HHS Public Access

Author manuscript

J Musculoskelet Pain. Author manuscript; available in PMC 2015 November 11.

Published in final edited form as:

J Musculoskelet Pain. 2013 ; 21(3): 224–230. doi:10.3109/10582452.2013.827289.

The Relaxation Response Resiliency Enhancement Program in the Management of Chronic Refractory Temporomandibular Joint Disorder: Results from a Pilot Study

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Abstract

Objectives—This is an open-pilot study to evaluate the feasibility, acceptability and efficacy of a pain-specific version of an established mind–body medicine program, the Relaxation Response [RR] Resiliency Program [R_3P], in patients with chronic temporomandibular disorder [TMD].

Methods—Male and female with at least a six-month history of pain involving the masticatory muscles were sought in the Orofacial Pain Centers of the Massachusetts General Hospital [MGH] or through an advertisement sent to MGH employees from 2008 to 2010. Eligible participants underwent the R_3P intervention [eight group sessions] after standard medical management. Pre- and post-group patients underwent objective measures of impairment [vertical and lateral range of motion with and without pain, temporomandibular joint and muscle pain palpation, and algometer measures] and completed psychosocial measures [Symptom Severity Index, Perceived Stress Scale, the Symptom Checklist-90-Revised and Short Form 36 Health Survey].

Results—Twenty-four subjects [16 females, 90% from MGH Orofacial Pain Centers,10% from among MGH employees], mean age 38 years, met eligibility criteria and participated in the study. The intervention was highly feasible and accepted by patients, as evidenced by a 92% rate of completion. Paired *t*-test analyses revealed improvement on self-reported pain measures: pain intensity [$p<0.02$], pain frequency [$p<0.002$], pain duration [$p<0.027$], pain tolerability [$p<0.009$] and on several objective tests.

Conclusions—The pain specific R_3P is efficacious in reducing objective and subjective symptoms in patients with chronic refractory TMD. The comprehensive intervention, which combines educational information about pain with RR, cognitive behavioral and resiliency-enhancement skills, is accepted by patients and may be more efficacious than other treatments with fewer elements.

Keywords

Pain; relaxation response resiliency enhancement program; TMD

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Introduction

Temporomandibular disorders [TMDs] are a heterogeneous collection of syndromes characterized by orofacial pain, masticatory dysfunction or both. The high cost of treating TMD is directly related to the unresponsiveness of chronic TMD to traditional medical/dental approaches (1). Friction recommends a team approach [dentist, physical therapist and behavioral therapist] for the management of the masticatory muscle pain component of TMD symptoms (2).

Chronic TMD has received increasing attention from behavioral scientists. With the realization that psychosocial [e.g. stress, depression and anxiety] and physical factors may interact in the etiology and/or maintenance of TMD, a number of biobehavioral treatment modalities have been used effectively with these patients, including biofeedback (3,4), progressive muscle relaxation (5–7) and cognitive behavioral therapy [CBT] (8,9).

A recent series of studies evaluating the relative efficacy of four methods for treating chronic TMD [nonsurgical medical treatment alone, relaxation-biofeedback treatment, cognitive behavioral skills treatment [CBST], and combined relaxation-bio-feedback and CBST] showed a significant decrease in pain intensity and improvement in mood in the three biobehavioral groups as compared to the standard medical treatment (10,11). In these studies, relaxation-biofeedback was found to be most efficacious short term, while the combined treatment was found to be most efficacious at a one-year follow-up. Another study (12) compared the effects of combined education and medication, combined education and physical therapy and combined education and masseter muscle biofeedback training on symptom reduction in TMD patients and found that although all three groups showed reduction in symptoms, the combined education-medication group showed the most rapid improvements in pain intensity and jaw function (12). These studies were concordant with prior research suggesting that a combination of medical, relaxation, education and CBT components may be the most efficacious for short- and long-term treatment improvement in patients with TMD (3,5,13).

For over 25 years, the Massachusetts General Hospital [MGH] has been offering the Relaxation Response [RR] Resiliency Program [R_3P, formerly called the Medical Symptom Reduction Program], a comprehensive and efficacious mind–body medicine approach to decreasing distress from chronic medical symptoms such as multiple sclerosis, gastrointestinal disorders, skin pathologies, chronic pain, anxiety, depression and autoimmune disorders (14). The program's core component is the elicitation of the RR, defined as a series of coordinated physiologic changes occurring when a person engages in a repetitive mental or physical action and passively acknowledges and then disregards [without judgment] distracting thoughts. These changes include decreases in oxygen consumption, heart rate, respiratory rate and blood pressure, along with a sense of quiet acceptance and peace. The changes are opposite to those that occur during the stress response. Living with chronic pain represents a huge stressor; learning to elicit the RR, paired with educational and simple cognitive behavioral skills, can help patients decrease pain symptoms and improve quality of life.

