Prediction of Treatment-Seeking Behavior in Acute TMD Patients: Practical Application in Clinical Settings

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Aims: *To determine potential differences in predictive models of acute temporomandibular disorder (TMD) patients divided into groups based on the physiologic characteristics of their TMD.* **Methods:** *One hundred seventy-seven acute TMD patients were evaluated with an extensive battery that included biologic and psychosocial measures. Subjects were separated into 3 groups based on a physical exam using the Research Diagnostic Criteria for TMD (RDC): those with a myofascial pain diagnosis, those with either a disc displacement or other joint condition, and those who reported pain but did not receive an RDC Axis I diagnosis. Six months later, it was determined whether patients had sought additional treatment for relief of their symptoms. Treatment-seeking and non–treatment-seeking groups were compared for significant differences, and predictive models were generated to determine the array of variables that best predicted treatment-seeking behavior among each of the 3 classifications of TMD patients used in this study.* **Results:** *Among patients with a diagnosis of myofascial pain, gender, Multidimensional Pain Inventory (MPI) interference score, and MPI affective distress score accurately predicted treatment-seeking behavior in 76.1% of the sample. For patients with a diagnosis of disc displacement, arthralgia, arthritis, or arthrosis, the following variables predicted treatment utilization behavior in 93.6% of the sample: race, RDC graded chronic pain, and the introversion scale of the Minnesota Multiphasic Personality Inventory-2. For patients with no RDC Axis I disorder, 80.5% of the sample was accurately classified with regard to treatment-seeking behavior through the use of only the characteristic pain intensity score (ie, mean of visual analog scale scores for "pain right now," "worst pain," and "average pain").* **Conclusion:** *The factors that predict which acute TMD patients are most likely to seek additional treatment vary depending on the physiologic basis of their TMD. This suggests that acute TMD patients may benefit from different modalities of treatment, depending on the type of TMD with which they present.*

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The biopsychosocial model of pain contends that there is a complex and dynamic interaction among physiologic, psychologic, and social factors that often results in, or at least maintains, chronic pain conditions.[1,2] Chronic pain, whether it be in the temporomandibular joint (TMJ) or in other areas (eg, low back), tends to advance through stages before becoming chronic. Gatchel[3] has proposed a model that represents how these biologic and psychosocial factors can interact during this process. The

model consists of 3 successive stages (acute, subacute, and chronic disability, respectively) that follow from the experience of an identifiable injury. Stage 1 begins with a perceived pain and includes the resulting emotional reactions, such as fear, anxiety, and worry, that arise as a consequence of that perception. When this proceeds past a reasonably acute, normal healing time period (2 to 4 months), the progression into Stage 2 occurs. During this stage, the development and/or exacerbation of psychologic and behavioral problems occur, such as learned helplessness or depression, distress/anger, and somatization. In this model, the individual is assumed to have certain preexisting characteristics that are exacerbated by the stress of attempting to cope with the chronic pain. This complex interaction of physical, psychologic, and social elements leads to Stage 3. At this point, as the patient's life begins to become consumed by the pain and the concomitant psychologic and behavioral difficulties, the patient begins to accept a "sick role." In doing so, the patient may be excused from regular responsibilities and social obligations, receive compensation, and therefore be reinforced to maintain the sick role.

It becomes apparent that there can be considerable costs associated with chronic pain from both health care expenditures and loss of productivity. For example, Fricton and Schiffman[4] have estimated that the annual cost of treating chronic pain approximates US$80 billion, with 40% of the cost attributed to craniomandibular pain, including that of temporomandibular disorders (TMD). This high cost is directly related to the unresponsiveness of this TMD population to traditional medical treatment approaches, for many chronic TMD patients continue to seek treatment regardless of the success of interventions. However, the efficacy of dental treatment for this disorder should improve as clinicians' knowledge of the multiple processes that contribute to TMD are better understood and as clinicians are able to identify "at-risk" patients early in the progression of their disease. In fact, Linton and Bradley[5] have noted that, although there is still a paucity of cost-effectiveness studies in the scientific literature pertaining to pain management, those that have been reported do highlight the significant cost-savings associated with early intervention for pain-related disorders.

