



Therapeutic Effect of Combining Muscle Relaxant and Posture Correction in Patients with Myofascial Pain Dysfunction Syndrome of Temporomandibular Disorder

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Background: Many studies have shown that poor posture may lead to myofascial pain dysfunction syndrome (MPDS) of the trunk. Forward head posture is one of the most common forms of poor posture, and is related to neck pain. Hence, the aim of this study was to estimate the influence of body posture on MPDS of the temporomandibular joint (TMJ). **Methods:** Twenty-six otherwise healthy adults with MPDS of the TMJ were enrolled in this study. Clinical examination was performed at three time-points: prior to the treatment, at the 2-week follow-up, and at the 4-week follow-up. The subjects received a muscle relaxant drug and adjustment of body posture. Variables such as visual analogue scale (VAS) score, shoulder angle (SA), cervical spine angle-coronal (CSA-c), and cervical spine angle-sagittal (CSA-s) were evaluated at each stage. Generalized estimating equations (GEE) were used to control for non-independence among observations. **Results:** There were significant improvements in VAS score ($p < 0.001$), SA ($p < 0.001$), CSA-c ($p < 0.001$), and CSA-s ($p < 0.001$) after treatment compared to the corresponding values obtained before treatment. **Conclusions:** Correcting body posture in conjunction with use of a muscle relaxant had an extremely therapeutic effect on patients with MPDS of TMJ. The improvement of the angle of sagittal cervical spine may have reduced the pain score, and we speculate that it is important to correct forward head posture when treating patients with MPDS of TMJ.

Key words: myofascial pain dysfunction syndrome, temporomandibular joint, posture, temporomandibular disorders

INTRODUCTION

Temporomandibular disorder (TMD) is defined in terms of the presence of signs and symptoms involving the temporomandibular joint (TMJ), masticatory muscles, or both.¹ The pathogenesis of TMD includes two parts: myofascial pain dysfunction syndrome (MPDS) and intra-articular disorders.² TMD is generally recognized as a multifactorial disease, comprising biological, behavioral, environmental, social, emotional, and cognitive factors, alone or in combination.² The discomfort or pain is often localized to the TMJ, and the associated

muscles of mastication. The pain may radiate to the ears, temporal region, periorbital region, and neck. Common associated symptoms include jaw pain, earache, tinnitus, headache, facial pain, neck pain, neuralgia, and toothache and require differential diagnosis.

Many practitioners have speculated that poor posture of the head and neck is an important consideration with regard to TMD and cervical pain, and that it can adversely affect treatment outcomes.^{3,4} The causes of poor posture include congenital disease, physical trauma events, and habitual or work-related behavioral influences. Vocations that potentially entail poor postures include dentistry, office work, student-related activity, and work that requires frequent bending and twisting. Forward head posture is one of the more common poor head and neck postures and has been linked to pain of the head, neck, and shoulder.^{4,5} With regard to this posture, the strain on the posterior cervical muscles is increased, leading to increased masticatory muscle activity, that in turn causes muscle contraction, spasm, and pain.⁶

Based on our clinical experience, we hypothesized that there may be a relationship between body posture

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Table 1 The Group I of the research diagnostic criteria for temporomandibular disorders (RDC/TMD) guidelines.⁷

Group I	Diagnosis	Diagnostic criteria
Ia	Myofascial pain	1. Subjective pain over the jaw, temples, face, preauricular area, or inside the ear at rest or during function; plus 2. Subjective pain to palpation of at least three sites of the following 20 muscle sites (right and left side of each muscle count as two separate sites): Posterior temporalis, middle temporalis, anterior temporalis, origin of masseter, body of masseter, insertion of masseter, posterior mandibular region, submandibular region, lateral pterygoid area, and tendon of the temporalis. At least one of the sites must be on the same side as the complaint of pain.
Ib	Myofascial pain with limited mouth opening	1. Myofascial pain as defined in Ia; plus 2. Pain-free unassisted mouth opening of less than 40 mm; plus 3. Maximum assisted mouth opening (passive stretch) of 5 mm or greater than pain-free unassisted opening.

and MPDS of TMJ. In order to investigate this we conducted this study, the specific aims of which are described below. Our main hypothesis was that the pain score of subjects with MPDS of TMJ may be improved via posture correction in conjunction with the use of muscle relaxants. Secondly, we hypothesized that such treatment may also improve the body posture of subjects with MPDS of TMJ. Lastly, we investigated potential relationships between body posture and pain scores in subjects with MPDS of TMJ that were undergoing posture correction treatment while using muscle relaxants.