In an open pilot study, we set out to test the feasibility, acceptability and efficacy of a modified R_3P in reducing TMD-specific psychosocial and objective measures. The modified R_3P contains elements found to be efficacious in previous interventions with TMD patients, including educational information, relaxation training and CBT skills. We hypothesized that the intervention would be feasible and accepted by patients, as evidenced by a high rate of program completion. We also hypothesized that there would be a significant improvement in psychosocial and objective TMD-specific symptoms upon intervention completion.

Materials and Methods

Participants

TMD patients were to be recruited from the Orofacial Pain Clinic at MGH and through an advertisement sent to MGH employees. The MGH Human Research Committee approved the study's procedures, and all patients underwent informed written consent procedures. Participants were identified by code and not by name or initials.

To be eligible, patients had to receive a primary myofascial pain syndrome [MPS, involving muscles of mastication] TMD diagnosis based on published Research Diagnostic Criteria [RDC] (15). All TMD diagnostics were conducted by a senior dentist with formal training in RDC procedures and reliability calibration. Additional eligibility criteria for TMD patients included minimal symptom duration greater than six months and a commitment to participate in the R_3P [eight weeks]. We excluded patients who self-reported a primary pain condition other than TMD, a history of substance abuse or significant psychopathology, i.e. untreated, unresponsive or uncontrolled mental health disorders such as anxiety disorders, bipolar disorder, psychotic disorders or major depressive disorder.

All participants were to complete a four-week standard nonsurgical protocol. Upon completion of the standard treatment, patients were to undergo eight weeks of the R_3P. Before and after the R_3P, patients completed the following self-report psychosocial measures: Modified Symptom Severity Index [SSI] (16), Perceived Stress Scale [PSS] (17), Short Form-36 Health Survey [SF-36] (18) and Symptom Checklist-90-Revised [SCL-90-R] (19). Patients were also to participate in the following objective assessments, performed by a senior trained dentist: (1) vertical and lateral range of motion [ROM], with and without pain, (2) temporomandibular joint [TMJ] and muscle pain palpation, and (3) algometer measures.

Measures and instruments

Symptom checklist-90-revised—The SCL-90-R was used to assess psychological symptoms pre- and post-R_3P (19,20). The SCL-90-R is a 90-item self-report symptom inventory; each item is rated on a five-point scale of distress, ranging from “not at all” [0] to “extremely” [5]. The 90 items are scored and interpreted in terms of nine primary dimensions and one global severity index. The nine dimensions are somatization, obsessive-compulsiveness, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideations and psychoticism.

Modified SSI—The SSI was used to assess severity of pain symptoms pre- and post-R_3P (16). This SSI is a five-item self-report instrument assessing pain frequency, duration,

intensity, unpleasantness and difficulty to endure. Potential responses for pain intensity, unpleasantness and difficulty to endure range from “zero” on the far left to “worst imaginable” on the far right. Responses for pain frequency and duration range from “never” on the far left to “constant” on the far right. Within the pain frequency and duration scales, descriptors are periodically posted between the extremes to spread the responses over the full scale. Frequency is defined as the number of episodes of pain that occurred during the past month. Duration is defined as the typical length of time each episode of pain was present during the same time frame, during the past month.

Short form 36 health survey—The SF-36 (16) is a patient-rated measure of quality of life. Eight subscales measure physical functioning, role-physical [limitations in daily activities caused by physical health], body pain, general health, role-emotional [limitations in daily activities due to emotional problems], vitality, social functioning and mental health. A number of studies have proven the SF-36 to be a reliable and valid measure of quality of life in populations with general medical illness, as well as those with chronic health problems such as heart disease, lung disease, diabetes, hypertension and major depression (21–23).

PSS, short form—The PSS (17) is a four-item scale designed to measure the degree to which situations in one's life over the past month are appraised or considered as stressful. Items were designed to detect how unpredictable, uncontrollable and overloaded respondents find their lives. Patients answer the four questions on a five-point Likert scale from “never” [0] to “very often” [4]. A total score is computed by summing up the items after two are reverse-scored.

Vertical and lateral ROM—The ROMs, both with and without pain, were measured in millimeters.

