

Posttraumatic Stress Disorder Symptoms and Chronic Orofacial Pain: An Empirical Examination of the Mutual Maintenance Model

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Aims: As there is a high correspondence between the experience of trauma and posttraumatic stress disorder (PTSD) symptoms among chronic orofacial pain patients, study objectives included: (1) to document the nature of traumatic experiences and severity of PTSD symptoms among a female sample of orofacial pain patients, (2) to examine the relationship between PTSD symptoms and both pain-related and psychosocial outcomes, and (3) to use structural equation modeling (SEM) to test hypotheses of mediation derived from the Mutual Maintenance Model of chronic pain and PTSD. **Methods:** The study design was a cross-sectional, retrospective case series of 411 female patients (mean age 41.0, SD 13.1) who were seen at the University of Kentucky Orofacial Pain Center between 1997 and 2007. A series of correlational and SEM analyses were conducted to test study hypotheses. **Results:** Of the total sample, 23.6% ($n = 97$) reported PTSD symptoms consistent with a diagnosis of PTSD. Higher PTSD symptom reports were associated significantly ($P < .01$) with the following outcomes: symptoms of psychological and affective distress, life interference due to pain, receipt of punishing responses from one's spouse, limited activity levels, and poor sleep quality. SEM analyses indicated PTSD symptoms likely exert their influence on pain severity through depression and sleep quality. **Conclusion:** PTSD and depression screening as well as thorough sleep evaluations should be included in the routine assessment for orofacial pain patients and, if appropriate, referrals for treatment of PTSD symptoms should be considered part of the standard of care. *J OROFAC PAIN* 2009;23:243–252

Key words: chronic pain, mutual maintenance, orofacial pain, posttraumatic stress disorder, sleep quality

The experience of trauma is common among orofacial pain patients.^{1–4} Including both direct trauma (eg, serious auto accident, violent attack) and indirect trauma (eg, observing someone hurt or killed), 50% to 64% of orofacial pain patients have reported experiencing at least one traumatic experience.^{2,3} Of particular significance, the experience of trauma is often reported to have occurred before the onset of orofacial pain rather than vice versa.² Thus, the occurrence of trauma may be an important etiological factor contributing to the development of orofacial pain and may have important implications for its treatment. Consequently, psychological disorders and related problems resulting from the experience of trauma, including posttraumatic stress disorder (PTSD), should be an area of concern for both orofacial pain clinicians and researchers alike.

Due to the significance of PTSD symptoms co-occurring with significant pain complaints,¹⁻⁷ attempts have been made to document the prevalence of PTSD among orofacial pain patients. Studies using structured clinical interviews to ensure reliable and valid diagnoses have reported that the rate of PTSD among orofacial pain patients ranges between 5% to 23%.^{5,6} Given the frequency of orofacial pain patients reporting the experience of significant trauma and those meeting the criteria for PTSD, it has become increasingly important to assess the extent of psychological distress among these patients.

Research examining the association between traumatic experiences and current functioning has consistently demonstrated poor pain-related and psychosocial outcomes among orofacial patients.^{1-3,5,6} For those orofacial pain patients reporting symptoms consistent with a diagnosis of PTSD,⁶ outcomes fare much worse. Research suggests these patients report significant pain severity, perceived suffering, affective distress, and life interference due to their pain.^{1-3,5,6} Clinical levels of psychological distress (eg, depression, anxiety, and paranoia symptoms),^{1-3,5,6} maladaptive coping strategies (eg, dysfunctional, interpersonally distressed), greater sleep disturbances, and low activity levels have also been reported in cohorts of chronic orofacial pain patients.^{1,6} In addition, difficulties with interpersonal functioning have also been found among orofacial pain patients with PTSD symptoms.^{1,2} Thus it appears that the presence of PTSD symptoms comorbid with chronic orofacial pain is associated with significant pain-related and psychosocial outcomes.

