PSYCHOSOCIAL SYMPTOMS AS PREDICTORS FOR PERSISTENT PAIN IN TEMPOROMANDIBULAR DISORDER

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A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science in Dentistry

University of Washington

2017

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Program Authorized to Offer Degree:

Oral Medicine

University of Washington

Abstract

Psychosocial symptoms as predictors for persistent pain in temporomandibular disorder

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This longitudinal study of temporomandibular disorder (TMD) reports the association of psychosocial dysfunctions (depression, somatization without pain, somatization, and anxiety) with characteristic pain intensity (CPI), pain interference (PI), and number of disability days (DD) for subjects with TMD. Subjects (N=330) underwent a thorough series of assessments at baseline and follow-up (5-10 years later) to receive both Axis I and Axis II diagnoses per the Research Diagnostic Criteria for TMD (RDC/TMD). They reported their levels of CPI, PI, and DD at baseline and follow-up. Linear and log-binomial regression analyses were used to evaluate the change in CPI and PI and assess the risk of DD by baseline categories of psychosocial symptoms as measured by the Symptom Checklist (SCL-90). Linear regression analysis revealed that subjects with depression at baseline had higher PI at follow-up. Also, subjects with moderate to severe somatization with and without pain had higher CPI at follow-up than subjects without somatization. Furthermore, among subjects with no DD at baseline, subjects with moderate to

severe somatization without pain were more likely to have 1 or more DD at follow-up than subjects without somatization. In conclusion, we found that psychosocial impairments (depression, somatization) were associated with increased characteristic of pain intensity, pain interference, and disability days at follow-up.

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ACKNOWLEDGEMENTS

This thesis was supervised by the chair committee member Lisa Heaton PhD,

Lloyd Mancl PhD, Edmond Truelove DDS, MSD.

DEDICATION

To my wonderful family provided me with support and endless love

To my professors who provided me with guidance, kindness and knowledge

Chapter 1. INTRODUCTION

1.1 BACKGROUND

Temporomandibular disorder (TMD) is a term used to describe pain and dysfunction of the temporomandibular joint (TMJ) and muscles of mastication that control jaw motions (1). TMD consists of three subtypes and may affect one or more of these areas: myofascial (discomfort or pain in the muscles), internal derangement of the joint (displaced disc), and arthritis (degenerative/inflammatory joint disorders that affect TMJ) (2).

Pain is the primary characteristic of TMD and pain relief is the main reason for seeking treatment (3,4). Other symptoms include disturbances in mandibular movement patterns, joints sound, and/or impairment in functional movement (2). TMD is considered to be one of the most common musculoskeletal conditions that cause pain and disability. Also, TMD pain is one of the three most prevalent types of chronic pain conditions globally after tension type headache and back pain (5,6). TMD generally affects females more often than males, with ratios ranging from approximately 2:1 to 8:1 (7,8). Most patients presenting with symptoms are between 20 and 50 years of age, but frequency decreases after the age of 55 with an incidence rate of 4% across different populations (9, 10). The overall prevalence of TMD is reported to range from 4.6 to 15% (10,11). Furthermore, a number of surveys have indicated that 20 to 25% of the United States (U.S.) population has experienced TMD-like pain; some estimates place the number of individuals suffering from TMD symptoms around 30 million, with 1 million cases diagnosed annually (10, 11, 12, 13).

1.2 ETIOLOGY

The etiology of TMD is considered to be multidimensional, but the importance of individual factors is still unclear. These factors include, but are not limited to: biomechanical (occlusal overloading and parafunctions such as bruxism); biological (increased levels of estrogen hormones); medical conditions (back pain, fibromyalgia, sleep apnea, and rheumatoid arthritis); macro trauma (head trauma, old or recent motor vehicle accidents, sports injuries); and bio-psychosocial factors (stress, anxiety or depression) (14, 15, 16, 17, 18, 19, 20).

1.3 TREATMENT OPTIONS

The treatment of TMD is based on symptom management through conservative approaches, which show positive outcomes in the majority of patients.

1.3.1 *Self-care:*

Self-care includes muscle exercises, physical therapy, massage, and stretching; applying warm and cold pack on the affected muscles; eating soft foods and avoiding eating crunchy and "gummy" foods; and taking over-the-counter analgesics under a doctor's supervision (21, 22, 23, 24,25). These are considered first-line treatments, and show high response rates, especially with patients who have no or low psychosocial aspects to their pain.

