

Psychophysical Subtypes of Temporomandibular Disorders

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This study presents an approach to the classification of temporomandibular disorders (TMD) based on acknowledgment of the interaction of physical, psychologic, and social factors using a multidimensional instrument that has been previously validated. The psychometric properties of this instrument were reevaluated in 140 women with TMD. Multidimensional clustering identified three subgroups of patients with TMD, including a highly distressed, psychosocially maladaptive group; a moderately distressed, behaviorally functional group; and a predominantly physical disorder group with an unremarkable psychosocial profile. These groups were termed maladaptive, adaptive, and uncomplicated, respectively, according to the constellation of predominant symptoms and psychosocial profiles of each cluster. The groups showed no consistent differences in pain frequency, use of medication, or duration of pain. This finding supports earlier work that suggested the prominence of three subtypes of this disorder according to both physical illness and psychosocial illness impact parameters.

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Temporomandibular disorders (TMD), also known as temporomandibular pain-dysfunction disorder, is a broad term that encompasses a constellation of symptoms, such as pain and/or discomfort in the temporomandibular joint(s) and/or muscle(s) of mastication, impairment of masticatory function, and joint noises. The traditional approaches to treatment of TMD involve physical and occlusal therapies and the use of analgesic and anti-inflammatory medications; success rates of approximately 70% to 80% have been reported with these approaches.^{1,2} Although these approaches predominate, it is becoming evident that a considerable minority of patients may fail to respond to such treatment. In this regard, there is emerging literature that suggests that some individuals with TMD may benefit from multidisciplinary and psychologic approaches to the management of this condition, such as cognitive-behavioral therapy, biofeedback, stress management, and the use of psychotropic medications.¹⁻⁴ Although psychologic approaches to chronic pain are not new,^{5,6} it is only in recent decades that they have come to be recognized as integral to the treatment of TMD.^{7,8} The recent proliferation of articles focusing on behavioral and cognitive elements of TMD reflects the trend toward a more balanced approach to evaluation and management of chronic musculoskele-

tal pain conditions such as TMD.^{7,9,10} Attempts to classify patients with TMD according to psychosocial characteristics have also become more prominent.¹¹⁻¹³

The aims of the present study were to reevaluate the psychometric properties of the Temporomandibular Disorders questionnaire (TMDQ)¹⁴⁻¹⁶ and attempt to subdivide patients with TMD according to meaningful psychophysical subtypes based on the profile of patients on this instrument, which comprises a physical symptom scale, pain coping strategy and illness behavior scales, and an illness impact profile.

Materials and Methods

The sample consisted of 140 consecutive women with a confirmed diagnosis of TMD (mean age 39.2 years, standard deviation [SD] 16.8) presenting to the Oral Medicine Clinic at the Royal Dental Hospital of Melbourne. A diagnosis of TMD was established if (1) the patients demonstrated pain/discomfort in the temporomandibular joint(s) and/or muscle(s) of mastication, as well as masticatory dysfunction, for a period exceeding 6 months and (2) they met the Research Diagnostic Criteria for Temporomandibular Disorders.¹⁷ Exclusion criteria were the inability to comprehend English or the presence of a psychiatric or physical disability (other than anxiety or depression) severe enough to prohibit participation in the conservative treatment program.

All patients completed the self-administered TMDQ¹⁴⁻¹⁶ at initial assessment, before commencing treatment. The TMDQ¹⁴⁻¹⁶ was developed to be sensitive to the physical illness domain, as well as the psychosocial and illness impact domains of TMD. It consisted of the following scales: the self-administered anamnestic or symptom profile¹⁸; the psychosocial illness impact profile, based on the Coping Strategies Questionnaire (CSQ¹⁹); the Illness Behavior Questionnaire (IBQ²⁰); and the Hospital Anxiety and Depression Scale (HAD²¹). Both symptom profiles and psychosocial profiles, according to the biopsychosocial model of pain, could be generated, including the type, frequency, location, and duration of symptoms suffered and the extent of affective disturbance, cognitive control, illness behavior, and illness impact factors. All the scales were used in their original form to provide validity¹⁸⁻²¹ and were retested in the present study for their psychometric properties and to provide data comparable to other musculoskeletal pain conditions. The TMDQ measured the frequency of

cardinal symptoms for which patients with TMD frequently seek treatment, such as pain and/or mandibular dysfunction. The physical symptoms tabulated included the frequency of facial pain, headache, pain during function, difficulty opening the mouth wide, tiredness/heaviness in the jaws, and joint sounds.

