

# Psychometric Profiles and Related Pain Characteristics of Temporomandibular Disorder Patients

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*The psychological characteristics of patients with temporomandibular disorders have received much attention in the literature. A multivariate clustering technique has been used in the study of psychological characteristics of other chronic pain conditions, and this has recently been applied to "temporomandibular joint pain" patients to develop homogeneous psychometric subgroups. The primary objective of this study was to determine if these subgroups could be replicated in a separate sample. A group of 109 consecutive patients, presenting with complaints of jaw pain, were administered a Symptom Checklist-90 Revised and a questionnaire regarding characteristics of the pain complaint. A multivariate clustering technique was used to identify three discrete psychometric subgroups, as in previous studies. Although similar, these subgroups were not identical to those of previous studies. The small number of subjects in the psychometrically abnormal subgroup was of special interest.*

J OROFACIAL PAIN 1993;7:247-253.

The presence of behavioral and psychological problems in patients with temporomandibular disorders (TMD) has been well documented.<sup>1-8</sup> This diverse group of masticatory problems has long been suspected of being greatly influenced by behavioral and psychological factors. Results of investigations of this relationship have indicated that patients with TMD can be characterized by a wide range of behavioral and psychological problems and are not psychologically homogeneous.<sup>3,7,9</sup> There is apparently no typical psychological profile for TMD patients. The psychological characteristics of patients with TMD have proven as diverse as the physical diagnoses within this group of musculoskeletal disorders.

It has been suggested that further investigation of TMD use specific criteria for subject classification, to allow comparison of homogeneous test groups.<sup>3,7</sup> To accomplish this, two approaches have been used to examine psychological characteristics of TMD. The first involves establishing specific physical diagnostic subgroups and evaluating them for psychological or behavioral differences. The second approach is essentially the inverse of the first. Psychologically discrete subgroups are established and evaluated for differences in pain characteristics. Two recent studies have attempted to use the first approach.<sup>10,11</sup> Discrete test groups consisting of muscle and joint dysfunction subjects were established and assessed for psychometric differences. Although the diagnostic criteria and the psychometric tests utilized were dissimilar, both investigations suggested that the prevalence of abnormal psychological profiles is greater in patients with muscle pain disorders than in patients with joint pain disorders.<sup>10,11</sup>



The second approach has been used more commonly in the investigation of chronic pain disorders other than TMD. Psychological characteristics of patients with low back pain, headache, shoulder pain, and facial pain have been investigated.<sup>9-16</sup> Discrete, homogeneous psychological groups have been identified and evaluated for differences in pain presentation, prognosis, and treatment outcome. Most of these studies have used the Minnesota Multiphasic Personality Inventory (MMPI) and multivariate clustering techniques to develop psychologically homogeneous subgroups. Typically, three or four psychologically discrete subgroups have resulted that appear to be replicable in different chronic-pain patient populations.<sup>12-15</sup> It has been postulated in these studies that the psychological subgroups may be affected differently by their pain and may have different treatment outcome characteristics.

A recent effort by Butterworth and Deardorff<sup>17</sup> to investigate "TMJ pain" patient profiles has been reported. These investigators applied a clustering technique to the psychometric profiles of a group of craniomandibular pain patients established with the Symptom Checklist-90 Revised (SCL-90R), a much shorter test than the 566-item MMPI. It was felt that the three resultant group profiles compared favorably to the groups established in previous MMPI studies. Their assessment of the pain characteristics of the three psychometric subgroups suggested differences in pain severity and interference with daily functioning. A more recent clustering investigation of TMD subjects has been reported by Rudy et al<sup>9</sup> using the West Haven-Yale Multidimensional Pain Inventory (WH-YMPI).<sup>19</sup> This study produced three profile clusters that were identified as "dysfunctional," "interpersonally distressed," and "adaptive copier." Some comparisons were made with Butterworth and Deardorff, but they were limited by the use of different psychometric instruments.