1.3.2 *Oral Appliances (Splints):*

Different types of oral appliances exist, ranging from thin to thick, soft to hard, over-the-counter to lab-made, and those that reposition the mandible in one direction or another. The main purpose of such appliances is to reduce parafunctional jaw activities (clenching, bruxism), to

protect teeth and reduce the working load on the condyles. The overall results of treatment with oral appliances are promising for the reduction of pain when used as adjunctive treatment along with self-care (26,27,28). More comprehensive evidence-based reviews of splint therapy, however, have shown equivocal results (29, 30).

1.3.3 *Arthrocentesis & Arthroscopy:*

Arthrocentesis and arthroscopy are considered the least invasive TMD surgical procedures. Arthrocentesis is usually suggested for sudden-onset, restricted jaw opening in patients with no significant history of TMJ problems. Arthroscopy is performed for a variety of purposes including to return the disc to a normal relationship with the condyle. It is not widely used and is usually used in cases of recurrent and prolonged displacement of the disc. While arthroscopic surgery and arthrocentesis may be performed to lubricate joint surfaces and reduce inflammation, more research is needed to identify long-term outcomes, particularly in the absence of disc repositioning or replacement (31,32,33).

1.3.4 *Joint replacement and condyloectomy:*

Joint replacement and condyloectomy are surgical procedures used to address severe structural damage to the joint (condyle and fossa) (34).

1.3.5 *Treatment outcome modifiers:*

Most patients, regardless of the subtype of TMD describe a favorable natural course of the disease, with self-limiting and fluctuating symptoms that often seem to respond well to nonspecific treatments (35, 36, 37). Some patients with TMD however, develop chronic pain

representing a challenge for pain clinicians, especially because of the concurrent presence of psychosocial disorders and their relationship with pain (38).

1.4 PSYCHOSOCIAL FACTORS

Psychosocial factors have been implicated in the initiation as well as in the permanence of TMD (39). Depression, somatic distress, and anxiety may be potential etiological risk factors for TMD-related pain (40). The role of psychosocial factors in different stages of TMD has been intensively investigated, with equivocal results. Multiple studies indicate that psychosocial factors such as depression, stress, and anxiety play a role in the initiation and continuation of TMD as well as in patients' response to treatment (41, 42). The role of those factors diverges in different cases according to the TMD diagnostic subgroup (43, 44). For instance, when the duration of pain increases, psychosocial factors may become more prominent. Even after reducing the pain, pain behavior and affect associated with it may continue and in some case may worsen (45).

Although depression is more prevalent in patients with chronic pain, data concerning its co-morbidity, especially in the chronic stage of pain, is diverse (46, 47, 48). Moreover, the role of anxiety in chronic pain is controversial. For instance, anxiety levels in patients with migraine and facial pain is positively related to muscle tenderness. However, multiple studies have failed to find a link between TMD and anxiety (49,50, 51, 52, 53).

1.5 AIMS

Depression, somatization, and anxiety have been identified as major psychosocial symptoms associated with TMD, and are regularly assessed in the Oral Medicine Clinical

Service at the University of Washington department for patients with TMD. The general aim of this study was to determine if the presence or absence of psychosocial symptoms (depression, somatization without pain, somatization, and anxiety) at baseline is associated with a different course of pain and associated disability at follow-up.

1.6 THESIS QUESTION

The main thesis question is whether the course of TMD pain and related interference with daily activities in participants with psychosocial symptoms differs over a period of 5-10 years compared to participants without psychosocial symptoms in terms of 1) characteristic pain intensity (CPI), 2) pain interference (PI), and 3) disability days (DD). The research hypothesis of this study is that participants with psychosocial symptoms at baseline would have less improvement with regard to their TMD-related pain at follow-up compared with subjects who do not have psychosocial symptoms at baseline.

Chapter 2. METHODS

2.1 SETTING AND SUBJECTS

This longitudinal study included subjects from the Research Diagnosis Criteria for Temporomandibular Disorder (RDC/TMD) Validation (baseline) and Impact (follow-up) projects. These multisite projects involve three universities including University of Washington, the University of Minnesota, and the State University of New York University at Buffalo. The RDC/TMD provides a dual-axis biopsychosocial diagnostic approach assessing both physical (Axis I) and psychosocial (Axis II) diagnoses. While the Axis I diagnoses involve different muscle and joint disorders, diagnosing Axis II conditions involves instruments for the evaluation

of different psychosocial aspects of pain. The study is described in detail elsewhere (2). Of those 705 subjects (case and control) who were included in RDC/TMD at baseline, 330 (case) were included in the study because they met primary criteria of having TMD at baseline and completing their Chronic Graded Pain Scale (CGPS) scores in both times.