Efforts to identify risk factors for pain conditions have been published for chronic low back pain[6] and TMD,[7,8] and subsequent early-intervention studies have been initiated for each condition. However, within the TMD population, it is reasonable to suspect that the prediction of chronicity based on risk factors could differ depending on the particular type of TMD diagnosis. This is supported in part by the finding[7] that, among all research diagnostic criteria (RDC) for TMD diagnoses,[9] only the presence of myofascial pain and a self-reported characteristic pain intensity score were significant factors in predicting chronicity in a sample of acute TMD patients.

If one of the goals of such efforts is to decrease the cost and disability associated with chronic TMD, then it is reasonable to measure and attempt to differentially predict treatment utilization. Previous research has demonstrated that facial pain patients who seek treatment have maladaptive thoughts and beliefs compared to those who do not seek treatment.[10] In addition, a recent study conducted with fibromyalgia patients found that a tendency to experience and report negative emotional and physical symptoms was associated with more health care visits.[11] However, other researchers have reported that psychologic disturbance is not a strong predictor of treatment-seeking behavior in TMD pain.[12] To date, there has not been a consensus as to the role that various factors play in treatment-seeking behavior among patients with TMD.

Perhaps different models of risk factors that predict treatment-seeking behavior would be beneficial for different classifications of TMD patients. For instance, a patient with a disc displacement disorder who has never sought treatment might present with a different set of risk factors for future treatment utilization than a patient with a primary diagnosis of myofascial pain with limited opening. If such different models can be identified, it stands to reason that the optimal treatment modalities for each set of patients would also differ. Thus, intervention strategies for decreasing disability and excess service utilization could be customized to particular groups.

The goal of the current study was to identify potential differential predictive models for determining the set of risk factors associated with treatment-seeking behavior in groups of TMD patients separated based on the physical characteristics of their disorder.

Materials and Methods

One hundred seventy-seven patients who presented with complaints of pain in the TMJ and/or surrounding muscles participated in the initial assessment phase of this study. Each of these patients

was considered a treatment "non-utilizer" because none had sought treatment prior to 6 months before entering the study. In other words, each subject had either never sought treatment or was within 6 months of his/her initial visit to a physician's office for relief of symptoms. There were 121 women and 56 men, and their mean age was 34.7, with a range from 18 to 65 years. The average duration of self-report of pain was 57.6 months (SD 84.0), with a range from 0 to 420 months. Participants were referred to the TMD Clinical Research Project, University of Texas Southwestern Medical Center at Dallas, by general dentists and oral surgeons of the Dallas/Fort Worth area and the Baylor College of Dentistry in Dallas, Texas. In addition, flyers were posted at local universities to recruit subjects. Patients were diagnosed with TMD on the basis of the RDC Axis I criteria,[9] which include the presence of pain and tenderness in the muscles of mastication; the presence of joint sounds, such as clicks and crepitus; and/or limitations in mandibular movements. All patients were paid US$20 for their participation.

Clinical psychology research personnel reviewed the purpose and procedure of the study with subjects before obtaining subjects' informed consent. Subjects also completed the following: a general information questionnaire, RDC history questionnaire, Beck Depression Inventory (BDI),[13] Multidimensional Pain Inventory (MPI),[14] and Minnesota Multiphasic Personality Inventory-2 (MMPI-2).[15] The research personnel then interviewed all patients with a Structured Clinical Interview (SCID I and SCID II[16]), which is based on the *Diagnostic and Statistical Manual*, fourth edition (DSM-IV),[17] to determine DSM-IV Axis I clinical disorders and Axis II personality disorders. Subjects were asked to sign a consent form allowing the structured interview to be audiotaped.

On completion of the audiotaped interview, the researcher physically examined the patient according to the RDC examination form. The examination consisted of physical measurements of the jaw and facial area, measurement of mandibular range of motion, identification of TMJ sounds, and manual palpation of extraoral and intraoral muscles. The clinical research personnel were trained and periodically "recalibrated" by an oral surgeon knowledgeable in the RDC.

The above initial assessment took approximately 2½ hours. Selected audiotapes were randomly evaluated to assess interrater reliability. In addition, monthly meetings with a psychiatrist knowledgeable in DSM-IV and the scoring of the SCID were held to clarify any diagnostic issues.