Mutual Maintenance Model of Chronic Pain and PTSD

Given the high correspondence between symptoms of chronic pain and PTSD,^{7,8} it is important to develop and test a theoretical model delineating the link between these conditions. Sharp and Harvey's Mutual Maintenance Model (MMM) posits that certain aspects of PTSD maintain or exacerbate chronic pain, and similarly, that certain aspects of chronic pain maintain or exacerbate PTSD symptoms.⁷ According to the MMM, the specific mechanisms by which the mutual maintenance of chronic pain and PTSD symptoms occurs include attentional biases, anxiety sensitivity, reminders of the trauma, avoidant coping, depression and reduced activity levels, anxiety and pain perception, and high levels of cognitive activity.⁷ While there are limitations to the MMM (eg, considerable

overlap among theorized mechanisms of mutual maintenance), the MMM does provide several hypotheses worthy of empirical investigation, and suggestions for clinical intervention.⁸

In the case of anxiety, depression, and reduced activity levels, which were the focus of the present study, the MMM suggests the experience of anxiety, which is characteristic of PTSD,⁹ may intensify the subjective experience of pain due to increased attention given to symptoms and related disability.⁷ Furthermore, increased anxiety is associated with decreased pain tolerance,¹⁰ and may influence distress and disability by overtaxing available coping resources in patients with both chronic pain and PTSD symptoms.⁷ As depression is a frequently reported symptom among patients with chronic pain^{11,12} and PTSD symptoms,¹³ the MMM posits that depressed mood may also function as a mechanism of mutual maintenance.⁷ Depression is thought to exert its effect via indirect means. That is, the behavioral changes often associated with depression, such as fatigue and reduced activity levels, can mutually maintain chronic pain (by increasing functional limitations and disability) and PTSD symptoms (by limiting exposure to trauma-related stimuli, which is thought important in the resolution of PTSD symptoms).⁷ In addition to those mediators specified by the MMM, it was theorized that the experience of poor sleep and hostility would function as mechanisms by which the link between chronic pain and PTSD symptoms would be maintained. This is thought to be the case because patients with both chronic pain and PTSD symptoms report poor sleep quality^{1,14-17} and the experience of hostility.¹⁸⁻²⁰ Furthermore, both of these problems are considered to be an important determinant of quality of life.

The present study had three aims: (1) to document the nature of traumatic experiences and severity of PTSD symptoms among a female sample of orofacial pain patients, (2) to examine the relationship between PTSD symptoms and both pain-related and psychosocial outcomes, and (3) to use structural equation modeling (SEM) to test hypotheses of mediation derived from the MMM of chronic pain and PTSD. For the purposes of the present study, a selected group of variables specified in the MMM were tested as possible mediators of the relationship between PTSD symptoms and orofacial pain. Other theorized mediators were excluded from analyses due to significant overlap among the variables (eg, PTSD symptoms overlap with "reminders of the trauma," and "anxiety" overlaps with "anxiety sensitivity"). To avoid criterion contamination, therefore, the

MMM was represented by using only anxiety, depression, and activity levels, with the addition of sleep quality and hostility. Based on the literature, the following were hypothesized: (1) higher PTSD symptoms would be associated significantly with poorer pain-related and psychosocial outcomes, (2) the psychological variables of anxiety, depression, hostility, and sleep quality, as well as the behavioral variable of activity levels would mediate significantly the relationship between PTSD symptoms and orofacial pain severity, and (3) the addition of hostility and sleep quality to the MMM model would significantly improve model fit.

Materials and Methods

Procedure

As part of routine clinical protocol for new patient examination, all adults (> 18 years old) seeking evaluation and/or treatment at the University of Kentucky Orofacial Pain Center are required to complete an orofacial pain questionnaire and a battery of self-report psychological questionnaires.²¹ The psychological questionnaires included the Symptom Check List-90 Revised (SCL-90-R),²² Multidimensional Pain Inventory (MPI),²³ Pittsburgh Sleep Quality Index (PSQI),²⁴ and PTSD Check List-Civilian (PCL-C).²⁵ All female patients who reported a traumatic experience on the PCL-C were considered for study participation, and no one was excluded on the basis of whether the most significant trauma experienced was direct or indirect. To qualify for study participation, and to establish the temporal sequence assumed in the SEM (described below), participants' trauma experience must have preceded orofacial pain onset by at least 2 months. All analyses were conducted on the data obtained from participants at the time of their initial evaluation, and the current study was approved by the University of Kentucky Institutional Review Board.