2.1.1 *Inclusion criteria (2):*

- Participants, aged 18 to 70 years old.
- Participants presenting at baseline with at least 1 of the 3 cardinal signs or symptoms of TMD: jaw pain, limited mouth opening, or TMJ noise.
- Participants who presented at follow-up 5-10 years (mean (SD) = 7.88 (0.78) years) and completed the questionnaires related to their TMD status including (CGPS) at both times.

2.1.2 *Exclusion criteria (2):*

- Systemic rheumatic, neurologic/neuropathic, endocrine, or immune/autoimmune diseases or wide spread pain; radiation treatment to head and neck; TMJ surgery; trauma to jaw; presence of non-TMD orofacial pain disorders.
- Pregnancy.
- Inability to participate due to language barrier or mental/intellectual incompetence.
- Use of narcotic pain medication, muscle relaxants or steroid therapy, over-the-counter NSAID, antidepressant medications.
- Drug abuse.

2.2 VARIABLES

Participants initially completed multiple questionnaires to establish Axis I & II diagnoses. There were three primary variables examined (CPI, PI, DD) in the presence of four psychosocial impairments (depression, somatization with and without pain, and anxiety). These variables were measured by using standardized self-report scales, as described below.

2.2.1 *Chronic Graded Pain Scale (CGPS) (54)*

2.2.1.1 Characteristic Pain intensity (CPI)

Participants were asked at baseline (Validation) and at follow-up (Impact) to grade their pain on a 0 to 10 scale, including their 1) current pain, 2) average pain, and 3) worst pain experienced in their facial area, (ranging from 0= no pain at all to 10 = the worst imaginable pain over the last six months). The CPI score was obtained by taking the average of the three questions and multiplying by 10.

2.2.1.2 Pain Interference (PI)

Participants were asked to rate the amount of interference in last 6 months that pain caused on 0 to 10 scale, with 0 = no interference in activities to 10 = unable to carry on any activities. This was assessed in three categories: daily activities, recreational and social activities, and ability to work. The PI score was obtained by taking the average of the three questions and multiplying by 10.

2.2.1.3 Disability Days (DD)

The amount of disability days was measured by asking for the numbers of days over the last 6 months (ranging from 0 to 180 days) that participants were unable to perform their usual activities at work, school and home or reduced by more than half.

2.2.2 *Symptom Check List 90 (SCL-90)*

The SCL-90 is a questionnaire commonly used for self-report of psychosocial distress. The SCL-90 is validated for individuals aged 13 years and above. It contains 90 items and takes 12 - 15 minutes complete (55). Each item consists of a question to rate a specific compliant (e.g., "In the last month, how much have you been distressed by: Feeling easily annoyed or irritated"), and the response1 is scored on a five-point scale (0 = not at all, 1 = slight, 2 = somewhat, 3 = high, 4 = extremely), producing nine categories of primary symptom dimensions. Each primary symptom was categorized into normal, moderate, and severe. In this study, the three primary symptom dimensions evaluated were depression, somatization with and without pain, and anxiety. A number of studies have been conducted demonstrating the reliability, validity, and use of this instrument (56, 57). Also, a subtype of somatization (without pain) was assessed in order to differentiate between subjects who have general somatic complaints in their body that do not involve pain.

2.3 ANALYSES

Descriptive statistics were used to describe the population sociodemographic, baseline psychosocial symptoms, and baseline and follow-up levels of pain. Linear regression analyses were used to evaluate the change in CPI and PI by baseline categories of depression,

somatization with and without pain items, and anxiety. The dependent variable was the change between baseline and follow-up pain measures (CPI, PI, and DD). Independent variables were depression, somatization, anxiety, baseline pain level, gender, age (years), and follow-up time (years). Disability days was dichotomized as no disability days versus any disability days because relatively few subjects had any disability days at baseline (22%) or at follow-up (18%) and skewed distribution was wide. Log-binomial regression was used to assess the risk of any disability days at follow-up by baseline levels of depression, somatization, and anxiety, while the dependent variable was any disability days (>0) vs no disability days (0) at follow-up.

