aggravated by stress or worry, emotional upset, disturbed sleep, or certain situations is relatively high (58.8%), it is comparable to and even slightly lower than that reported by the other pain patients (61.5%). It would seem that a painful condition of any type is aggravated by emotional upset, stress or worry, and certain other situations.

Analyses

In order to determine whether there is a direct relationship between the 3 symptom-related variables (independent variable set) and the personality-related variables (dependent variable sets)

among the TMJPD subjects ($n = 202$), 4 canonical correlation analyses were performed using SPSSx [35]. A canonical correlation analysis is a method for examining the relationship between multiple independent and dependent variables [26,36]. Canonical correlation is superior to multiple regression in that relationships of greater complexity may be examined with fewer analyses than would be necessary using multiple regression. An excellent overview of this approach is provided by Tabachnick and Fidell [36].

In each of the 4 analyses, the independent set included the chronicity, pain intensity, and perceived severity of the TMJ dysfunction, as measured by the TMJ dysfunction index.

First set of analyses

Is there a direct relationship between the chronicity, pain intensity, and perceived severity of the TMJ dysfunction as one set of variables and diverse aspects of personality as another set? In the first analysis of this set, the dependent variables included the Perceived Stress Scale and the Basic Personality Inventory. The PSS and BPI were treated as a set in this analysis and further analyses because they both tapped what might be considered a broad range of traditional personality dimensions. In the second analysis of this set, the dependent variable

TABLE II

SUMMARY OF 4 CANONICAL CORRELATION ANALYSES OBTAINED FROM DATA ON THE TMJPD GROUP ($n = 202$)

The independent variable set in each analysis contains the items pain intensity, chronicity, and the dysfunction index score.

Dependent variable sets	Rc	Rc SQR	df	Sig.	Redund. of I.V.	Redund. of D.V.	Struct. coeff. I.V. (> 0.30)	Struct. coeff. D.V. (> 0.30)
PSS and BPI	0.36	0.13	(27, 517.57)	NS	–	–	–	–
IBQ	0.34	0.12	(21, 514.54)	NS				
MHLC	0.30	0.09	(9, 447.96)	0.016	0.04	0.04	Intens (0.96) Dysfunc (0.61)	Powerf others (0.94) Chance (0.53)
Ways of Coping	0.32	0.10	(24, 519.76)	NS	–	–	–	–

Rc = canonical correlation; Rc SQR = squared canonical correlation; df = degrees of freedom; Sig. = significance; Redund. of I.V. = redundancy of the independent variable set; Redund. of D.V. = redundancy of the dependent variable set; Struct. coeff. I.V. = structure coefficients of the independent variable set; Struct. coeff. D.V. = structure coefficients of the dependent variable set.

included the Illness Behavior Questionnaire. The third analysis included the Multidimensional Health Locus of Control and the fourth analysis, the Ways of Coping scale.

The results of these 4 analyses are presented in Table II. Using Wilks' criterion, the only analysis to obtain significance was that for the dependent MHLC set ($F(9, 447.96) = 2.30$; $P = 0.016$). However, the canonical variates accounted for only 9% of the shared variance. The results of the canonical analyses were confirmed using the more traditional multiple regression approach.

Summary. The results of the canonical correlation analyses on the TMJPD patients suggest that there is not a meaningful, direct relationship between diverse measures of personality and measures of chronicity, pain intensity, and the perceived severity of the dysfunction. That is, increases in one set of variables are not associated with either increases or decreases in the other set of variables.

The lack of significance would not appear to be a function of intercorrelated variables as the assumptions of multicollinearity and singularity were

not violated. Furthermore, the variables were blocked into groups during the analyses, as indicated, in order to reduce the probability of highly intercorrelated variables, in different personality tests, appearing in the analyses.

Second set of analyses

Among patients with non-TMJ pain-related disorders, is there a direct relationship between the chronicity and pain intensity of the physically painful condition as one set of variables and diverse aspects of personality as the other set? In order to answer this question, the first set of analyses was repeated using the 79 pain controls. The analyses were the same with the exception that the dysfunction index score was excluded from the symptom set as the pain controls were not experiencing TMJ-related problems. All of the analyses were significant with the exception of that for the Ways of Coping scale (Table III).