The research personnel contacted all patients by telephone 3 and 6 months after the initial evaluation. This contact consisted of a brief interview, which included questions regarding whether the patient had sought any additional treatment and questions from the RDC history questionnaire. The researchers used these data to calculate a characteristic pain intensity score (CPI), which is the mean score of ratings of current pain, worst pain in the last 3 months, and average pain in the last 3 months. At the 6-month assessment, patients who had sought any additional treatment were considered to have exhibited treatment-seeking behavior (ie, treatment utilizers), while those who did not were considered non-utilizers. Of the 177 subjects evaluated, 51 were subsequently classified as utilizers and 126 as non-utilizers, based on the above criterion.

Patients were also divided into 3 diagnostic groups using the RDC data: those with a Group 1 disorder (myofascial pain, n = 83); those with a Group 2 and/or Group 3 disorder (disc displacements and other joint conditions, n = 53); and those without an Axis I diagnosis on the RDC (n = 41). Each of the diagnostic groups was analyzed separately to determine significant differences on the dependent measures between those patients who continued to seek treatment and those who did not. The dependent measures consisted of the following: demographic data (ie, gender, age, education, race, marital status); duration of TMD pain; medication usage for TMD pain (ie, yes/no); Axis II of the RDC (ie, CPI, disability scores, depression, nonspecific physical symptoms); BDI; MPI; MMPI-2; SCID I diagnoses (ie, frequency of DSM-IV clinical disorders); and SCID II diagnoses (ie, presence or absence of DSM-IV personality disorders). Subsequently, those variables found to significantly differ between the 2 groups were entered into logistic regression models to determine the array of factors that best predicted those patients who sought treatment and those who did not.

The data were interpreted with analysis of variance, Mann-Whitney *U* tests, and Chi-square analyses. The level of significance was set at $\alpha = 0.05$.

Results

Analyses of variance, Mann-Whitney *U* tests (reported as *z* scores), and Chi-square analyses revealed that there were numerous significant demographic and psychosocial differences between the group of TMD patients who sought additional treatment for their symptoms and those who did

Table 1 Significant Differences Between Treatment-Seeking and Non–Treatment-Seeking Patients

	Statistic	df	*P* value
Gender	$\chi^2 = 8.43$	1, n = 177	0.004
Medications	$\chi^2 = 23.77$	1, n = 177	< 0.001
Duration	$F = 6.81$	1, 176	0.010
Disability score	$F = 9.74$	1, 176	0.002
Characteristic pain intensity	$F = 27.13$	1, 176	< 0.001
Beck Depression Inventory	$F = 6.16$	1, 176	0.014
Diagnostic and Statistical Manual-IV			
GAF	$F = 6.73$	1, 176	0.010
Current Axis I disorders	$F = 4.94$	1, 176	0.027
Total no. Axis I disorders	$F = 4.20$	1, 176	0.042
Total no. non-substance abuse d/o	$F = 4.98$	1, 176	0.027
Presence of a mood disorder	$\chi^2 = 8.43$	1, n = 177	0.004
Presence of a somatization disorder	$\chi^2 = 8.43$	1, n = 177	0.004
Minnesota Multiphasic Personality Inventory-2			
Hypochondriasis (Scale 1)	$F = 5.55$	1, 162	0.020
Depression (Scale 2)	$F = 8.99$	1, 162	0.003
Hysteria (Scale 3)	$F = 6.94$	1, 162	0.009
Masculinity/femininity (Scale 5)	$F = 3.97$	1, 162	0.048
Multidimensional Pain Inventory			
Pain severity	$F = 25.49$	1, 171	< 0.001
Interference	$F = 25.07$	1, 171	< 0.001
Affective distress	$F = 5.04$	1, 171	0.026

not (Table 1). Each of these variables was then entered into a forward step-wise logistic regression, through the use of the likelihood-ratio method of comparisons, to determine the array of significant factors that best predicted whether or not patients would seek additional treatment. The following variables were utilized in the model generated: gender, current medications (yes/no), CPI, Scale 5 of the MMPI-2 (masculinity/femininity), and Scale 2 of the MPI (pain-related interference). This model correctly predicted treatment seeking in 81.25% of the patients (Table 2).