For all regression analyses, depression, somatization, and anxiety were dichotomized as normal versus moderate or severe due to the small number of subjects in the "severe" group. For each of the outcomes five regression models were evaluated: Model 1: Included only SCL-90 measures. Model 2: Also, included baseline pain level (CPI, PI, or DD (yes/no)). Model 3: Also, included an interaction between the SCL-90 measure and baseline pain level. Model 4: Same as Model 2 and also adjusted for age, gender, and follow-up time. Model 5: Same as Model 3 and also adjusted for age, gender, and follow-up time. Additional models were evaluated which included all three psychosocial symptoms, baseline levels of pain, and the interaction between psychosocial symptoms and baseline levels of pain, and adjusted for age, gender and follow-up time. SAS software version 9.4 was used for all analyses (SAS Institute Inc., Cary, NC, USA)

Chapter 3. RESULTS

The total number of subjects who met the inclusion and exclusion criteria was 330. Subjects were mainly female (85.8%) and white (92.1%) with a mean (SD) age of 37.95 (12.8) years (Table1). Follow-up time ranged from 5.75 to 10.7 years (mean (SD) = 7.88 (0.78) years).

Duration of facial pain for 267 subjects reporting pain at baseline ranged from 0 to 40 years (mean (SD) = 9.8 (9.38) years). Among the 330 subjects at baseline, 32.1% (n=105) had moderate to severe depression; 26.1% (n=86) had moderate to severe somatization without pain; 70.9% (n=234) had moderate to severe somatization with pain; and 20% (n=66) had moderate to severe anxiety (Table 2).

Table 1. Sociodemographic characteristics of subjects.

	Number	Percentage
Sex		
Male	47	14.2
Female	283	85.8
Race/ethnicity		
White	304	92.1
Black	6	1.8
Asian	9	2.7
Other	8	2.4
American Indian and Alaska Native	3	0.9
Education		
10-12 years	4	1.2
13-15 years	135	40.8
16-17 years	105	31.8
18-19 years	56	17
20 years	29	8.8
Marital status		
Never married	85	25.8
Married	144	43.6
Separated/divorced	45	13.6
Widowed	4	1.2
Significant others in house	25	7.6
Significant other not in house	26	7.9
Unknown	1	0.3
Household income		
<10k	50	15.2
10-39k	101	30.6
40-79k	114	34.5
>=80k	62	18.8
Unknown	3	0.9

Table 1, continued – Sociodemographic characteristics of subjects.

	Number	Percentage
General Health		
Excellent	50	15.2
Very good	164	49.7
Good	97	29.4
Poor	19	5.8
Oral Health		
Excellent	39	11.8
Very good	126	38.2
Good	110	33.3
Fair	12	3.6
Poor	43	13

Table 2. Psychosocial symptoms at baseline.

Psychosocial dysfunction	Moderate N (%)	Severe N (%)	Total N (%)
depression	73 (22.4)	32 (9.7)	105 (32.1)
somatization without pain	50 (15.2)	36 (10.9)	86 (26.1)
somatization with pain	92 (27.9)	142 (43)	234 (70.9)
anxiety	48 (14.5)	18 (5.5)	66 (20)

Overall, the mean scores for CPI and PI were higher in subjects scoring "moderate to severe" on depression, somatization with and without pain, and anxiety compared to subjects without psychosocial symptoms. Also, subjects who scored "moderate or severe" on depression, somatization, and anxiety were more likely to report DD compared to subjects without psychosocial impairments. Overall, on average subjects improved from the baseline to the follow-up in all three variables (CPI, PI and DD) regardless of their psychosocial symptoms. The greatest reduction in pain and disability was found in moderate and severe depression, somatization with and without pain, and anxiety groups (Tables 3,4,5).

Table 3. CPI at baseline, follow-up and change by depression, somatization with and without pain, and anxiety.

	Baseline		Follow up		Change	
Psychosocial impairments	Normal Mean(SD)	Moderate/severe Mean(SD)	Normal Mean(SD)	Moderate/severe Mean(SD)	Normal Mean(SD)	Moderate/severe Mean(SD)
Depression	34.4 (26.8)	48 (25.7)	21.3 (20)	29.1 (22)	-13.2 (24.1)	-18.9 (23.9)
Somatization without pain	35.1 (26.9)	49.3 (25)	20.7 (19.3)	32.6 (32.1)	-14.4 (24.3)	-16.7 (23.7)
Somatization with pain	20 (25.2)	46.5 (24)	12.9 (17.4)	28.2 (20.7)	-7.1 (24.9)	-18.2 (23.1)
Anxiety	35.6 (26.9)	51.7 (24.1)	22.5 (20.3)	28.9 (22.9)	-13.1 (23.3)	-22.7 (26.1)

Table 4. PI at baseline, follow-up and change by depression, somatization with and without pain, and anxiety.