Further study is needed using the psychometric-subgroup approach in the investigation of the interaction of TMD and psychological and behavioral factors. Replicability of psychometric subgroups must be demonstrated in different TMD patient samples using different clustering techniques if these subgroups are to prove clinically useful.<sup>20</sup> The purpose of this study was to determine if a cluster analysis of the SCL-90R profiles for a group of TMD patients would result in the same psychometric groupings as the study by Butterworth and Deardorff.<sup>17</sup> In addition, the groups resulting from the cluster analysis were evaluated for differences in the descriptions of

their pain to identify any relationship between pain perception and psychometric profiles. This objective allowed testing the hypothesis that the description and location of a patient's pain may provide insight into their psychological status.

## Materials and Methods

This study was conducted in the Temporomandibular Disorders Clinic at Group Health Inc of St Paul, Minnesota. This facility is part of a staffed model health maintenance organization in the Twin Cities metropolitan area, which has an enrollment of about 295,000 members. Patients presenting to the clinic are typically referred by medical and/or dental professional staff. Participants in this study were 109 consecutive consenting patients with a complaint of "jaw pain." This study sample consisted of 12 men (mean age 38.2 years, range 25 to 53 years) and 97 women (mean age 35.3 years, range 17 to 68 years).

The subjects were given the SCL-90R and a pain questionnaire. The SCL-90R is a 90-item, self-report symptom inventory developed by Derogatis.<sup>18</sup> It is designed to reflect the psychological symptom patterns of psychiatric and medical patients. Each question is rated on a 5-point scale measuring distress in a range from 0 (not at all distressed) to 4 (extremely distressed). The SCL-90R consists of nine primary scales (Somatization, Obsessive-Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism) and three global indexes (Global Severity Index [GSI], the Positive Symptom Distress Index [PSDI], and the Positive Symptom Total [PST]). Scores are expressed in terms of *t* scores, with a mean of 50. Scores greater than or equal to 63 on the GSI or any two primary dimensions are considered a positive diagnosis or "case." Extensive testing has shown the SCL-90R to be reliable and valid.<sup>18</sup> All subjects were instructed per the procedural manual for the SCL-90R and were told that their responses should reflect how they felt during the past 7 days.

A clustering technique applied to the nine primary scales of the SCL-90R was used to identify three psychologically homogeneous groups. The specific technique used is based on complete linkage, or the "furthest neighbor."<sup>21</sup> This method calculates the distance between two clusters as the distance between their furthest points. Most clustering techniques require a pretest decision regarding the number of groups to be established. In this



study, the number of groups was chosen to be three, to allow comparisons with Butterworth and Deardorff's outcome.<sup>17</sup> The resulting groups were examined for their uniqueness using multivariate tests of significance and univariate F tests.<sup>22</sup>

The pain questionnaire consisted of seven questions (Table 1). These questions were designed to obtain the patient's perception of pain location, severity, quality, aggravating factors, duration, lifestyle effect, and frequency. They are typical of those asked in a clinical interview of a patient presenting with a potential TMD.

Question 1 addressed pain location, and the responses to this question were categorized into four groups. The first group comprised those patients who identified areas 1, 2, or 3 unilaterally and was considered descriptive of unilateral masticatory pain. The second group identified areas 1, 2, or 3 bilaterally and was specific for bilateral masticatory pain. The third group based on location of pain identified areas 1, 2, or 3 unilaterally, as well as areas 4 or 5 unilaterally. This was considered a location consistent with unilateral masticatory and cervical pain. The fourth group identified some combination of the same areas bilaterally and was considered descriptive of bilateral masticatory and cervical pain. This question tested the hypothesis that more generalized pain descriptions, including cervical pain, are associated with elevated psychometric profiles.