Group 1 Disorders: Myofascial Pain

All patients with the presence of a Group 1 disorder on the RDC (ie, myofascial pain) were analyzed in a similar manner. Patients in the treatment-seeking group had more impaired scores with regard to the following:

1. RDC disability (ie, disability days and pain-related interference in daily activities; $F = 8.29$, df = 1,82, $P = 0.005$);
2. The CPI ($F = 12.45$, df = 1,82, $P = 0.001$);
3. The depression scale of the MMPI-2 ($F = 6.09$, df = 1,77, $P = 0.016$);
4. MPI pain severity ($z = -4.05$, df = 1,81, $P < 0.001$);
5. MPI interference ($z = -3.81$, df = 1,81, $P < 0.001$); and
6. MPI affective distress ($z = -2.59$, df = 1,81, $P = 0.001$).

Surprisingly, the group of patients who sought treatment also reported that their pain began significantly more recently (mean = 22.9 months) relative to the group who did not seek treatment (mean = 74.5 months, $F = 9.01$, df = 1,82, $P = 0.004$). In addition, for those patients who had a "significant other," the group of patients who sought additional treatment reported having more support (MPI Scale 5) than those patients who did not seek treatment ($z = -2.22$, df = 1,67, $P = 0.027$).

The above variables were entered into a logistic regression analysis, as described previously. The subsequently generated predictive model included gender, duration of pain, MPI interference score, and the MPI affective distress score to accurately classify treatment-seeking episodes in 76.12% of this sample (Table 3). This model was found to be more accurate for non-utilizers (84.09%) than utilizers (60.87%).

Table 2 Predictive Equation Model for All Patients

Observed behavior	Expected behavior		
	Treatment	No treatment	Correct
Treatment	23	21	52.27%
No treatment	9	107	92.24%
Total			81.25%

Treatment-seeking behavior = –0.45 – 1.20 (gender) + 0.80 (medication) + 0.03 (CPI score) – 0.05 (MMPI-2 masculinity/femininity) + 0.35 (MPI interference).

Table 3 Predictive Equation Model for Patients with Myofascial Pain

Observed behavior	Expected behavior		
	Treatment	No treatment	Correct
Treatment	14	9	60.87%
No treatment	7	37	84.09%
Total			76.12%

Treatment-seeking behavior = –1.90 – 1.62 (gender) – 0.03 (duration) + 0.53 (MPI interference) + 0.45 (MPI affective distress).

Table 4 Classification Rates for Patients with Disc Displacement and Other Joint Conditions

Observed behavior	Expected behavior		
	Treatment	No treatment	Correct
Treatment	6	1	85.71%
No treatment	2	38	95.00%
Total			93.62%

Table 5 Predictive Equation Model for Patients with No RDC Axis I Diagnoses

Observed behavior	Expected behavior		
	Treatment	No treatment	Correct
Treatment	5	5	50.00%
No treatment	3	28	90.32%
Total			80.49%

Treatment-seeking behavior = –4.11 + 0.07 (CPI).

Group 2 and 3 Disorders: Disc Displacements, Arthralgia, Osteoarthrosis, Osteoarthritis

Because of the relatively small number of patients in each of these diagnostic groups, and resultant statistical power analysis issues, patients with either a Group 2, Group 3, or a combination of Group 2 and 3 disorders were collapsed into a single group for analyses. It should be noted that there were no demographic or RDC Axis II psychosocial differences between these groups. For this group, among all demographic and psychosocial measures, there were statistically significant differences between treatment-seeking and non-seeking patients only with regard to race (χ^2 (3, n = 53) = 7.82, P = 0.050); RDC graded chronic pain (χ^2 (3, n = 53) = 12.80, P = 0.012); and the introversion scale of the MMPI-2 (F = 5.74, df = 1,46, P = 0.021). Predictive modeling demonstrated that each of these variables was a risk factor for treatment utilization behavior, and the model that was generated accurately classified 93.62% of this sample (Table 4).

No RDC Axis I Disorders

As noted earlier, there were several patients (n = 41) who reported pain but did not meet criteria for an RDC Axis I disorder. Comparisons of demographic variables and the mean scores of psychosocial variables between utilizers and non-utilizers showed that the former had scores indicative of greater distress and impairment on several variables. Those patients who sought treatment had significantly greater CPI scores (F = 13.93, df = 1,40, P = 0.001); more disabled graded chronic pain scores (χ^2 (3, n = 41) = 15.63, P = 0.001); more frequent historic psychologic or psychiatric treatment (χ^2 (4, n = 41) = 12.26, P = 0.016); and were more likely to be taking medications for their TMD (χ^2 (1, n = 41) = 4.70, P = 0.050).