Pain palpation—Pain palpitation was performed by the dentist, and the pain was rated by the patients as mild, moderate or severe. In addition to the TMJ, the masticatory muscles [right and left middle temporalis, right and left masseter origin, right and left masseter body, and right and left masseter insertion] and neck muscles [right and left inferior sternocleidomastoid [SCM], right and left splenius capitis and right and left trapezius insertion] were also palpated and rated in terms of pain.

Algometer measures—Algometer measures for pain sensitivity with pressure were performed on the right and left temple and the right and left masseter. The algometer was placed over the subject's sensitive area [trigger point] in the temple and masseter areas. The subject was asked to raise their hand when first feeling pain while the examiner gradually increased pressure from the algometer. This process was repeated three times for each trigger point over a period of five minutes. The average of these three measurements was reported as the patient's PPT for that area.

Treatments

Standard nonsurgical treatment—Standard therapy consisted of educational information about the nature of myofascial pain and its causes. Treatments included anti-inflammatory and muscle relaxant medications to manage acute symptoms, appliance therapy to control parafunctional forces and stabilize occlusion, and simple jaw stretching exercises to reduce muscle tension and increase jaw ROM. The appliances were made from thermoplastic material and adjusted at delivery to have mutually protected occlusion in the subject's habitual jaw position. They were fitted to the arch [maxillary or mandibular] that would best stabilize the subject's occlusion and covered all the teeth on that arch. The subjects were instructed to wear the appliances at night.

RR resiliency program—The R_3P is a comprehensive outpatient program based on the principles of mind–body medicine. The program consists of eight weekly group therapy sessions [6–10 participants per group], 1.5 hours in length. The program is designed to buffer the effects of stress and increase resiliency by teaching coping strategies. The foundation of the program is the elicitation of the RR, a physiological state that is the opposite of the stress [fight or flight] response. Patients are taught to elicit the RR in each session *via* a series of methods including imagery, mindfulness, contemplation, yoga and single-pointed focus meditation. The curriculum incorporates educational information about mind–body interactions and training to develop mind–body awareness. Patients also learn simple cognitive behavioral principles, including how to identify negative automatic thoughts and restructure them into more adaptive, positive thoughts. Other skills include activity scheduling, pacing, sleep hygiene and healthy eating strategies. The R_3P was modified for this group to address the medical symptom of pain. To ensure the practice of skills at home, patients were given weekly homework assignments, which were reviewed at the beginning of each session. The last session was focused on reviewing all skills learned and discussing relapse prevention.

Statistical analyses—All data were analyzed with SPSS [Statistical Package for the Social Sciences; Chicago, IL] v.16.0. We used *t*-tests [for continuous variables] and chi-squared tests [for categorical variables] to compare completers and noncompleters, and used frequencies and means to describe demographic and primary study variables. We used paired-sample tests to compare pre- and post-test means on continuous main study measures and objective measures of functioning, and Fisher's exact test to assess differences in frequencies of cases for categorical variables. We calculated effect sizes for the significant [$p<0.05$] and close to significant [$p<0.1$] pre- and post-mean differences, using Cohen's formula (24).

Results

Patient characteristics

Twenty-six [$N = 26$] patients with TMD including myofascial pain participated in the study. Ninety percent were recruited from the MGH Orofacial clinics and 10% came from the announcement to MGH employees. Among them, 24 patients [$N = 24$] completed the intervention [at least six of the eight group sessions] and provided post-test data. Dropouts

failed to show up for treatment sessions and were lost to follow-up. There were no differences in demographic or pretest variables between patients who completed the intervention and those who dropped out [$p>0.05$]. The average age of the patients was 38 [standard deviation = 14.82, range 24–72]. The majority of participants were white [$N = 22$] and working full time [$N = 14$]; 16 were women, 9 were married and 11 had graduate school education. There were no significant differences by demographic variables in any of the study measures [$p>0.05$]. Table 1 presents demographic variables.

Feasibility of intervention

Fifty-seven patients met study criteria and were eligible to participate. Among them, 26 committed to undergoing the eight-week R_3P program at the specified available times and were enrolled [46%]. Of those enrolled, 24 [92%] completed at least six sessions and provided post-test data.