	Baseline		Follow up		Change	
Psychosocial impairments	Normal Mean(SD)	Moderate/severe Mean(SD)	Normal Mean(SD)	Moderate/severe Mean(SD)	Normal Mean(SD)	Moderate/severe Mean(SD)
depression	12.00 (19.9)	22.1 (24.3)	5.7 (14.3)	12.3 (19.5)	-6.3 (20.5)	-9.80 (20.3)
somatization without pain	12.6 (19.8)	22.7 (25.5)	6.2 (15.5)	12.4 (17.9)	-6.40 (20.0)	-10.3 (21.4)
somatization with pain	5.00 (10.9)	19.5 (23.8)	2.8 (11.00)	9.90 (17.7)	-2.2 (13.4)	-9.50 (22.4)
anxiety	12.6 (19.8)	26.1 (26.3)	7.10 (16.0)	10.9 (17.5)	-5.50 (19.7)	-15.2 (21.5)

Table 5. DD at baseline and follow-up by depression, somatization with and without pain, and anxiety.

	Baseline		Follow up	
Psychosocial impairments	Normal N (%)	Moderate/severe N (%)	Normal N (%)	Moderate/severe N (%)
depression	42 (18.8)	42 (39.6)	30 (13.4)	31 (29.2)
somatization without pain	49 (20.1)	35 (40.7)	32 (13.1)	29 (33.7)
somatization with pain	5 (5.2)	79 (33.8)	6 (6.3)	55 (23.5)
anxiety	54 (20.5)	30 (45.5)	41 (15.5)	20 (30.3)