METHODS

The project was approved by the Human Research Ethics Committee of the Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan, ROC (TSGHIRB No: 1-101-05-047), and all subjects provided written informed consent prior to participation.

Participants

The potential subject pool was comprised of 85 patients with TMD, who attended the division of oral and maxillofacial surgery, Tri-Service General Hospital, Taipei City, Taiwan. The research diagnostic criteria for temporomandibular disorders (RDC/TMD) guidelines were used to determine the primary source of the patient’s TMD pain.⁷ These 85 potential subjects were further screened in order that the final study sample analyzed only included those with myofascial pain as defined in Group I of RDC/TMD (Table 1), who also consented to participate in the follow-up procedures of the study. Accordingly, we excluded 49 patients because their pain originated from intra-articular disorders or combined MPDS and intra-articular disorders. Further, 10 more

patients could not guarantee compliance with the two follow-up visits and were thus also excluded. The final study sample was comprised of 26 otherwise healthy adults with MPDS of TMJ, 17 women and 9 men, aged 20 to 64 years (mean, 40.9 years).

Data collection

Clinical examinations were performed at three time-points: prior to the treatment (T1), at the 2-week follow-up (T2) and at the 4-week follow-up (T3). The variables evaluated at each time-point included visual analogue scale (VAS) score, shoulder angle (SA), cervical spine angle-coronal (CSA-c), and cervical spine angle-sagittal (CSA-s) (Fig. 1). All clinical examinations were performed by the same researcher. The pain score and findings of photography were determined as described below:

- (A) Visual analogue scale (VAS) score: All subjects with MPDS reported the intensity of average VAS over head and neck on a 100-mm VAS.⁸
- (B) Photography: For the acquisition of photographic data, all subjects were first stood in front of a Postural Analysis Grid Chart. Three photographs of anterior, lateral, and posterior views of their self-balanced posture were then taken, while the subjects were not wearing a hat, coat, or shoes and had empty pockets. Three angles were derived from these photographs: (1) SA, the angle between the line passing through the right and the left acromions and the horizontal dotted line (Fig. 2); (2) CSA-c, the angle between the line passing through the glabella to the midpoint of the chin (pogonion) and the vertical dotted line (Fig. 2); and (3) CSA-s, the angle between the line passing through the tragus of the ear and the C7 process and the horizontal line (Fig. 3).