Intervention outcome

Paired-samples *t*-tests comparing pre- and post-test means on main study measures revealed significant or close to significant improvements on continuous self-report and objective measures of functioning [Table 2]. As depicted, there was a significant increase in SF-36 mental health functioning, physical health dimension and overall health functioning and a trend toward increase in vitality [$p<0.1$]. There was also a decrease in SSI frequency, duration, intensity, unpleasantness and ability to endure symptoms [all $p<0.05$]. With regard to the objective measures, we found a significant increase in ROM with and without pain, and significant decrease in pain with palpation of right and left insertion masseter, right and left inferior SCM, right splenius capitis and right insertion trapezius [$p<0.05$]. There was also a significant increase in pain-pressure threshold in algometer measurements of the right and left temporalis and right and left masseter [$p<0.05$]. There was also a trend toward a decrease in pain from palpation of the right medial tempor-alis, right and left origin masseter, and right body masseter [$p<0.1$], SCM, splenius capitis and tra-pezius muscles [$p<0.1$]. All other measurements were not significant [$p<0.1$].

Discussion

This uncontrolled pilot study examines the response of a cohort of subjects who exhibit symptoms of a TMD. TMDs are multifaceted diseases with physical and psychosocial elements requiring a comprehensive treatment to address all aspects of the disorders. TMD is not a specific diagnosis, but represents a collection of problems with similar symptoms. To successfully manage a patient with TMD, one must identify the specific diagnoses that are contributing to their symptoms and treat each individually. A positive response to such individual treatments can collectively improve the patient's overall function and decrease the impact that jaw dysfunction [“TMD”] has for the patient. Before the study's “relaxation response” intervention, the subjects were given a “standard” therapy consisting of exercise therapy to improve pain-free jaw ROM and appliance therapy to control night-time parafunctional forces and daytime clenching if indicated. The appliances used were thermoplastic appliances all fabricated by the same lab adjusted to a jaw relation corresponding in the subject's habitual occlusion [maximum intercuspal position].

The study looks at subjects exhibiting the specific diagnosis of MPS involving one or more muscles of mastication and their response to the behavioral intervention of the “relaxation response”. The intervention does not address the etiology of the subject's disease process; rather, it is aimed at helping patients adjust to a chronic condition.

This study's purpose is to examine the response of a group of subjects with chronic MPS of six months duration non-responsive to traditional non-operative therapy composed of jaw exercises, anti-inflammatory and mild analgesic medications, and appliance therapy to a standard program of relaxation-response treatment. The goal of this therapy is to “decrease pain symptoms and improve quality of life”, i.e. manage the illness associated with myo-fascial pain. But as the etiology of myofascial pain can involve psychosocial factors as well as biomed-ical ones, the disease process for myofascial pain can also be affected by this R_3P intervention. An example would be a subject whose muscle pain is related to a heightened autonomic nervous system response related to a past history of being subjected to physical abuse. Decreasing a heightened automatic nervous system response to stress *via* a R_3P intervention would affect the actual disease affecting pain processing in such a subject. In general, one expects the benefit from a R_3P intervention, rather than targeting the disease process affecting the patient, to enhance the subject's coping skills for management of the impact of their TMD symptoms.

In a sample of patients with TMD of the MPS type, we found that the pain-specific R_3P intervention combining educational, RR and CBT elements is efficacious and accepted by patients. We also found significant improvements in pain-specific measures such as frequency, intensity, duration, unpleasantness and ability to endure symptoms, as well as psychological measures such as reports of mental health, physical health, total health functioning and a trend for vitality. Furthermore, we found improvement in several objective functioning measures including TMD-specific ROM and muscle functioning.

The findings of this study are consistent with previous reports (10,11) and underscore the benefits of incorporating the biopsychosocial perspective of pain in order to comprehensively deal with both physical and psychosocial concomitants of chronic pain conditions such as TMD. Given the high cost of treatment for TMD, its relative unresponsiveness to purely medical management approaches, and the established evidence that as the duration of pain increases, patients become more and more refractory and distressed, it is of utmost importance to identify patients at risk within the acute stage in order to prevent the development of chronicity and treatment difficulties. TMD may be best treated with multidisciplinary approaches, which include standard medical/dental treatment, as well as comprehensive psychosocial treatments such as R_3P.

This study should be viewed in light of several limitations. First, patients were recruited from the MGH Orofacial Pain Clinic, a tertiary care facility, which serves patients with more severe, refractory TMD. Typically, such patients have undergone multiple medical/dental treatments for their conditions with limited improvement. As such, our results are not fully generalizable. Although we believe that treatment effects would be higher with patients with less severe TMD, this is an open pilot study without a control group, which limits our internal validity. However, consistent with recommendations for design and testing of

interventions (25), open pilot studies should precede larger randomized controlled interventions. We are in the process of conducting a randomized controlled trial testing the R_3P versus a control intervention in TMD patients, as well as developing a reliable screening program to identify patients at risk for developing chronic refractory TMD. It is important to note, however, that although the small sample size limits our power, effect sizes, which are not affected by sample size, clearly show medium to large improvements in most subjective and objective measures.