Although, as noted above, several variables differentiated the 2 treatment groups, logistic regression analyses demonstrated that only 1 variable—the CPI—was a significant risk factor among patients who did not have an RDC Axis I diagnosis (Table 5). The generated predictive model was more accurate with regard to classifying non-utilizers (90.32%) than utilizers (50.0%), with an overall classification rate of 80.49%.

Discussion

The present investigation clearly demonstrated that there were significant differences in an array of demographic and psychosocial variables between TMD patients who sought treatment and those who did not. In addition, the differences between these 2 groups varied depending on the

physiologic characteristics of the TMD with which they were diagnosed. More important, this separation based on type of TMD, which used a standardized method of diagnosis, enabled the generation of predictive models that have relatively high accuracy rates and that are unique to each of the 3 categories of TMD used in this study. This is consistent with the biopsychosocial model of chronic pain conditions, which focuses on the complex interactions of physical, psychologic, and social variables that contribute to and maintain such disorders as TMD. In studying the prediction of a behavioral manifestation such as treatment utilization from such a theoretical perspective, one would expect to observe different groups of psychosocial factors being associated with the different clusters of physical characteristics (ie, RDC diagnostic groups) of the disorder. This is precisely what we found.

For patients who had never sought treatment for their TMD and received a diagnosis of myofascial pain, with or without limited opening and regardless of additional RDC diagnoses, 4 variables emerged as risk factors for treatment-seeking behavior: female gender, shorter duration of symptoms, and higher scores on the interference and affective distress scales of the MPI. For patients with a diagnosis of a disc displacement disorder (with or without reduction), other joint condition (ie, arthralgia, osteoarthrosis, osteoarthritis), or a combination of these, the array of predictive factors was very different. The 3 variables that emerged as major risk factors for treatment-seeking behavior in this group were graded chronic pain, the introversion scale of the MMPI-2, and race. Finally, for acute patients without a definitive RDC diagnosis, only higher CPI scores identified patients as being at risk for treatment-seeking behavior.

One of the benefits of these models is that they provide researchers and clinicians with added insight into the factors that should be areas of focus when concern arises about continued treatment-seeking behavior. These models will enable us to develop specific algorithms that can, with a high degree of accuracy, predict whether or not a patient is likely to return and/or seek additional treatment elsewhere. Another benefit of these particular models is that the information necessary to calculate which patients are "at risk" can be gathered in just a few minutes with a brief self-report questionnaire, a physician evaluation of the TMJ and surrounding muscles, and use of the RDC. In so doing, clinicians assessing acute TMD patients could maximize the use of their time and effort.

These differential models based on RDC diagnoses also pave the way for differential treatment options based on both diagnosis and "at-risk" status. Researchers have already demonstrated that patients with internal joint derangement respond differently to treatment than patients with predominantly muscular symptoms,[18] and we have begun to identify interventions that are differentially effective depending in part on presenting TMD symptomatology.[19] In conjunction with such TMD diagnosis-based interventions, the use of these predictive models creates the opportunity for more efficient utilization of available resources by applying such treatment techniques to those patients who are most at risk for continued treatment-seeking behavior.

The data presented suggest that, with regard to prediction of treatment-seeking behavior, the most salient characteristics of TMD patients who have not yet sought treatment vary depending on the type of diagnosis they receive (ie, the physical characteristics of their TMD). In addition, other researchers have advocated the use of interventions specifically selected on the basis of the type of TMD presentation. The application of an approach that uses both diagnosis-oriented identification of "at-risk" patients and diagnosis-oriented interventions should have at least 2 primary benefits. First, a higher number of TMD patients can be kept from advancing to a chronic, more treatment-resistant stage, thus decreasing the likelihood of increased psychosocial distress. Second, effective intervention early in the progression of TMD should help to decrease the high cost of numerous visits to multiple health care professionals. Thus, both the patient and the health care industry will benefit.

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