Using Wilks' criterion, the canonical correlation (0.54) for the PSS and BPI was significant ($F(18, 136) = 1.96$; $P = 0.016$) and accounted for 28.9% of the variance between the 2 canonical

TABLE III

SUMMARY OF THE 4 CANONICAL CORRELATION ANALYSES OBTAINED FROM DATA ON THE PAIN CONTROLS (n = 79)

The independent variable set in each analysis contains the items pain intensity and chronicity.

Dependent variable sets	Rc	Rc SQR	df	Sig.	Redund. of I.V.	Redund. of D.V.	Struct. coeff. I.V. (> 0.30)	Struct. coeff. D.V. (> 0.30)
PSS and BPI	0.54	0.29	(18, 136)	0.016	0.154	0.058	Intens (0.91) Chron (0.48)	PSS (0.84) Hypo (0.81) Depr (0.47) Anxi (0.30)
IBQ	0.56	0.31	(14, 140)	0.006	0.161	0.096	Intens (0.96) Chron (0.36)	DisCon (0.89) AffDis (0.84) Hypo (0.69)
MHLC	0.41	0.17	(6, 148)	0.005	0.079	0.043	Intens (0.77) Chron (-0.58)	Powerf Others (0.80)
Ways of Coping	0.35	0.12	(16, 138)	NS	-	-	-	-

Rc = canonical correlation; Rc SQR = squared canonical correlation; df = degrees of freedom; Sig. = significance; Redund. of I.V. = redundancy of the independent variable set; Redund. of D.V. = redundancy of the dependent variable set; Struct. Coeff. I.V. = structure coefficients of the independent variable set; Struct. Coeff. D.V. = structure coefficients of the dependent variable set.

variates. The canonical variate of the dependent set extracted 20.1% of the variance from the PSS and BPI variables while the canonical variate of the independent set extracted 53.1% of the variance from the 2 symptom-related items. Considering the redundancy index for the symptom set, the PSS and BPI measures were able to account for 15.4% of the variance in that set. Pain intensity and chronicity were able to account for only 5.8% of the variance in the dependent set.

With a structure coefficient cut-off score of 0.30 for interpretation, perceived stress (0.84), hypochondriasis (0.81), depression (0.47), and anxiety (0.30) tended to be the more important variables in the dependent set. Among the symptom set, pain intensity (0.91) was more relevant than chronicity (0.48). Hence, as pain intensity and chronicity increase there is a tendency for perceived stress, hypochondriasis, depression, and anxiety to increase as well.

The canonical correlation (0.56) for the IBQ dependent set also obtained significance ($F(14, 140) = 2.34; P > 0.006$) and accounted for 30.8% of the variance between the canonical variates. The IBQ variables were able to account for 16.1% of the variance in the symptom set. Pain intensity and chronicity were able to account for only 9.6% of the variance in the dependent set. An examination of the structure coefficients indicates that

disease conviction (0.89), affective disturbance (0.84), and hypochondriasis (0.69) were the important variables in the dependent set. As in the PSS and BPI analysis, pain intensity (0.96) was more relevant than chronicity (0.36). The variance (17.1%) accounted for by the canonical variates of the MHLC dependent set and symptom set was considerably less than that accounted for by the PSS/BPI and IBQ, although it was still significant ($F(6, 148) = 3.25; P = 0.005$).

The analyses were confirmed using stepwise multiple regression. The proportion of variance accounted for was slightly higher using the multiple regression approach but this tended to be the result of only 1 or 2 variables meeting the criteria for entry into the regression equation.

Summary. The results of these analyses indicate a significant but weak relationship between the chronicity and pain intensity of non-TMJ painful conditions, on the one hand, and personality, particularly perceived stress, hypochondriasis, depression, anxiety, and disease conviction, on the other.

Third set of analyses

Are there any personality differences among TMJPD subgroups, pain controls, and pain-free, healthy controls? In order to compare TMJPD patients with controls who do not, themselves, have significant TMJPD symptomatology, indi-