Measures

The SCL-90-R²² is a 90-item questionnaire assessing the number and nature of psychological symptoms experienced by participants. Participants were asked to consider how much each symptom (item) "distressed or bothered" her during the past week. All items were scored on a graded response scale from 0 ("not at all") to 4 ("extremely"). The SCL-90-R measures nine primary symptom dimensions (somatization, obsessive compulsive, anxiety,

depression, interpersonal sensitivity, hostility, paranoid ideation, phobic anxiety, and psychoticism) and three global indices of functioning (global severity index, positive symptom distress index, and positive symptom total). The scale scores are expressed as standardized T scores, where the mean is 50 and the standard deviation (SD) is 15. Psychometric research suggests the SCL-90-R has favorable construct validity,²⁶ and internal consistency for the nine subscales are generally found to be within the acceptable range (coefficient alphas > 0.70).²⁶ Due to intercorrelation among the nine subscales,^{27,28} the global severity index (GSI) may be used as an indicator of overall psychological distress.

The MPI²³ is a 52-item self-report questionnaire assessing the impact of pain on participants' lives, the response of others to participants' experience of pain, and the extent to which participants engage in common daily activities. Participants were asked to use a numeric rating scale from 0 to 6 to respond to each item. Scoring of the MPI yields several scale scores including pain severity, interference, life control, affective distress, support, punishing responses, solicitous responses, distracting responses, and general activity level. Support for the construct, convergent and discriminant validity of the MPI for chronic pain patients has been found.^{23,29} Test-retest reliability and internal consistencies (coefficient alpha) for the individual scales have usually been found acceptable.^{23,30} Due to research that suggest poor test-retest reliability of MPI profile classifications (eg, Adaptive Coping, Dysfunctional),³¹ this aspect of the original questionnaire was not be used in the current study.

The PSQI²⁴ is a 19-item questionnaire that assesses participants' sleep habits in the previous month. The PSQI provides information concerning subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The sum of scores for these seven components yields one global score. In the current study, attention was given mostly to participants' subjective sleep quality subscale score, and higher scores on this measure indicate poorer sleep. The PSQI has demonstrated adequate test-retest reliability ($r = 0.85$) and internal consistency (coefficient alpha: $r = 0.83$).²⁴

The PCL-C²⁵ is used to assess the prevalence of PTSD symptoms in civilians. This 15-item self-report questionnaire assesses participants' number of traumatic experiences, including both direct (eg, violent attack) and indirect (eg, observed someone hurt or killed) experiences, and the extent of post-traumatic stress associated with these experi-

ences.²⁵ Participants also provide information concerning which traumatic experience was the most significant and when that experience occurred. Considering only the most significant trauma, participants were asked to indicate to what extent they had been bothered by each of 17 PTSD symptoms (items) in the past month. Sample items include the following: "Repeated, disturbing memories, thoughts, or images of a stressful experience from the past," "Avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it," "Feeling jumpy or easily startled," and "Feeling distant or cut off from other people." Participants were asked to respond to each item by using a graded response scale from 1 ("not at all") to 5 ("very much"). The PCL-C has demonstrated adequate test-retest reliability ($r = 0.96$), and internal consistency (coefficient alpha: $r = 0.92$).³² In orofacial pain patients, a PCL-C total score of 41 is considered a valid and reliable cutoff for determining whether a patient reported symptoms consistent with a diagnosis of PTSD.⁶

Statistical Analyses

Chi-square tests and independent samples *t*-tests were conducted using the Statistical Package for the Social Sciences, Release 14.0, to determine whether study participants differed significantly on demographic and clinical variables from those orofacial pain patients who did not meet the criteria for study inclusion. In addition, descriptive statistics were accomplished to determine the nature of participants' traumatic experience(s) and the severity of PTSD symptoms (PCL-C). Pearson's product moment correlational analyses were conducted to assess the association between PTSD symptoms and key pain-related (eg, interference, life control) and psychosocial (eg, psychological distress, spousal support, sleep quality) outcomes.