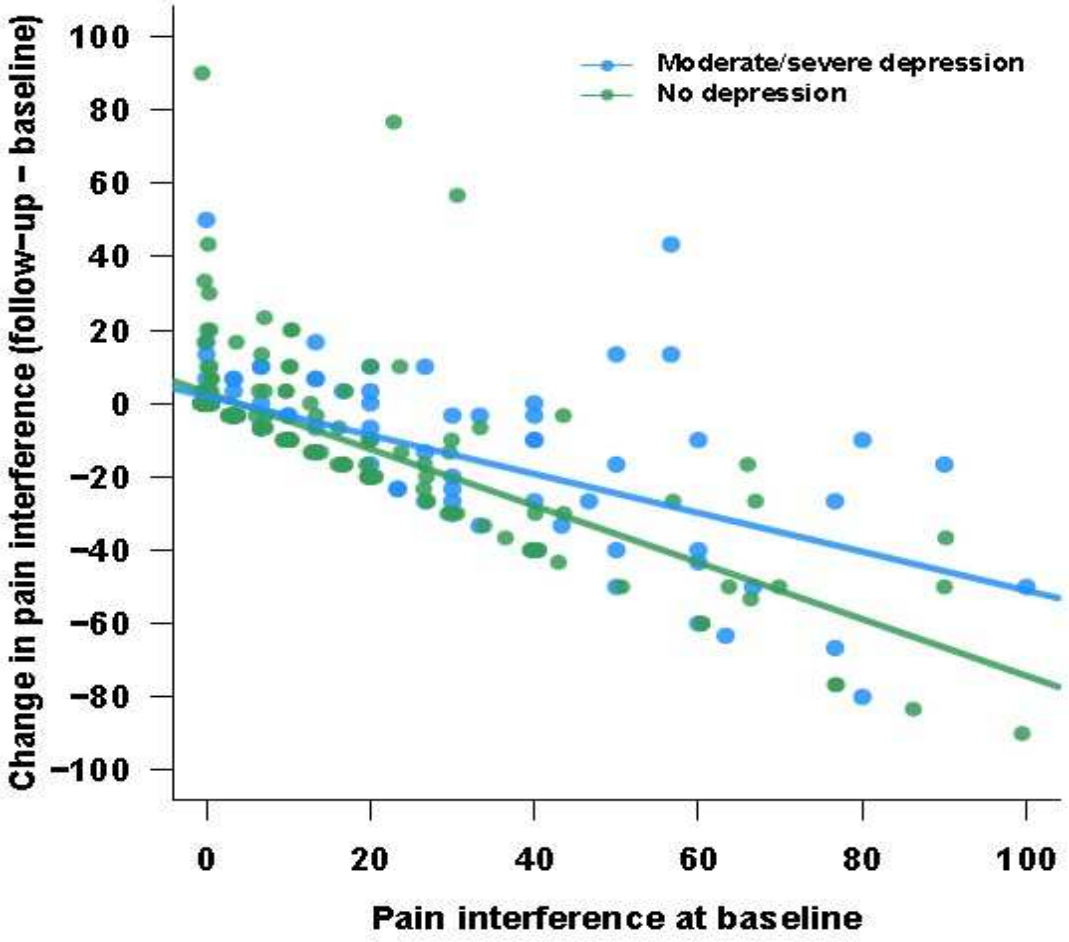
3.1 DEPRESSION

Depression was not associated with CPI at follow-up after adjusting for baseline pain intensity, or adjusting for gender, age, and follow-up duration (Table 6).

The linear regression for depression, identified a significant interaction between depression and baseline PI (interaction estimate [SE] = 0.24 [0.08]; p = .0014) (Table 6). On average subjects had lower levels of PI at follow-up than baseline, but the reduction was smaller for subjects with moderate to severe depression than subjects without depression among subjects with elevated levels of PI at follow-up. For example, among subjects with a baseline PI one standard deviation above the mean (PI = 37.2), subjects with moderate to severe depression had a significantly smaller reduction in PI at follow-up than subjects without depression (estimate [SE]

= 7.65 [2.28]; p = .0009). Whereas among subjects with a baseline PI one standard deviation below the mean (PI = 0), there was no difference by depression in the reduction of PI (estimate [SE] = -1.35 [2.20]; p = .54 (Figure 1)).

Figure 1. Interaction effect of baseline PI and depression on the change in PI.



Subjects with moderate to severe depression were more likely to have 1 or more disability days at follow-up than subjects without depression (RR = 2.18; CI 95% 1.39 to 3.41; p = .0006). However, the increased risk was no longer statistically significant after controlling for baseline disability days, gender, age, and follow-up time (adjusted RR = 1.50; 95% CI 0.96 to 2.33; p = .071) (Table 7).

3.2 SOMATIZATION WITHOUT PAIN

For somatization without pain, subjects with moderate to severe somatization had higher CPI at follow-up than subjects without somatization without pain (normal), after adjusting for baseline somatization, gender, age, and follow-up time [estimate (SE) = 5.27 (2.28); p = .022] (Table 6). For subjects with baseline CPI one standard deviation below the sample mean there was no significant interactions p= 0.85. Somatization was not associated with pain interference at follow-up after adjusting for baseline pain interference, or adjusting for gender, age, and follow-up duration.

There was a significant interaction between somatization without pain and having any disability days at baseline (p = .029). Among subjects without any disability days at baseline, subjects with moderate to severe somatization without pain were more likely to have 1 or more disability days at follow-up (RR(95%CI) = 2.94 (1.45, 5.92) p-value = 0026). In contrast, for subjects with 1 or more disability days at baseline, the risk of 1 or more disability days at follow-up was similar for subjects with and without somatization without pain (RR (95% CI) = 1.14 (0.67, 1.90); p = .63) (Tables 7 and 8).

3.3 SOMATIZATION WITH PAIN

For somatization with pain, subjects with moderate to severe somatization had higher pain intensity at follow-up than subjects without somatization (normal), after adjusting for baseline somatization, gender, age, and follow-up time [estimate (SE) = 4.55 (2.4), p = .059]. Somatization was not associated with pain interference or disability days at follow-up (Tables 6 and 7).

3.4 ANXIETY

Anxiety at baseline was not predictive of CPI [estimate (SE) = -0.32 (2.5), p = .90], PI [estimate (SE) = -0.94 (2.07), p = .65], and DD (RR (95%CI) = 1.34 (0.82, 2.16), p = .23) at follow-up (Tables 6 and 7).

Table 6. Linear regression results for CPI and PI scores (Model 4).