TABLE IV
TMJPD, PAIN CONTROLS, AND PAIN-FREE, HEALTHY CONTROLS WHO MET THE INCLUSION CRITERIA

	MFP (S.D.)	Type I (S.D.)	Type II (S.D.)	Pain controls (S.D.)	Healthy controls (S.D.)
Number	42	69	85	56	52
% female	85.7	82.9	89.4	83.9	84.6
Mean age	29.0 (11.3)	29.0 (10.3)	26.7 (9.9)	31.5 (10.4)	29.3 (7.8)
Chronicity (mode in months)	12-24	7-12	12-24	1-3	-
TMJ dys. index	20.5 (7.0)	24.7 (7.8)	25.7 (7.6)	6.3 (5.0)	4.5 (4.4)
Pain intensity	3.2 (1.7)	3.0 (1.8)	3.0 (1.7)	3.6 (1.7)	-

viduals in the 2 control groups whose score on the TMJPD index exceeded a level 1 S.D. below the mean of the TMJPD group were excluded from the analyses. This involved 11 subjects in the pain group and 7 in the pain-free group. Four subjects in the pain-free, healthy control group who reported chronic headaches were also excluded. An

additional 12 males were randomly excluded from the pain control group and 8 from the healthy control group in order to balance the groups on sex. The TMJPD groups classified as internal derangement type III ($n = 6$), degenerative joint disease ($n = 3$), or symptomless click ($n = 1$) were excluded from the analyses due to insufficient

TABLE V

MEAN PRE-TREATMENT SCORES ON THE PERSONALITY MEASURES FOR THE TMJPD GROUPS, PAIN CONTROLS, AND PAIN-FREE, HEALTHY CONTROLS

	MFP ($n = 42$) (S.D.)	Type I ($n = 69$) (S.D.)	Type II ($n = 85$) (S.D.)	Pain controls ($n = 56$) (S.D.)	Healthy controls ($n = 52$) (S.D.)
<i>Basic Personality Inventory</i>					
Hypochondriasis	8.0 (3.9)	6.5 (3.4)	6.9 (4.2)	7.3 (4.1)	3.2 (2.6) *
Depression	3.4 (2.8)	2.7 (2.8)	4.0 (4.2)	3.2 (2.7)	2.2 (2.5) *
Denial	6.2 (2.2)	6.3 (2.7)	5.8 (2.4)	6.3 (2.9)	5.5 (2.9)
Interpersonal	7.6 (3.3)	8.6 (3.2)	8.0 (3.7)	7.9 (3.5)	6.9 (2.9)
Anxiety	8.1 (3.9)	7.6 (3.9)	7.7 (4.4)	6.9 (3.3)	6.8 (3.6)
Impulse control	6.0 (3.4)	6.5 (4.0)	6.7 (3.7)	6.3 (3.4)	5.3 (3.0)
Social introver	4.4 (2.9)	4.3 (3.4)	4.8 (3.6)	4.5 (3.3)	3.8 (2.9)
Self depreciation	1.6 (1.8)	1.4 (1.6)	2.1 (2.2)	1.2 (1.6)	1.3 (1.4)
<i>Perceived Stress Scale</i>					
PSS	22.3 (10.4)	22.4 (8.7)	21.2 (8.7)	22.3 (8.5)	19.4 (8.4)
<i>Illness Behavior Questionnaire</i>					
Hypochondriasis	1.5 (1.6)	1.5 (1.6)	1.6 (2.1)	1.7 (1.9)	- -
Disease conviction	1.4 (1.3)	1.3 (1.1)	1.2 (1.3)	1.7 (1.4)	- -
Psych vs. somatic	1.8 (1.0)	1.8 (1.0)	1.7 (0.9)	1.4 (0.9)	- -
Affective inhib	2.0 (1.9)	2.1 (1.8)	2.3 (1.8)	2.1 (1.8)	- -
Affective disturb	2.2 (1.8)	1.5 (1.6)	1.6 (1.8)	1.5 (1.6)	- -
Denial	2.4 (1.5)	2.5 (1.3)	2.7 (1.4)	2.7 (1.6)	- -
Irritability	2.1 (1.1)	1.9 (1.1)	2.1 (1.3)	2.0 (1.4)	- -
<i>Multidimensional Health Locus of Control</i>					
Internal HLC	25.2 (5.0)	25.7 (4.9)	25.3 (5.0)	25.3 (5.3)	26.8 (4.6)
Powerful others	16.0 (4.9)	15.8 (5.2)	16.0 (5.6)	16.5 (7.0)	15.7 (5.3)
Chance	16.5 (5.4)	16.9 (5.5)	17.6 (5.2)	17.7 (5.2)	16.8 (5.1)
<i>Ways of Coping</i>					
Confrontive	6.1 (2.7)	6.9 (2.9)	5.9 (3.2)	5.9 (2.9)	6.3 (2.6)
Distancing	6.6 (3.1)	6.4 (3.1)	6.6 (3.4)	6.0 (3.3)	5.9 (2.4)
Self-controlling	9.5 (3.3)	9.7 (2.8)	9.6 (3.4)	8.9 (3.6)	9.3 (2.8)
Seeking soc supp	8.8 (3.3)	9.1 (3.6)	8.4 (3.6)	8.7 (3.5)	9.1 (3.4)
Accepting respons	4.9 (2.1)	5.0 (2.1)	5.1 (2.4)	4.1 (2.4)	5.2 (2.3)
Escape avoidance	6.2 (4.0)	6.3 (3.9)	6.7 (4.9)	6.0 (4.2)	5.8 (3.9)
Planful prob sol	7.6 (2.3)	7.6 (2.6)	7.3 (2.9)	7.0 (2.8)	7.9 (2.0)
Positive reappr	9.4 (3.7)	9.5 (4.1)	8.7 (4.5)	8.5 (4.5)	8.8 (3.7)