The SEM was addressed by using Mplus software to test two competing models of mutual maintenance. The first model examined the relationship between PTSD symptoms and pain severity as mediated by depression, anxiety, and activity levels (model A). Model A closely resembles the MMM as defined by Sharp and Harvey,⁷ with the exclusion of the overlapping mediators of attentional biases and reminders of the trauma, which are included in the PTSD symptom variable. The second model built upon the first, such that the relationship between PTSD symptoms and pain severity was mediated by depression, anxiety, activity level, as well as, hostility and sleep quality (model B).

The following were defined as measured variables (assessed by the indicated questionnaires): PTSD symptoms (PCL-C), pain severity (MPI), depression (SCL-90-R), anxiety (SCL-90-R), hostility (SCL-90-R), sleep quality (PSQI), and activity level (MPI). Age (years) and pain duration (months) were also included in the SEMs, and were specified as unrelated to the proposed mediational pathways. All variables were allowed to intercorrelate.

To measure model fit, we relied on four fit indices: the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). The CFI and the TLI each represent the proportion of improvement the model provides over a null model in which none of the variables are related. Rules of thumb are that CFI and TLI values of 0.90 represent good fit and values of 0.95 or greater represent excellent fit.^{33,34} The SRMR involves a direct comparison of the covariance matrix implied by the model and the actual covariance matrix obtained in the study. It represents the average deviation between the implied and obtained values for a given covariance. The RMSEA is closely related to the SRMR, but adjusts for the complexity of a model: it produces more favorable values for simpler, parsimonious models. RMSEA values of 0.06 are thought to indicate a close fit, 0.08 a fair fit, and 0.10 a marginal fit,^{33,35} and SRMR values of approximately 0.09 tend to indicate a good fit.³² Overall evaluation of model fit is made by considering the values of each of the four fit indices; models that fit well on most indices are generally considered well-fitting. The criterion for statistical significance for all analyses was set conservatively at $P < .01$.

Results

Sample

A total of 3,735 adult (ie, > 18 years old) female patients, seen between October 1997 and November 2007 at the University of Kentucky Orofacial Pain Center, were considered for study participation. Of this initial pool of patients, only 1,447 had complete PCL-C data, and 1,258 reported at least one traumatic experience. Of those who reported such an experience, 506 stated their most significant trauma preceded the onset of orofacial pain symptoms, and 411 met the criterion of at least 2 months difference (mean difference

Table 1 Reported Traumatic Stressors and Selected Most Significant Stressor Among Female Orofacial Pain Patients (n = 411)

Event (PCL-C)	Traumatic stressor/ experience	Most significant stressor/ traumatic experience
Being diagnosed with a life-threatening illness	43 (10.5)	21 (5.1)
Being kidnapped	3 (0.7)	0 (0.0)
Incarceration*	1 (0.2)	1 (0.2)
Family member or close friend was hurt or killed	191 (46.5)	106 (25.8)
Child has a life-threatening illness	32 (7.8)	19 (4.6)
Military combat	1 (0.2)	1 (0.2)
Natural or manmade disaster	26 (6.3)	6 (1.5)
Observed someone hurt or killed	89 (21.7)	26 (6.3)
Severe auto accident	111 (27.0)	62 (15.1)
Sudden injury/serious accident	101 (24.6)	33 (8.0)
Taken hostage	0 (0.0)	0 (0.0)
Terrorist attack	0 (0.0)	0 (0.0)
Torture	2 (0.5)	1 (0.2)
Violent attack [†]	69 (16.8)	43 (10.5)
Other	123 (29.9)	93 (22.6)

Data reported are frequency (percentages); Percentages may add up to more than 100 owing to some participants reporting multiple traumatic experiences/stressors.

*POW, concentration camp. [†]Mugging, robbery, sexual or physical assault.

between trauma experience and pain onset = 156.1 months; median 52.0; SD 507.1). The study sample consisted of 411 female patients (mean age 41.0, SD 13.1 years) of whom approximately 59% (n = 241) were married. Only 18.0% (n = 74) of participants reported being employed and 59.6% (n = 245) reported receiving or applying for disability. Participants who were retained for the study (n = 411) and those who were excluded on the basis of when their traumatic experience occurred (n = 847) were not found to differ ($P > .01$) on any demographic or clinical variable, including age, marital status, employment status, disability status, or pain severity.