All data were analyzed with the SPSS program.²² Analyses included Cronbach's α coefficient statistics for internal reliability of the various subscales and cluster analysis to consider possible subgroups of TMD. Informed consent was obtained from all subjects according to ethical requirements.

Results

Subtypes of TMD

Subtypes of TMD were generated using an iterative partitioning method, the k-means cluster,²³ which has proven to be a reliable and algorithmically appropriate method of classification.²² Subjects' scores on the physical symptom profiles and psychosocial illness impact profiles, which included coping styles, illness behavior, and impact on daily living subscales of the TMDQ, were subjected to k-means clustering using Euclidian distance as the similarity measure.²⁴ The number of clusters present in the data was determined with the Kaiser criterion, which was also consistent with the interpretability of the resulting TMDQ profiles at various partition levels (two to six clusters). An element of subjectivity is inevitable in employing a given criterion for determining the number of clusters, but it was believed that reliability and clinical interpretability were paramount, especially since there are many techniques available for determining the true number of clusters and none of these has proven to be effective across all techniques and samples.²⁵

Three distinct subtypes of TMD were identified, including a "maladaptive" group (highly distressed, psychosocially maladaptive; 31%), an "adaptive" group (moderately distressed, behaviorally functional group; 35%), and an "uncomplicated" group (predominantly physical disorder group with an unremarkable psychosocial profile, ie, all scores for this group were at the lower end of the disability spectrum according to normative data; 34%).

The terms *simple* (uncomplicated), *intermediate* (adaptive), and *complex* (maladaptive) are also proposed as an alternative to the current subdivision as a possible guide to clinical subdivision of TMD patients.

Table 1 Mean Values (and Standard Deviations) of Sociodemographic Factors of Patients With Temporomandibular Disorders According to Cluster

	Maladaptive (complex)	Adaptive (intermediate)	Uncomplicated (simple)
Age (y)	37.2 (14.3)	38.3 (15.7)	40.7 (18.9)
Level of education (y)	11.0 (2.3)	11.3 (2.4)	11.0 (3.2)
Occupational status (unemployed) (%)	24	23	21
Married (%)	27	25	38
Medication usage (%)	73	54	57
General health (poor) (%)	11	7	6

Table 2 Symptom/Psychologic Profiles of TMD Subgroups

	Maladaptive (complex)		Adaptive (intermediate)		Uncomplicated (simple)	
	Mean	SD	Mean	SD	Mean	SD
Physical factors						
Facial pain	3.8	0.5	3.2	0.8	3.5	0.8
Headache	3.0	0.9	3.1	0.8	2.6	1.0
Pain during jaw movement	3.4	1.0	2.9	1.1	3.1	1.1
Difficulty opening mouth/biting	3.2	1.1	2.9	1.3	2.8	1.3
Tiredness/heaviness of jaws	2.9	1.2	2.9	1.2	2.4	1.3
Clicking (jaws)	2.8	1.2	3.1	1.1	3.3	1.1
Creptus (jaws)	2.4	1.4	2.6	1.3	2.5	1.3
Coping factors						
Diverting attention	9.7	5.8	16.7	8.3	4.4	4.6
Pain coping behaviors	17.1	5.8	26.1	5.3	11.8	6.8
Praying and hoping	16.9	8.5	17.6	8.9	6.1	4.8
Catastrophizing	19.0	7.2	11.6	8.7	6.3	6.1
Ability to decrease pain	2.1	1.4	2.7	1.3	2.3	1.3
Control over pain	2.3	1.1	3.5	1.4	2.8	1.4
Illness behavior						
General hypochondriasis	2.6	2.1	1.5	1.6	1.2	1.6
Disease conviction	3.8	1.1	2.8	1.5	2.2	1.3
Affective disturbance	3.5	1.4	2.5	1.5	2.2	1.9
Irritability	2.1	1.7	1.7	1.5	1.5	1.5
Psychologic/life impact factors						
Anxiety	6.3	2.9	4.1	3.0	4.0	2.9
Appetite	4.0	3.8	3.1	3.0	2.8	3.4
Home life	3.4	3.0	2.3	2.2	2.4	2.5
Panic	4.5	3.5	2.7	3.0	2.0	2.8
Self-reported severity of symptoms	4.1	0.6	3.8	0.9	3.3	0.8
Sleep disturbance	7.0	3.0	5.5	3.4	5.0	3.4
Worry	7.8	2.0	5.7	3.0	6.0	3.3

Independence of the three clusters was assessed using analysis of variance with α set at .05. Post-hoc comparisons were conducted using the Scheffe statistic. Table 1 presents sociodemographic characteristics of the TMD clusters identified.