Question 2 measured pain intensity using a 100-mm visual analog scale (VAS). The VAS has often been used in the measurement of various aspects of pain.<sup>23-25</sup> Typical descriptors of pain were used in question 3 to identify the quality of pain experienced. Common exacerbating factors of TMD were listed in question 4. Duration of pain was evaluated using discrete time intervals in question 5. A 100-mm VAS was again used in question 6 to determine the effect of pain on daily lifestyle. The frequency of pain was indirectly evaluated with question 7, using discrete percentages of time spent with pain.

## Results

The results of the pain questionnaire were evaluated for differences among the three psychometric groups resulting from the clustering process. Descriptive statistics were used for this assessment.

The clustering analysis produced three statistically unique psychometric groups (Table 2). Due to the limited size of group III ( $n = 7$ ), only groups I and II were checked for uniqueness using the

**Table 1** Questions Used in the Pain Questionnaire Regarding Characteristics of Pain

- Place an (x) in the area or areas you are experiencing pain. (A drawing was provided of the head and neck from the right and left profiles. Areas were identified over the (1) TMJ, (2) facial masseter, (3) temporal, (4) posterior cervical, and (5) anterior cervical regions.)
- On the scale below, with the left end being "no pain" and the right end being the "worst pain you can imagine," place an (x) on the line that best represents the level of pain you are experiencing. (A 100-mm VAS scale was provided with the indicated descriptors at each end.)
- Place an (x) in the box that best describes your pain. (Four pain quality descriptors were listed including: dull aching, sharp, throbbing and burning.)
- Which single factor will more than likely make your pain worse? (Four common aggravating factors were listed including: eating or opening your mouth wide, clenching or grinding your teeth, stress, and don't know.)
- How long have you been experiencing pain? (Discrete responses included: 0 to 6 months, 6 to 12 months, 1 to 2 years, and over 2 years.)
- On the scale below, with the left end being "no effect" and the right end being the "worst imaginable effect on daily lifestyle," place an (x) on the line that best represents your situation. (A 100-mm VAS scale was provided with the indicated descriptors at each end.)
- What percentage of the time are you in pain? (Discrete percentages were provided including: <10%, 10% to 50%, 50% to 75%, and 75% to 100%.)

**Table 2** Mean Scores (Standard Deviations) for the SCL-90R Primary Scales and Global Indexes as Distributed Among the Groups Established With Cluster Analysis

	Group I ( $n = 23$ )*	Group II ( $n = 79$ )*	Group III ( $n = 7$ )†
Somatization	49.6 (6.7)	58.2 (6.9)	71.4 (12.3)
Obsessive-Compulsive	34.7 (8.4)	54.0 (8.3)	72.0 (12.3)
Interpersonal Sensitivity	41.4 (7.0)	55.3 (8.0)	74.6 (11.6)
Depression	42.6 (8.7)	54.6 (7.4)	77.0 (15.9)
Anxiety	41.0 (9.0)	52.4 (8.3)	65.3 (3.8)
Hostility	37.9 (5.6)	53.2 (8.2)	80.0 (13.2)
Phobic Anxiety	40.7 (2.9)	45.0 (8.4)	54.9 (10.3)
Paranoid Ideation	36.6 (5.5)	49.2 (10.0)	70.3 (4.2)
Psychoticism	43.6 (6.3)	51.5 (8.4)	72.4 (12.8)
Global Symptom Index	41.6 (5.9)	66.0 (5.8)	70.0 (9.8)
Positive Symptom Distress Index	49.2 (9.3)	54.4 (6.2)	67.3 (3.5)
Positive Symptom Total	40.5 (6.1)	55.3 (5.8)	80.9 (17.0)

\*All differences between groups I and II significant at  $P < .001$ .

†Not tested due to limited size.