Participants reported an average pain severity of 53.9 (SD = 23.1) on a 100-cm visual analog scale, and average pain duration of 27.6 months (SD 54.1). Participants' primary diagnoses were as follows: masticatory muscle pain (n = 159, 38.7%), cervical muscle pain (n = 45, 10.9%), temporomandibular joint (TMJ) pain (n = 86, 20.9%), neuropathic pain (n = 40, 9.7%), other pain (n = 78, 19.0%), and missing data (n = 3, 0.8%). Many participants (n = 322, 78.3%) were found to have multiple orofacial pain conditions; secondary diagnoses were as follows: masticatory muscle pain (n = 139, 43.2%), cervical muscle pain (n = 37, 11.4%), TMJ pain (n = 78, 24.2%), neuropathic pain (n = 11, 3.4%), and other types of pain (n = 57, 17.8%). Diagnoses for masticatory muscle pain and TMJ pain were established according to the Research

Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD groups 1 and 3, respectively).³⁶ As the RDC/TMD does not include cervical muscle pain or neuropathic pain in its classification system, participants presenting with such features were diagnosed according to the Orofacial Pain Guidelines of the American Academy of Orofacial Pain.³⁷

Nature of Traumatic Experiences and Severity of PTSD Symptoms

The nature of participants' experience of trauma was diverse (Table 1). With an average of 1.9 (SD 1.2) traumas experienced, the most frequently reported traumas included learning that a family member or close friend was hurt or killed (n = 191, 46.5%), severe auto accident (n = 111, 27.0%), sudden injury/serious accident (n = 101, 24.6%), and observed someone hurt or killed (n = 89, 21.7%). The traumatic experiences most frequently identified as "the most significant stressor" included learning that a family member or close friend was hurt or killed (n = 106, 25.8%), other (n = 93, 22.6%), severe auto accident (n = 62, 15.1%), and violent attack (n = 43, 10.5%). Participants' PTSD symptom report ranged from 17.0 to 80.0 (mean 32.0, SD 13.8). Of the total sample, 23.6% (n = 97) reported PTSD symptoms consistent with a diagnosis of PTSD.

Table 2 Correlation Between PTSD Symptoms and Key Pain-Related and Psychosocial Outcomes Among Female Orofacial Pain Patients with a History of Traumatic Experience

Outcome	Correlation coefficient (<i>r</i>)
Pain severity	.37*
Interference	.45*
Life control	.04
Overall psychological distress	.71*
Affective distress	.51*
Support	-.01
Punishing responses	.29*
Distracting responses	.11
Soliciting responses	.10
General activity level	-.30*
Subjective sleep quality	.32*
Sleep latency	.27*
Sleep duration	.27*
Habitual sleep efficiency	.17*
Sleep disturbances	.38*
Use of sleep medication	.32*
Daytime dysfunction	.39*

For ease of presentation, the only correlations (Pearson's *r*) shown are between PTSD symptoms (PCL-C) and key outcomes. Pain severity: MPI subscale; Interference: MPI subscale; Life control: MPI subscale; Overall psychological distress: SCL-90-R global severity index; Affective distress: MPI subscale; Support and punishing responses: MPI subscale; Distracting responses: MPI subscale; Soliciting responses: MPI subscale; General activity level: MPI subscale; Subjective sleep quality: PSQI subscale; Sleep latency: PSQI subscale; Sleep duration: PSQI subscale; Habitual sleep efficiency: PSQI subscale; Sleep disturbances: PSQI subscale; Use of sleep medication: PSQI subscale; Daytime dysfunction: PSQI subscale; *denotes $P < .01$.