Statistically significant differences between the three groups were found for use of coping strategies, illness behavior, psychological distress, and impact on daily life (Table 2). Post-hoc comparisons suggested statistically significant differences

between clusters 1 and 2 (complex and intermediate TMD) for coping factors (diverting attention, coping, catastrophizing), illness behavior (general hypochondriasis, disease conviction), anxiety, and self-reported severity of symptoms ($P < .05$). Statistically significant differences were also observed between clusters 1 and 3 (simple and complex TMD) for coping factors (diverting attention, coping, praying and hoping, catastrophizing), illness behavior (general hypochondriasis, disease conviction,

tion, and affective disturbance), as well as anxiety, sleep disturbance, and self-reported severity of symptoms. Statistically significant differences between groups 2 and 3 (intermediate and complex TMD) were observed for all coping factors and for the self-report rating of the severity of symptoms ($P < .05$). Overall, there were no consistent differences between the groups in terms of frequency of physical symptoms ($P > .05$). To control for possible confounding variables, an analysis of variance (ANOVA) was conducted; this showed no differences between the clusters in terms of age, use of medications, level of education, duration of pain, or outcome of previous treatment ($P > .05$).

The rating of the severity of symptoms was significantly associated with catastrophizing, facial pain, and disease conviction ($P < .05$). Table 2 presents psychophysical symptom profiles of the three clusters. In terms of the internal reliability of the TMDQ, Cronbach's α coefficient values for the subscales of the TMDQ ranged from .58 to .79, while mean reliability was .73.

Discussion

The results of the present study indicated the importance of an integrated assessment of TMD as a disorder that results in significant disability in daily living and masticatory function and that may involve a combination of physical and psychosocial dysfunction. It is clear that instruments such as the TMDQ, which appear to be sensitive to each of these aspects of TMD and which have a high degree of reliability, represent an effective approach to the assessment of this disorder and may facilitate the adequate prioritization of health care resources in caring for the specific needs of individual patients.

The main finding from the present study relates to the identification of distinct TMD subgroups in terms of psychophysical factors. One of the three subgroups identified in the present study included a maladaptive group, which is associated with relatively high levels of psychologic distress and impact of pain on daily life, use of maladaptive coping strategies, disease conviction, and hypochondriasis. This group also showed a nonsignificant trend toward greater medication usage. The adaptive group, another subgroup, is associated with greater use of adaptive coping strategies, low levels of psychologic distress and impact of pain on daily life, and less prominent hypochondriasis and disease conviction. The final cluster, the uncomplicated group, reflected well-functioning behavior, with

minimal use of coping strategies; relatively low levels of hypochondriasis and disease conviction; and minimal psychologic distress, severity of current symptoms, and impact of pain on daily life.

In general terms, the findings of the present study suggest that patients with TMD may be characterized according to at least three broad patterns of behavior, with approximately 30% of patients demonstrating a behaviorally maladaptive pain profile; two other groups, comprising 70% of patients, display better-functioning, yet distinct, profiles. Although there were significant overlaps between the latter two groups (ie, adaptive and uncomplicated), in terms of their lower levels of illness behavior, psychologic distress, use of maladaptive coping strategies, and impact of pain on daily life, relative to the maladaptive group, these groups were distinguished by their use of coping strategies generally as well as their levels of disease conviction and self-reported severity of TMD symptoms.

The subtypes that emerged from the k-means procedure were compared to those derived by previous researchers using similar symptoms and psychologic factor methods (eg, Symptom Checklist 90-Revised [SCL-90-R]²⁶; West Haven-Yale Multidimensional Pain Inventory [WHYMPI]²⁷). Despite the differences in assessment methods employed, the results of the present study are consistent with the ternary models developed by Butterworth and Deardorff¹¹ and Rudy et al,¹² who have distinguished between adaptive coping-normal, moderately-severely distressed, and dysfunctional subgroups of TMD patients. Butterworth and Deardorff¹¹ used a multivariate clustering procedure and identified three relatively homogeneous subgroups of patients with TMD—psychologically normal, moderately distressed, and severely distressed groups. Measures used included the SCL-90-R²⁶ and a temporomandibular pain questionnaire. Rudy and colleagues¹² have proposed a psychologic taxonomy of patients with TMD based on the WHYMPI,²⁷ distinguishing between dysfunctional, interpersonally distressed, and adaptive coping groups, a taxonomy that has proven significantly robust.^{8,28}