Variables	depression		somatization without pain		somatization with pain		anxiety	
	Estimate (SE)	P-value	Estimate (SE)	P-value	Estimate (SE)	P-value	Estimate (SE)	P-value
Characteristic Pain Intensity								
Psychosocial variables	1.38 (2.33)	.53	5.27 (2.28)	0.021	4.55 (2.62)	.059	-0.32 (2.5)	.90
Baseline CPI	-0.60 (0.04)	<.0001	-0.61 (0.04)	<.0001	-0.63 (0.04)	<.0001	-0.60 (0.4)	<.0001
PI Score								
Psychosocial	2.96 (1.78)	.096*	2.34 (1.88)	.22	1.95 (1.87)	.30	-0.94 (2.07)	.65
Baseline PI	-0.68 (0.04)	<.0001	-0.67 (0.04)	<.0001	-0.68 (0.04)	<.0001	-0.66 (0.04)	<.0001

*There was significant interaction between baseline depression and baseline PI, p = .0014.

Table 7. Log-binomial results for any disability days (Model 4)

Variable	depression			somatization w/o pain			somatization with pain			anxiety		
Any disability days	RR	95% CI	P-value	RR	95% CI	P-value	RR	95% CI	P-value	RR	95% CI	P-value
Psychosocial	1.50	(0.96, 2.33)	.071	1.70	(1.06, 2.71)	.027*	2.05	(0.87, 4.82)	.097	1.34	(0.82, 2.16)	.23
Any DD at baseline	3.14	(1.97, 5.0)	<.0001	3.04	(1.87, 4.93)	<.0001	2.94	(1.84, 4.67)	<.0001	3.21	(1.98, 5.21)	<.0001

*There was significant interaction between baseline somatization without pain and any disability days at baseline, p = .029.

Table 8. Interaction between baseline disability days and somatization without pain for disability days at follow-up

Any disability days at baseline	somatization w/o pain (SCL-90 baseline)	Any disability days, follow-up			
		N	N (%)	RR (95%CI)	P-value
No	Normal	195	14(7.2)		
	Moderate/Severe	51	12(23.5)	2.94(1.45, 5.92)	.00026
Yes	Normal	49	18(36.7)		
	Moderate/Severe	35	17(48.6)	1.14(0.67, 1.90)	.63

The associations between depression and somatization with psychosocial symptoms remained significant after adjusting for the other psychosocial symptoms (Tables 9 and 10). Interestingly, anxiety at baseline was not predictive of pain intensity, pain interference or disability days at follow-up (Tables 6 and 7), but after adjusting for depression and somatization without pain, there was a significant interaction between anxiety and baseline CPI ($p = .035$) with an unexpected effect. Among subjects with a baseline CPI one standard deviation above the mean (CPI = 65.9), subjects with moderate to severe anxiety had a significantly greater reduction in CPI at follow-up than subjects without anxiety [estimate (SE) = -8.77 (3.77); $p = .021$].

Table 9. Linear regression results with all 3 psychosocial variables included in the regression model (Model 4)

Variable	Characteristic pain intensity		Pain interference		Any disability days	
	Estimate (SE)	P-value	Estimate (SE)	P-value	RR (95% CI)	P-value
Baseline	-0.61 (0.04)	<.0001	-0.67 (0.04)	<.0001	3.33 (2.04, 5.40)	<.0001
depression	0.21 (2.63)	.94	4.03 (2.18)	.065[3]	1.27 (0.73, 2.21)	.40
somatization (without pain items)	6.71 (2.66)	.012[1]	2.26 (2.20)	.31	1.79 (1.05, 3.04)	.031
anxiety	-3.71 (3.03)	.22[2]	-4.54 (2.52)	.073	0.89 (0.50, 1.58)	.69

[1]There was significant interaction between baseline somatization and baseline CPI, p = .044.
[2]There was significant interaction between baseline anxiety and baseline CPI, p = .035
[3]There was significant interaction between baseline depression and baseline PI, p = .0006.

Table 10. Regression results with all 3 psychosocial variables included in the regression model (Model 4)

Variable	Characteristic pain intensity		Pain interference		Any disability days	
	Estimate (SE)	P-value	Estimate (SE)	P-value	RR (95% CI)	P-value
Baseline	-0.63 (0.04)	<.0001	-0.68 (0.04)	<.0001	2.80 (1.72, 4.52)	<.0001
depression	1.53 (2.56)	.55	4.43 (2.11)	.037	1.35 (0.78, 2.33)	.28
somatization (with pain items)	4.56 (2.46)	.064	1.60 (1.92)	.41	1.86 (0.78, 4.42)	.16
anxiety	-2.01 (2.92)	.49	-3.40 (2.43)	.10	1.04 (0.58, 1.83)	.90

[*]There was significant interaction between baseline depression and baseline PI, p = .0003.