Relationship between PTSD Symptoms and Pain-Related and Psychosocial Outcomes

Correlational analyses indicated participants' reports of PTSD symptoms were associated significantly ($P < .01$) with a number of key outcomes (Table 2). Specifically, greater PTSD symptoms were associated with increased pain severity and life interference due to pain, increased symptoms of psychological and affective distress, more punishing responses from one's spouse, and reduced activity levels. In addition, greater PTSD symptoms were correlated with poorer sleep quality, sleep latency, sleep efficiency, more sleep disturbances, shorter sleep duration, greater use of sleep medication, and more daytime dysfunction. In sum, participants' PTSD symptoms appear to have important implications for their general functioning.

Tests of the MMM

Bivariate correlations among variables included in the SEM can be seen in Table 3. To test the mediational hypothesis posited by the MMM, two separate SEM models were tested. Model A, which tested the validity of the MMM, fitted the data well: CFI = 0.99, TLI = 0.99, RMSEA = 0.03, SRMR = 0.02. As seen in Fig 1, PTSD symptoms significantly predicted pain severity in its direct effect. Additionally, the relationship between PTSD symptoms and pain severity was mediated by depressive symptoms. While anxiety and general activity levels were significantly related to PTSD symptoms, neither was significantly related to pain severity. Model B also tested the validity of the MMM, with the addition of hostility and sleep quality. This model also fitted the data well, although there was some loss of fit: CFI = 0.96, TLI = 0.89, RMSEA = 0.09, SRMR = .03. As Fig 2

Table 3 Bivariate Correlations Among Study Variables in SEM Analyses

	PTSD symptoms	Anxiety	Depression	Hostility	Sleep quality	Activity level	Pain severity	Pain duration	Age
PTSD symptoms	-								
Anxiety	.67*	-							
Depression	.64*	.79*	-						
Hostility	.60*	.71*	.71*	-					
Sleep quality	.32*	.36*	.36*	.29*	-				
Activity level	-.30*	-.35*	-.35*	-.29*	-.28*	-			
Pain severity	.37*	.37*	.37*	.33*	.38*	-.23*	-		
Pain duration	.16*	.11	.09	.07	.11	-.14*	.11	-	
Age	-.03	-.04	.00	-.20*	-.10	-.03	-.07	.06	-

PTSD Symptoms: PCL-C symptom report; Anxiety: SCL-90-R anxiety subscale; Depression: SCL-90-R depression subscale; Hostility: SCL-90-R hostility subscale; Sleep quality: PSQI subjective sleep quality subscale; Activity level: MPI general activity level subscale; Pain severity: MPI pain severity subscale; Pain duration: pain duration (months); Age: years; *denotes $P < .01$.

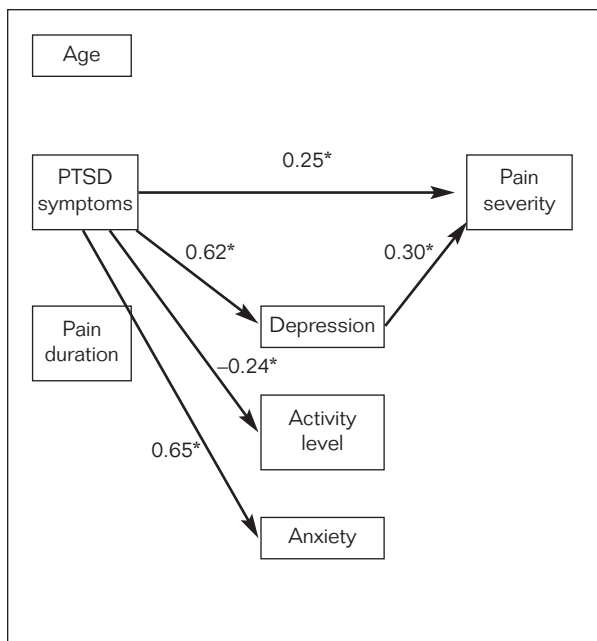


Fig 1 Depiction of the SEM model A of the relationships among PTSD symptoms (PCL-C symptom report), pain severity (MPI pain severity subscale), anxiety (SCL-90-R anxiety subscale), depression (SCL-90-R depression subscale), activity levels (MPI general activity level subscale), pain duration (months), and age (years). All variables were measured variables. Straight arrows reflect factor loadings and prediction pathways. Direct path values are presented on pathways, indirect path values for each mediator are presented above the mediator. For ease of presentation, correlations among the variables are not depicted (see Table 3). * $P < .01$.

shows, the only significant mediators of the relationship between PTSD symptoms and pain severity were depression and poor sleep quality.