Acknowledgments

Declaration of Interest: This research was funded by the Center for Disease Control and Prevention [Grant R01DP000339].

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Table 1

Patient demographic and descriptive statistics for completers [*N* = 24].

Variable	M [SD]/*N* [frequency]
Age	38.41 [14.82]
Gender	
Male	8 [33.3%]
Female	16 [66.7%]
Race	
White	22 [91.7%]
Asian	1 [4.2%]
Others	1 [4.2%]
Marital	
Married	9 [37.5%]
Widowed	1 [4.2%]
Separated/divorced	1[4.2%]
Never married and living alone	8[30.8%]
Never married and living with partner	5 [23.2%]
Highest education	
Some college	5 [20.8%]
College graduate	8 [33.3%]
Graduate school	11 [45.8%]
Work status	
Full time	14 [58.3%]
Part time	3 [12.5%]
Homemaker	1 [4.2%]
Unemployed	1 [4.2%]
Others	5 [20.8%]
Income	
<$ 10 000	4 [18.2%]
$ 10001–20 000	1 [4.5%]
$ 20001–30 000	3 [13.6%]
$ 30001–40 000	1 [4.5%]
$ 40001–50 000	2 [9.1%]
$ 60001–75 000	4 [18.2%]
>$ 75 001	2 [9.1%]
Refused	7 [30.4%]

M = mean; SD = standard deviation; *N* = number.

Table 2

Pre- and post-intervention data [mean, standard deviation, paired sample t-test analysis, Cohen's effect size].

	Pretest	Posttest	*t*	*p*	ES
SF-36 Vitality	40.25 [18.81]	49.25 [20.79]	−1.905	0.072	−0.427
SF-36 Mental health	63.30 [16.73]	71.40 [14.81]	−2.384	0.028	−0.537
SF-36 Physical health dimension	53.15 [20.69]	60.43 [22.21]	−2.152	0.045	−0.484
SF-36 total	57.80 [16.06]	64.66 [19.94]	−2.142	0.045	−0.495
SSI frequency of symptoms	23.09 [4.76]	18.86 [6.22]	3.382	0.002	1.012
SSI duration of symptoms	22.15 [6.20]	19.34 [7.21]	2.343	0.027	0.506
SSI symptom intensity	15.63 [5.74]	12.92 [6.86]	2.555	0.017	0.847
SSI unpleasantness of symptoms	15.69 [5.78]	12.42 [7.26]	2.826	0.009	0.772
SSI difficulty to endure	16.53 [7.34]	13.21 [7.89]	2.787	0.010	1.118
Range of motion without pain	33.80 [11.25]	37.50 [11.13]	−3.207	0.004	−0.556
Range of motion with pain	42.11 [10.40]	47.61 [7.86]	−3.654	0.001	−0.943
Right middle temporalis	1.13 [1.05]	0.69 [0.97]	1.738	0.096	0.436
Right origin masseter	1.41 [1.01]	1.04 [1.01]	1.740	0.095	0.361
Left origin masseter	1.70 [0.90]	1.33 [1.04]	1.813	0.083	0.381
Right body masseter	1.70 [0.90]	1.33 [1.04]	1.813	0.083	0.381
Right insertion masseter	1.45 [0.97]	0.875 [1.19]	2.933	0.007	0.532
Left insertion masseter	1.54 [0.93]	1.04 [0.99]	3.140	0.005	0.521
Right inferior SCM	1.16 [1.30]	0.54 [1.02]	2.901	0.008	0.534
Left inferior SCM	1.12 [1.30]	0.54 [1.02]	2.429	0.023	0.500
Right splenius capitis	1.54 [1.28]	0.83 [1.09]	2.899	0.008	0.599
Right insertion of trapezius	1.37 [1.24]	0.87 [1.07]	1.958	0.062	0.433
Algorithm right temple	0.26 [0.21]	0.40 [0.22]	−3.681	0.003	−0.651
Algorithm left temple	0.20 [0.16]	0.37 [0.21]	−3.310	0.006	−0.960
Algorithm right masseter	0.19 [0.10]	0.28 [0.14]	−3.116	0.005	−0.750
Algorithm left masseter	0.17 [0.12]	0.28 [0.16]	−4.053	0.000	−0.786

Cohen's effect size: 0.3 small; 0.5 medium; and 0.8 large. ES = effect size, SF-36 = short form-36 health survey, SSI = modified symptom severity index, SCM = sternocleidomastoid.