* Using multivariate analysis of variance, the subjects suffering from pain (3 TMJPD groups and pain controls) differed significantly from the healthy controls on Hypochondriasis ($P < 0.001$) and Depression ($P = 0.005$).

sample size. Table IV presents data on the remaining 3 TMJPD groups and the 2 control groups used in the following analyses.

A between-groups multivariate analysis of variance (MANOVA) was performed in order to determine whether there was a significant difference between groups on any of the dependent measures. In the first MANOVA, 9 dependent variables were entered, including the PSS and the 8 scales from the BPI.

Mean values for the variables in each of the 5 groups appear in Table V. The healthy controls score lower on all but one of the PSS and BPI measures. Employing Wilks' criterion, the overall test for a group effect was significant ($F(36, 1088.5) = 2.53$; $P < 0.001$).

The Roy-Bargman stepdown analysis indicates a significant effect for hypochondriasis ($F(4, 297) = 11.80$; $P < 0.001$), depression ($F(4, 296) = 3.12$; $P = 0.015$), and anxiety ($F(4, 295) = 2.57$; $P = 0.038$). The strength of association (η^2) between each significant variable and the group effect was strongest for hypochondriasis (13.7%), followed by a marginal association for depression (4.1%) and anxiety (3.4%).

Post hoc follow-up tests indicate that the TMJPD groups and the pain control group differed significantly from the healthy controls on hypochondriasis and depression. There were no significant differences between the TMJPD groups and the pain controls or among any of the TMJPD subgroups.

A second between-groups MANOVA was conducted on the Illness Behavior Questionnaire (IBQ). As the healthy controls were not suffering from any physical problems, they did not complete the IBQ. The analysis therefore tests whether there are any differences among any of the 3 TMJPD groups and the pain controls. There were no significant differences between any of the groups.

Two additional between-groups MANOVA were performed using the 3 Multidimensional Health Locus of Control scales and the 8 Ways of Coping scales as the dependent sets. The groups did not differ on any of these measures.

Summary. Although the effect is weak, TMJPD patients and pain controls differ significantly from

pain-free, healthy controls on the hypochondriasis and depression scales of the BPI. There are no differences among TMJPD subgroups or between TMJPD patients and the pain controls on any of the measures. What these results seem to suggest, particularly in light of the differences between the pain controls and the healthy controls, is that a painful condition may result in minor elevations on hypochondriasis and depression. A stronger test of this hypothesis would be to see if these elevations decrease in response to treatment.

Fourth set of analyses

Do scale elevations on the various personality measures decrease as a function of treatment? In order to determine whether elevations on the personality measures would decrease in response to a positive treatment outcome, subjects were selected from among the 99 follow-ups on the basis of their pain intensity and TMJ dysfunction index scores after treatment. Response to treatment was considered positive if either follow-up pain intensity or dysfunction index scores were less than their respective baseline assessment scores. Eighty-four TMJPD subjects met either or both of these liberal criteria. The condition of the remaining 15 was unchanged or worsened.

The overall effect of treatment was significant ($F(2, 74) = 43.70$; $P < 0.001$). The effect was significant for both pain intensity ($F(1, 75) = 70.42$; $P < 0.001$), which decreased from a mean of 3.0 to 1.2, and the TMJPD index ($F(1, 74) = 9.25$; $P = 0.003$), which decreased from 26.0 to 19.9. The strength of the association (η^2) was strongest for pain intensity (48.4%) and considerably less for the TMJPD index (11.1%), indicating that improvement weights more heavily on changes in pain intensity than changes in overall TMJ symptomatology.