Discussion

Among a sample of female orofacial pain patients who reported a trauma history (eg, serious auto accident, violent attack, learning that a family member/close friend was seriously hurt or killed), the current study findings are consistent with previous reports indicating that the sequelae of traumatic events are substantial and far reaching.¹⁻⁸ To summarize, current findings support our first hypothesis suggesting that patients reporting PTSD symptoms

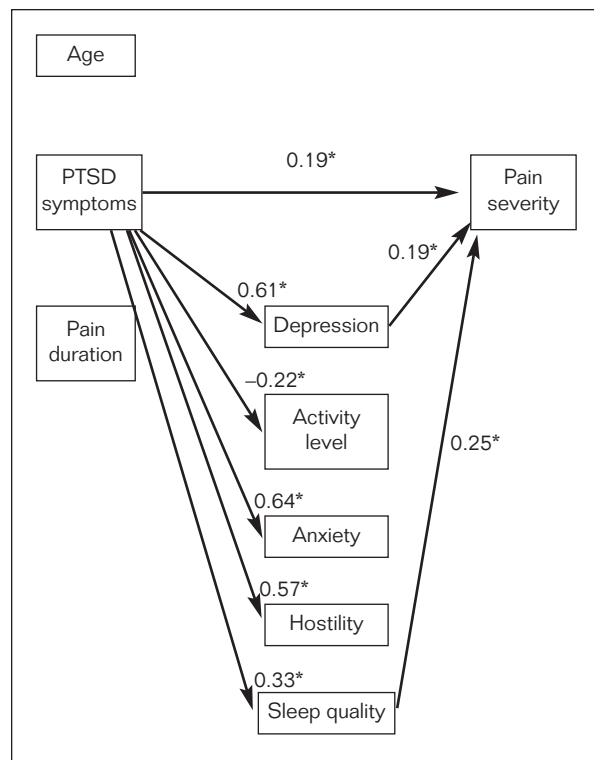


Fig 2 Depiction of the SEM model B of the relationships among PTSD symptoms (PCL-C symptom report), pain severity (MPI pain severity subscale), anxiety (SCL-90-R anxiety subscale), depression (SCL-90-R depression subscale), activity levels (MPI general activity level subscale), sleep quality (PSQI subjective sleep quality subscale), hostility (SCL-90-R), pain duration (months), and age (years). All variables were measured variables. Straight arrows reflect factor loadings and prediction pathways. Direct path values are presented on pathways, indirect path values for each mediator are presented above the mediator. For ease of presentation, correlations among the variables are not depicted (see Table 3). * $P < .01$.

are likely to also be experiencing other symptoms of psychological distress, including depression. In addition, reports of poorer pain-related and psychosocial outcomes, such as increased pain severity, greater life interference due to one's pain, poorer spousal support, limited activity levels, and poor sleep quality, were all found to be significant correlates of PTSD symptoms. Study findings give further support for continued work assessing the level of distress among chronic orofacial pain patients who report a significant history of trauma.

Although the experience of significant trauma and PTSD symptoms has consistently been found among chronic pain populations,¹⁻⁸ this is the first study to examine empirically a theory delineating the link between PTSD symptoms and chronic orofacial pain

by using SEM. Sharp and Harvey's model (MMM) of PTSD and chronic pain has theorized various mechanisms by which PTSD and chronic pain conditions are mutually maintained, including anxiety, depression, and reduced activity.⁷ Using SEM, the current study found support for the MMM. The first finding deserving recognition is that the relationship between PTSD symptoms and pain severity was significantly mediated by depressive symptoms. Previous work has found depression to be the most common comorbid psychiatric disorder among persons with PTSD,³⁸ and related changes in activity levels likely contribute to the mutual maintenance of PTSD symptoms and chronic orofacial pain. It is believed that characteristic symptoms of PTSD, such as avoidance, hypervigilance, and/or reexperiencing the traumatic event, contribute to increases in pain severity by depressing mood. Since the present study was not able to isolate the specific symptoms of PTSD associated with an individual pain experience, it is important that future research should aim to determine what PTSD symptom clusters and psychological variables are most important for influencing pain severity.