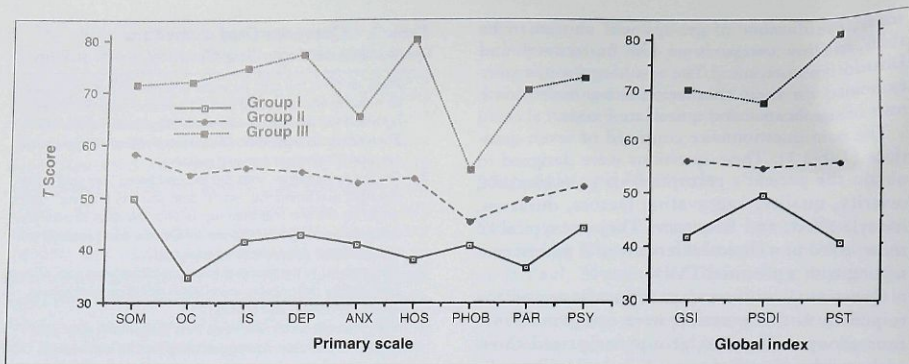


Fig 1 Graphic representation of mean *t* scores of primary scales (SOM = Somatization, OC = Obsessive-Compulsive, IS = Interpersonal Sensitivity, DEP = Depression, ANX = Anxiety, HOS = Hostility, PHOB = Phobic Anxiety, PAR = Paranoid Ideation, PSY = Psychoticism) and global indexes (GSI = Global Severity Index, PSDI = Positive Symptom Distress Index, PST = Positive Symptom Total) of the SCL-90R for groups I, II, and III.

Table 3 Distribution of Pain Location as Identified in Question 1 Among the Groups Established With Cluster Analysis\*

	Group I (n = 23)	Group II (n = 79)	Group III (n = 7)
Unilateral masticatory	11 (50)	27 (36)	1 (14)
Bilateral masticatory	8 (36)	20 (26)	2 (28)
Unilateral masticatory and cervical	1 (5)	8 (11)	0 (0)
Bilateral masticatory and cervical	2 (10)	21 (28)	4 (57)

\*No. of responses (%).

multivariate tests of significance and univariate *F* tests. These tests confirmed significant differences between groups I and II for the nine primary scales and three global scales at  $P < .001$ . Group mean scores for the primary and global scales are shown in Table 2 and Fig 1.

Group I ( $n = 23$ ) and group II ( $n = 79$ ) were considered psychologically normal when applying the operational definition of a "case"<sup>18</sup>; neither group's average scores was 63 or above on the GSI index or any two of the primary dimensions. Group III ( $n = 7$ ) demonstrated scores 63 or above on all indexes and primary dimensions except Phobic Anxiety. Individual "cases" per group were as follows: group I, 0 cases; group II, 20 cases; and group III, 7 cases. The total number for the entire test sample was 27 (25%).

The results of the pain questionnaire were analyzed descriptively due to the limited size of group III, which prevented meaningful inferential statistics. Question 1 addressed the location of the patient's pain and results are shown in Table 3. The intensity of pain as measured with the VAS resulted in the following means (standard deviations): group I = 5.0 mm (2.4 mm); group II = 5.5 mm (1.9 mm); and group III = 5.6 mm (2.4 mm). The quality of pain was described as dull aching by 68% of the study population and as sharp by 20%. These values showed no marked differences among the three psychometric groups.

Factors that aggravated the pain for the entire study sample were "eating" (53%), "bruxism" (12%), "stress" (14%), and unknown (20%). Stress accounted for 50% of the responses in group III. The duration of pain was similar for all groups. Pain of less than 6 months duration was reported by 24% of the subjects, while 16% reported pain for 6 to 12 months, 18% for 1 to 2 years, and 42% for more than 2 years.

Changes in daily lifestyle resulting from pain were evaluated using a VAS analog scale. Response to this question provided the following means (standard deviations): group I = 4.2 mm (2.9 mm), group II = 4.9 mm (2.3 mm), and group III = 6.1 mm (2.4 mm). The percentage of time the subjects reported to be in pain was distributed in the entire study group as follows: 16% of the study group reported pain less than 10% of the time; 24% of the study group reported pain 10%



to 50% of the time; 43% of the study group reported pain 50% to 75% of the time; and 16% of the study group reported pain 75% to 100% of the time. There were no pronounced differences among the three psychometric groups, with the exception of a tendency for patients in group I to have pain a lesser amount of the time.