An emerging view from the studies of psychophysical subtyping of patients with TMD has suggested the presence of a dysfunctional segment of the TMD population who show considerable psychologic distress, with a greater impact of pain on daily life; according to the current findings, this segment tends to employ maladaptive coping strategies and show greater disease conviction and hypochondriasis. There is some evidence for a maladaptive segment of the TMD population who, in

addition to maladaptive coping strategies and disease conviction, may also demonstrate depression, obsessive symptoms, and somatization.^{2,29} The data relating to functional behavior are somewhat more equivocal, since use of effective coping strategies was not a consistent distinguishing feature of the two higher functioning groups (simple and intermediate TMD) from the maladaptive (complex TMD) group. In fact, the adaptive and uncomplicated groups also differed considerably in their use of coping strategies. However, the present findings suggested that the use of maladaptive coping strategies may be an important correlate of maladaptive behavior in TMD and were a distinguishing feature of the maladaptive and well-functioning groups.

Finally, although such methods can be abused, it is suggested that multidimensional clustering approaches offer some promise in the psychophysical subdivision of TMD, particularly given the failure to identify important predictors of treatment response in this disorder.^{30,31} The ability to subdivide patients according to psychophysical criteria may be a key to providing the most appropriate treatment, especially for those patients identified as being severely distressed and given the recent support for psychologic factors in the DSM-IV³² classification of pain disorders.

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Resumen

Subgrupos Psicológicos de Desórdenes Temporomandibulares

Este estudio presenta un planteamiento de la clasificación de los desórdenes temporomandibulares (DTM) basado en el reconocimiento de la interacción de los factores físicos, psicológicos y sociales; utilizando un instrumento multidimensional que ha sido validado previamente. Las propiedades psicométricas de este instrumento fueron reevaluadas en 140 mujeres con DTM. Al ejecutar una agrupación multidimensional, se identificaron tres subgrupos de pacientes con DTM, incluyendo a un grupo con pacientes muy afligidos y maladaptados psicológicamente; a un grupo de pacientes con un comportamiento moderadamente funcional; y a un grupo de pacientes con un desorden físico predominantemente sin ningún perfil psicológico considerable. Estos grupos fueron denominados: maladaptados, adaptados y sin complicaciones, respectivamente de acuerdo al tipo de síntomas predominantes y perfiles psicológicos de cada grupo. Los grupos no presentaron diferencias consistentes en cuanto a la frecuencia del dolor, uso de medicaciones o duración del dolor. Este hallazgo respalda a los estudios anteriores que indicaban la distinción de tres subtipos de este desorden de acuerdo al impacto de los parámetros de las enfermedades físicas o psicosociales.

Zusammenfassung

Psychophysikalische Subtypen von temporomandibulären Erkrankungen

Diese Studie stellt eine Methode zur Klassifizierung von temporomandibulären Erkrankungen (TMD) vor, welche auf den Kenntnissen der Interaktion von physikalischen, psychologischen und sozialen Faktoren anhand eines multidimensionalen Instrumentes gründet, welches früher für gültig erklärt wurde. Die psychometrischen Eigenschaften dieses Instrumentes wurden bei 140 Frauen mit TMD reevaluiert. Multidimensionales Zusammensetzen ergab drei Subgruppen von Patienten mit TMD, es beinhaltet eine stark leidende, psychosozial maladaptive Gruppe; eine mässige, verhaltensfunktionierende Gruppe; und eine prädominant physikalisch kranke Gruppe mit einem unauffälligen psychosozialen Profil. Diese Gruppen wurden als maladaptive, adaptive, respektiv unkompliziert bezeichnet gemäss der Konstellation der prädominanten Symptome und der psychosozialen Profile jeder Gruppe. Die Gruppen zeigten keine übereinstimmenden Unterschiede bezüglich Schmerzhäufigkeit, Medikamentengebrauch oder Schmerzdauer. Diese Befunde unterstützen frühere Arbeiten, welche das Hervorragen von drei Subtypen dieser Krankheit gemäss beiden physikalischen und psychologischen Parametern, welche auf die Krankheit einwirken, nahelegen.

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