Chapter 4. DISCUSSION

The aim of this study was to determine if psychosocial symptoms at baseline were associated with a change in the course of pain and its associated disability from baseline to follow-up. This prospective study reports the prediction of pain outcomes by using baseline psychosocial dysfunctions (depression, somatization, anxiety) and Chronic Graded Pain Scale (CGPS) in patients in three different demographic areas (WA, NY, MN) who were diagnosed with Temporomandibular Disorder (TMD) in terms of characteristics of pain intensity (CPI), pain interference (PI), and disability days (DD).

We expected to find that subjects with psychosocial dysfunctions at baseline were likely to have more pain than subjects without psychosocial impairments at follow-up. We found that CPI at follow-up was reduced in all groups regardless of their psychosocial dysfunction at baseline. The greatest reduction was noticed in subjects who scored in the "normal" range on the somatization without pain symptoms scale. This is consistent with the literature in the way that subjects with somatization without pain tend to complain more about their pain (39,58). The significant correlation between somatization without pain items and pain may suggest that the pain experienced by some TMD patients may be somatic expressions of psychiatric and psychosocial disturbance (58). On the other hand, interestingly we found that subjects with anxiety at baseline had less pain at follow-up. This significant finding is inconsistent with the literature since most have either found the anxiety has an impact on pain or does not have significant impact at all.

Pain interference was generally low at both baseline and follow-up. In similar fashion to CPI, PI was reduced in all groups, however a greater reduction in PI was noted in subjects who

did not have depression at follow-up after adjusting for age, gender, and pain interference at baseline. This significant finding is in line with the literature for that psychosocial distress that chronic pain disorders, including TMD, have been shown to influence patients' behavior toward illness, with an increase in depression (59, 60). Moreover, psychosocial impairments, like depression, have been used to describe why some patients do not respond to conventional therapy (61).

In the absence of DD at baseline, TMD subjects who had somatization without pain were more likely to have DD at follow-up than subjects without somatization. This finding is in line with the literature that has shown psychosocial impairments as strong predictors for pain related disability. Our results suggest that psychosocial findings might be much more applicable to determine the presence of future DD than physical symptoms (62, 63). On the other hand, subjects who had DD at baseline and somatization without pain, were not different from subjects who did not have somatization with pain. We interpret this finding as an indication that both groups may have a real physical disability.

The study has several strengths. It is a large clinic-based multisite study and included well-defined cases with TMD. The strongest strength of this study is the long follow-up time that extends up to 10 years.

Several limitations of this study must be mentioned. Because the subjects were only examined at two time points during the study, we were only able to measure psychosocial distress and pain at those intervals. Additionally, while all the instruments used in this study have been validated multiple times, they are self-reported check lists which are susceptible to response bias and variability in response. Also, there was no detailed information on the treatment

methods used by participants between baseline and follow-up. Treatment data available was a checklist of 40 possible treatments. Treatment data was not analyzed as part of this study. Lastly, although the changes of psychosocial dysfunctions were not our primary outcome, it is merits mentioning that some psychosocial measures used a baseline were replaced by different validated measures at follow-up, and did not allow comparisons between baseline and follow-up status.

The literature includes many studies showing that chronic TMD pain is associated with psychosocial disorders such as those screened with the RDC/ TMD Axis II instruments (depression, somatization, anxiety) (39,64, 65). Such findings are in the same direction as studies that describe the relationship between psychosocial factors and pain in other body areas (58, 66). Whether chronic pain causes psychosocial dysfunction or psychosocial disorders are a major risk factor for chronic pain is still in debate. Despite this, Axis II findings are more likely to have strong association with pain in the clinical setting, in terms of influencing prognosis and treatment outcome (67).

The results of this study support the importance of psychological screening of TMD patients in order to evaluate the risks of depression and somatization that may influence treatment (68). Our findings indicate that a psychosocial assessment of TMD patients may be important as a physical evaluation and may be more important when predicting pain outcomes. Our findings suggest that the clinical relevance of measuring psychosocial dysfunction cannot be underestimated (67).

Chapter 5. CONCLUSION

The present study performed by means of a prospective analysis of RDC/TMD findings, suggests that there might be a significant correlation between psychosocial impairments (depression, somatization with and without pain) and characteristic pain intensity, pain interference, and disability days at baseline. We found that psychosocial impairments (depression, somatization with and without pain) were associated with increased of characteristic pain intensity, pain interference, and disability days at follow-up 5 to 10 years later.

Chapter 6. REFERENCES

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