## Discussion

The cluster analysis of the SCL-90R profiles resulted in three discrete psychometric groups. Groups I ( $n = 23$ ) and II ( $n = 79$ ) were normal according to test standards,<sup>18</sup> while group III ( $n = 7$ ) met the operational definition of "case."<sup>18</sup> This "psychopathologic-appearing" profile was much less prevalent in our study population than in previous reports. Butterworth and Deardorff<sup>17</sup> reported 26% of a sample of 81 consecutive patients with "TMJ pain" in their "case" group. Jamison et al<sup>16</sup> performed a cluster analysis of SCL-90R profiles of a sample of 453 chronic pain patients, which also identified three discrete groups. One group had extreme elevations of all scales and comprised 20% of the study population. However, comparison of the prevalence of "psychological cases" from this study with the TMD studies is not possible because the intermediate group of Jamison et al also had a composite profile suggestive of a "case." It would appear that groups of general chronic-pain patients tend to have more elevated profiles than do TMD patients.

The SCL-90R has been criticized as an instrument for TMD investigation because it has not been normed to a pain population.<sup>9</sup> This could result in profiles that are elevated due to the pain experience rather than psychological differences per se. This would not appear to be the case in this study. The number of patients identified as "cases" (25%) compares with surveys of the general US population, in which a prevalence of 17% to 23% for "cases" with psychological disorders was indicated.<sup>26</sup> Butterworth and Deardorff<sup>17</sup> reported only the number of individuals in their psychopathologic-appearing group and not the number of individual "cases" in their entire sample. However, their intermediate group (group 2) had higher  $t$  scores than did the group II from this study, and thus probably also contained a number of individual "cases." This would have made their percentage of individual psychometric "cases" notably higher than that in the present sample. The lower prevalence of psychopathology in this sample may be due to either sampling variation or the effective-

ness of the health maintenance organization in referring these "case" patients for mental health care before they reach the TMD clinic. It is also possible that a temporomandibular disorder clinic attracts a different type of patient than do clinics dedicated to the treatment of chronic facial pain.

Group I showed a modestly elevated Somatization scale, as did the "normal" groups of previous cluster studies with the SCL-90R.<sup>12,13</sup> This elevation is to be expected in patients with pain. Group II also showed an elevated Somatization scale; however, the elevations of the Depression and Anxiety scales observed in previous studies were absent.<sup>16,17</sup> Therefore, group II may represent an extended range of group I. It has been cautioned that cluster analysis can produce "artificial" groups from a single factor.<sup>16</sup> This would seem a likely possibility in this study, given the similar natures of the group I and II profiles.

The clinical utility of the subgroups obtained through clustering techniques is dependent on their replicability across parallel samples.<sup>20</sup> The subgroups identified in the present study were similar, but not identical, to those of Butterworth and Deardorff.<sup>17</sup> Salstone and Fraboni<sup>27</sup> have also observed difficulties in replicating psychometric clusters when using varied cluster techniques in a single sample. Only with demonstrable replicability can differences in patient pain characteristics be explored; empiric evaluation of different treatments for different subgroups can follow.

The secondary objective of this study was to study the relationship between pain description and psychometric profiles. As noted previously, statistical inference was prevented by the limited size of group III. Therefore, reported observations should be interpreted with extreme caution. There was some tendency for groups II and III to report more pain with a cervical component. However, this did not provide strong support for an association of more generalized pain descriptions with elevated psychometric profiles. Butterworth and Deardorff<sup>17</sup> found that patients classified as having psychological distress are likely to report pain that is very intense and results in an alteration in daily functioning. Our results would tend to support their findings. Patients in group III also reported more awareness of stress effects on their pain. Larger groups will be needed to study the significance of these observations.