The second SEM model tested whether the addition of hostility and sleep quality as mediators of the relationship between PTSD symptoms and pain severity improved model fit. Once sleep quality was included in the MMM, it was found to be a significant mediator of the relationship between PTSD symptoms and pain severity. Notably, depression was still a significant mediator, though the magnitude of its effect was reduced somewhat. This suggests the relationship between PTSD symptoms and pain severity is mediated partially by reductions in overall sleep quality. Findings of the current study are consistent with previous reports that have found significant complaints of sleep disturbances, reduced sleep quality, and daytime dysfunction among chronic orofacial pain patients.^{1,16,17,39,40} When data across various studies are aggregated, it would appear that poor sleep quality likely plays a significant role in influencing an individual's pain experience, an effect that appears to be exacerbated among those patients with PTSD symptoms.

While the current data are cross-sectional in nature, several recent studies give support for a causal relationship whereby PTSD symptoms influence depression and sleep quality, which then influence pain severity. Research with the hypothalamic-pituitary-adrenal (HPA) axis has documented relationships with depression,^{41,42} PTSD, and pain perception,^{42,43} as well as sleep quality.^{43,44} It is quite possible, therefore, that there is a physiological dimension contributing to the effect

of PTSD symptoms on pain, as mediated by depression and sleep quality. Further research is needed, however, to examine empirically the role of the HPA axis among those persons with symptoms of both PTSD and orofacial pain.

Study Limitations

Several limitations of the current study deserve recognition. First, the study was limited in that the data were based on cross-sectional observations of self-reported data. As the current study was able to identify a sample whose traumatic experience preceded pain onset, examining the relationship between PTSD symptoms and orofacial pain severity in this sample is an important first step in investigating mediational pathways. However, future research should involve prospective analysis of the proposed model, such as following individuals who experience a traumatic event over time and exploring the physical effects of said trauma. Additionally, causal roles can only be inferred by cross-sectional and prospective analysis; therefore, experimental manipulation must be conducted in order to further establish the role of PTSD symptoms on pain experiences. More specifically, studies could examine whether experimental manipulation of sleep quality results in significant changes in orofacial pain patients' pain severity.

As the current study included only female orofacial pain patients who reported a history of trauma, it is possible that study findings do not generalize well to male patients with similar trauma histories. As few males seek treatment for orofacial pain symptoms, it may be difficult to examine gender differences on the type of trauma experienced and the PTSD symptoms that might result from such experiences. However, future studies should be designed to examine potential gender effects, as a patient's gender might have significant bearing on PTSD symptoms and related problems. In regard to the psychological questionnaires utilized in the current study, it should first be noted that the MPI used in this study represents the original version and, since its publication, newer versions have been released⁴⁵; nevertheless, the original MPI has shown good reliability and validity in chronic pain patients,^{23,29} and the present study retained only scales that have been included in the revised versions. Despite some limitations, the study is an important first step in examining the MMM linking symptoms of PTSD and chronic pain. In all, this study is thought to establish an important foundation that will lead to future research in this area.

Conclusions

Given the potential significance of study findings, this study supports the importance of assessing PTSD symptoms, psychological distress, and sleep quality for women who present for orofacial pain treatment. According to the findings, when a female with orofacial pain reports depression and poor sleep, a legitimate and primary treatment goal would involve regulating her sleep, in the hopes of indirectly addressing the effects of depression and reduced activity level. If symptoms of depression persist, however, interventions targeting depressed mood should be recommended. Based on our findings, self-regulatory interventions should focus on cognitive-behavioral strategies to reduce depressive symptoms,⁴⁶ and cognitive-processing or exposure to address PTSD symptoms.⁴⁷ Additionally, given that the current study replicated the relationship between PTSD symptoms and poorer pain-related and psychosocial outcomes found by researchers,^{1-4,6} it is recommended that all patients presenting for chronic orofacial pain complaints should be screened for the experience of significant trauma and PTSD symptoms.

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