Table VI presents the pre-treatment and post-treatment scores for the various personality measures for the improved TMJPD subjects who completed the follow-up questionnaire. On many of the scales there is a decrease from assessment to follow-up. The overall decrease among the dependent measures of the BPI and PSS was significant ($F(9, 74) = 2.59$; $P = 0.012$). Roy-Bargman stepdown F tests indicate that the decrease was

TABLE VI

MEAN PRE-TREATMENT AND POST-TREATMENT SCORES ON THE PERSONALITY MEASURES FOR THE TMJPD PATIENTS ($n = 84$) WHO ANSWERED THE FOLLOW-UP QUESTIONNAIRE AND RESPONDED TO TREATMENT.

	TMJPD	
	Pre ($n = 84$) (S.D.)	Post ($n = 84$) (S.D.)
<i>Basic Personality Inventory</i>		
Hypochondriasis	6.9 (3.7)	6.1 (3.7) *
Depression	3.6 (3.8)	2.8 (3.0) *
Denial	5.8 (2.4)	6.0 (2.7)
Interpersonal problems	8.0 (3.7)	8.3 (3.8)
Anxiety	7.9 (4.2)	7.5 (4.2)
Impulse control	6.4 (3.1)	5.9 (3.2)
Social introversion	4.8 (3.4)	4.6 (3.2)
Self-depreciation	2.0 (2.0)	1.6 (2.0)
<i>Perceived Stress Scale</i>		
PSS	22.2 (9.2)	21.1 (7.9)
<i>Illness Behavior Questionnaire</i>		
Hypochondriasis	1.6 (1.9)	1.3 (1.8)
Disease conviction	1.3 (1.2)	0.7 (1.0) *
Psych vs. somatic	1.9 (1.0)	2.0 (0.8)
Affective inhibition	2.5 (1.9)	2.5 (1.8)
Affective disturbance	1.8 (1.7)	1.4 (1.6) *
Denial	2.5 (1.5)	2.1 (1.5) *
Irritability	2.2 (1.3)	1.7 (1.2) *
<i>Multidimensional Health Locus of Control</i>		
Internal	26.2 (4.7)	25.9 (4.4)
Powerful others	16.1 (5.7)	15.8 (5.3)
Chance	17.5 (5.3)	17.7 (5.5)
<i>Ways of Coping</i>		
Confrontive	6.2 (3.0)	6.0 (2.5)
Distancing	6.9 (3.4)	6.6 (2.9)
Self-controlling	10.0 (3.2)	9.7 (3.2)
Seeking social support	8.9 (3.3)	9.0 (3.3)
Accepting responsibility	4.9 (2.4)	4.9 (2.2)
Escape avoidance	6.4 (4.1)	6.1 (3.7)
Planful problem solving	7.6 (2.8)	7.4 (2.5)
Positive reappraisal	9.2 (4.3)	9.0 (4.3)

* Employing multivariate analysis of variance techniques significant pre-treatment and post-treatment differences were found on these variables. The remaining variables were not significantly different from one another.

significant for hypochondriasis ($F(1, 81) = 4.66$; $P = 0.034$) and depression ($F(1, 80) = 10.31$; $P = 0.002$). The strength of the decrease was stronger

for depression (11.4%) than for hypochondriasis (5.4%).

Scores tend to decrease on the IBQ as well ($F(1, 77) = 6.68$; $P < 0.001$). Stepdown tests indicate that the decrease is significant for affective disturbance ($F(1, 82) = 7.52$; $P = 0.007$), irritability ($F(1, 81) = 13.06$; $P = 0.001$), denial ($F(1, 79) = 7.53$; $P = 0.007$), and disease conviction ($F(1, 77) = 7.42$; $P = 0.008$). The strength of the associations, in decreasing order of significance, are: irritability (13.9%), disease conviction (8.8%), denial (8.7%), and affective disturbance (8.4%). As might be expected, these decreases did not occur over the more stable measures of personality styles for the MHLC or the Ways of Coping scales.