All groups were very similar when considering other pain characteristics. Only 12% of the study population reported "clenching and grinding teeth" as the chief aggravating factor, although bruxism is believed to be present in a large per-



centage of TMD patients as an important initiating and/or perpetuating factor.<sup>3,4,11</sup> It would seem that either the diagnosis of bruxism is dependent on a more complete history and clinical exam or that patients underreport bruxism at initial evaluations. As with most musculoskeletal disorders, movement of the system alters pain, and 53% of the study population reported that eating increased pain intensity. Other pain characteristics similar within all three groups included the quality of pain and the percent of time spent with pain.

## Conclusion

These data suggest a range of psychological profiles in TMD patients. Of special note was the relatively small number of subjects in the psychopathologic-appearing group III. The groups that resulted from the cluster analysis were similar, but not identical, to those of Butterworth and Deardorff.<sup>17</sup> Further investigation of subgroup replicability with other samples is warranted to determine if these patients present a continuum of psychological distress or discrete psychological profiles. This evidence would suggest the former. The pain characteristics given by the subjects provided no clinical "markers" that could be used to identify a particular psychological profile. The identification of clinically significant psychological factors in a given TMD patient remains a difficult clinical task.

## Acknowledgments

This study was supported in part by the Clinical Dental Research Center, School of Dentistry, University of Minnesota, Minneapolis, Minnesota, and Grant DE 09737 from the National Institute of Dental Research. The authors wish to thank Ms Nancy Hardie, Research Fellow, and Kathleen Keenan, PhD, Associate Professor, for their assistance with the statistical interpretation of the data.

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## Resumen

### Perfiles Psicométricos y Características de Dolor Afines a los Pacientes que Sufren de Desórdenes Temporomandibulares

Las características psicológicas de los pacientes que sufren de desórdenes temporomandibulares han recibido mucha atención en la literatura. Se ha utilizado una técnica de subgrupos multivariada en el estudio de las características psicológicas de otras condiciones de dolor crónico, y esta ha sido aplicada recientemente a los pacientes afectados por dolor en la "articulación temporomandibular" para desarrollar subgrupos psicométricos homogéneos. El objetivo primario de este estudio fué el de determinar si estos subgrupos podrían ser replicados en una muestra separada. Se administró una Lista Revisada de Síntomas y un cuestionario sobre las características del dolor a un grupo de 109 pacientes consecutivos quienes presentaban dolor en la articulación. Se utilizó una técnica de subgrupos multivariada para identificar tres subgrupos psicométricos distintos, como en estudios previos. Aunque similares, estos subgrupos no eran idénticos a aquellos de estudios previos. De interés especial fue el número reducido de personas que formaban parte del subgrupo psicométricamente anormal.

## Zusammenfassung

### Psychometrisches Profil und Schmerzcharakteristik bei Patienten mit Myoarthropathien des Kausystems

Den psychologischen Charakteristika von Patienten mit Myoarthropathien des Kausystems (MAP) wurde in der Literatur grosse Bedeutung beigemessen. Psychologische Charakteristika anderer chronischer Schmerzpatienten wurden mittels der "multivariate clustering technique" untersucht; dieselbe Technik wurde bei MAP-Patienten zur Bildung von homogenen psychometrischen Untergruppen angewandt. Das Ziel der vorliegenden Studie war zu ermitteln, ob diese Untergruppen in einer andern Testgruppe von MAP-Patienten reproduzierbar sind. Einer Gruppe von 109 konsekutiven Patienten mit Beschwerden im Bereich des Kiefers wurde eine "Symptom Check List" (SLC-90R) und ein Fragebogen zur Schmerzcharakteristik zum Ausfüllen überlassen. Mit der "multivariate clustering technique" konnten 3 Untergruppen gebildet werden, die denjenigen aus einer vorgängigen Studie ähnlich, jedoch nicht identisch waren. Auffällig war insbesondere die kleine Zahl der Subjekte in der psychometrisch abnormalen Untergruppe ( $n = 7$ ).