Summary. There was a significant decrease on the hypochondriasis and depression scales of the BPI and the irritability, disease conviction, denial, and affective disturbance scales of the IBQ among TMJPD patients who responded positively to treatment. There were no changes on the MHLC or the Ways of Coping scale. This outcome supports the hypothesis that at least some of the psychological distress observed in these patients may be a function of the physical condition itself. It suggests, rather than demonstrates, this as psychological distress and the TMJPD symptomatology may be unrelated but moderated by a third variable. Conceivably, the patients who seek treatment for this dysfunction may also tend to be somewhat more distressed. If this is the case, a reduction in symptomatology may have a beneficial effect on the anxiety or depression, for example, without the symptoms being the cause of the anxiety or depression. In a sense, there might be one less thing to worry about.

Discussion

Relationship between personality and TMJPD

One of the more interesting findings in this study is the lack of a meaningful canonical correlation for the TMJPD patients between the chronicity, pain intensity, and perceived severity of the TMJ dysfunction, as one set of variables, and diverse measures of personality, as the other set.

Increases in physical distress do not appear to be linearly related either to increases or decreases in psychological disturbance. This finding is interesting in light of some of the assumptions that have been made about the nature of the dysfunction and psychological disturbance. This finding is perhaps even more interesting when contrasted with the canonical correlation analyses for the pain controls. Three of the 4 analyses were significant and accounted for small but meaningful proportions of the shared variance.

The results of the canonical analyses suggest that it may be inappropriate to assume that different pain disorders are subsets of a larger, more all-encompassing pain syndrome. Many approaches to the evaluation and treatment of pain patients seem to view them as members of a homogeneous population, assuming that psychological responses to their disorder will be similar. In examining the relationship between personality and pain, it is insufficient to consider only the intensity and chronicity of the pain. The meaning or consequence of the pain may be of paramount importance. This needs to be followed up in future studies.

The effect of TMJPD on the well-being of the individual

The results of this study indicate that TMJPD patients and patients experiencing pain attributable to an organic pathology score significantly higher on the hypochondriasis and depression scales of the BPI than do pain-free, healthy subjects. Furthermore, elevations on these scales decrease in response to a positive treatment outcome. TMJPD patients do not seem to differ from either pain patients or healthy controls in their response to illness or in the ways in which they cope with stress. Even when the TMJPD patients are subdivided along a severity continuum, there still do not appear to be any major psychological differences between the TMJPD patients and the other groups. These results are in agreement with more recent studies in this area [10,15,18–22,34]. In general, TMJPD patients are found to differ on diverse psychological measures from pain-free controls but not from other pain patients. Merskey

et al. [24] suggest that TMJPD patients may even have a lower rate of psychological illness, as detected by questionnaire, than other chronic pain populations.

The only other study [7] to have used a classification of TMJPD similar to the present one found small but significant differences on the MMPI between myofascial pain (MFP), atypical facial pain (AFP), and TMJ internal derangement patients (TMJID), with the MFP and AFP groups scoring higher than the TMJID patients on hypochondriasis, depression, hysteria, psychopathic deviate, psychasthenia, and schizophrenia. However, as there was no apparent control for the multiple ANOVAs computed, the actual number of significant differences between groups may be somewhat lower. Furthermore, as in the present study, the elevations were still within the normal range.

Scudds et al. [31] suggest that small elevations on the BPI may reflect symptomatology rather than psychopathology. An examination of the BPI scales indicates that TMJPD patients may be more likely to respond to certain items as a result of their presenting symptoms than other patients. This criticism has already been raised with respect to the MMPI by Merskey et al. [23] and Smythe [33].

When one considers that TMJPD patients appear to be relatively normal and do not seem to attribute the onset of the problem to stressful events, it is somewhat puzzling as to why TMJPD has been considered a psychosomatic disorder. This may, in part, be a function of the way in which health care professionals have interacted with the less manageable patients. As in any large sample of people, there are likely to be individuals with psychological problems additional to their presenting problems. Salter et al. [30] estimate that between 20% and 30% of patients consult their physicians for primarily psychological reasons. If these patients are the ones who draw most of the attention then an association between psychopathology and the physical condition is likely to be made, especially if an organic pathology is not readily observable. Some support for this is offered through the cluster analytic work of Butterworth and Deardorff [3] who found that up to 26% of TMJPD patients may have severe emotional dis-

tress to the point of appearing psychopathological on screening measures. Generalizations about the role of psychological factors in TMJPD may, in part, be based on dentists' and physicians' interactions with these problematic patients.

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