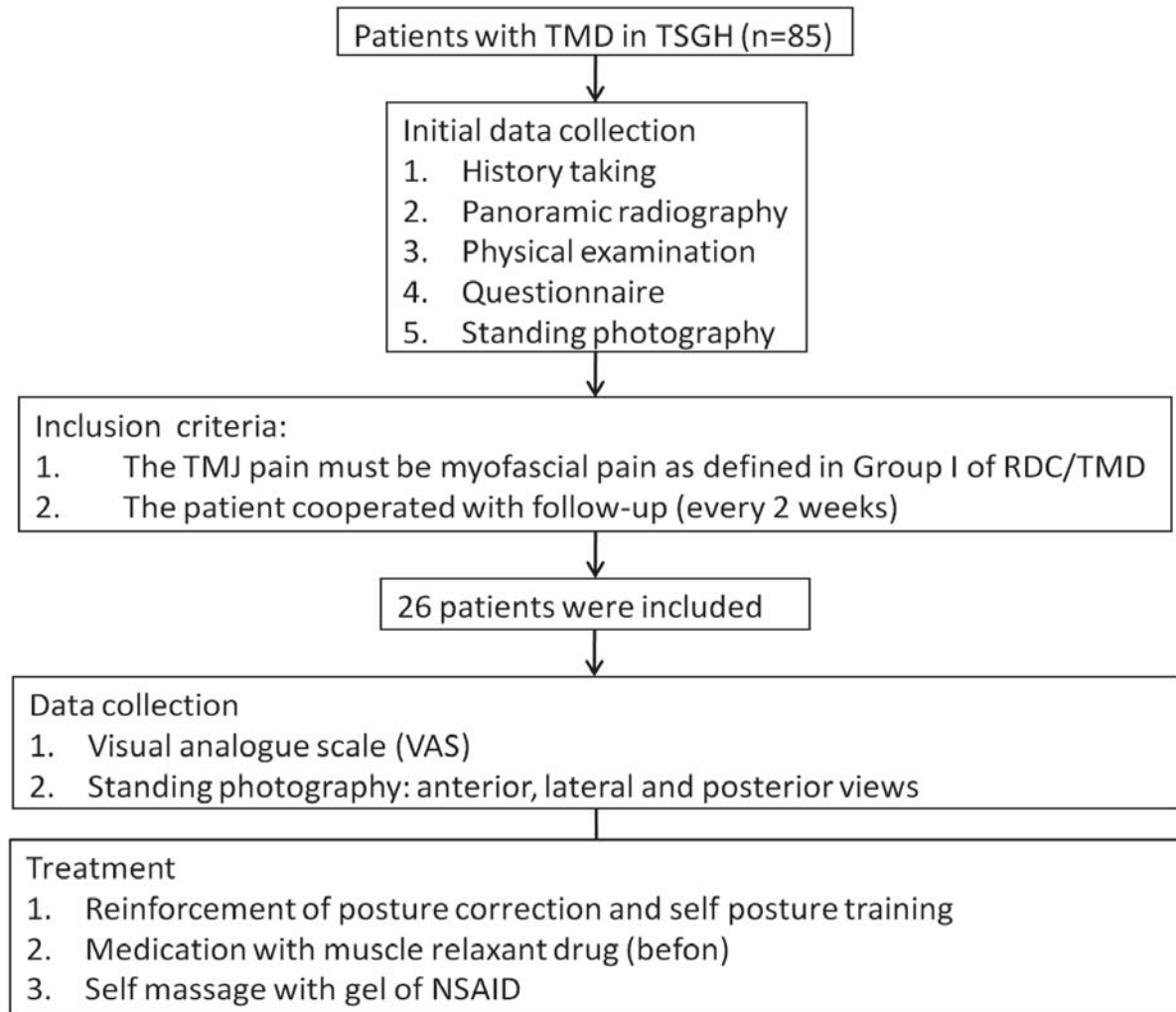


Fig. 1 Study flow-chart

Experimental procedure

The subjects were trained in correct posture and exercises related to posture development. They were also prescribed the muscle relaxant drug, befon (5 mg, h.s.), and were given instructions with regard to TMD self-management. These instructions encouraged the subjects to remain aware of their posture, to maintain good posture, and to avoid maintaining the same posture for more than 15 min. Further, the instructions included posture-training exercises at least three times a day, the use of warm and moist compression over the painful areas, and self-massage of painful areas with gel of NSAID (voren G).

Statistical analysis

We used four generalized estimating equations (GEE)

models of the VAS, SA, CSA-c, and CSA-s to compare the influence of each independent variable. The independent variables incorporated into our model included age, sex, body mass index (BMI), treatment time-points (T1, T2, and T3), traumatic history, and computer-use habits. We also further investigated the relationship between changes in body posture and pain scores by incorporating SA, CSA-c, and CSA-s as independent variables in a VAS model. All data were analyzed using PASW Statistics 18 (SPSS, Inc, Chicago).

RESULTS

TMD predominantly presented in middle-aged women. There were 26 subjects (17 female, 9 male), and their ages ranged from 20 to 64 years (mean, 40.9 years). The

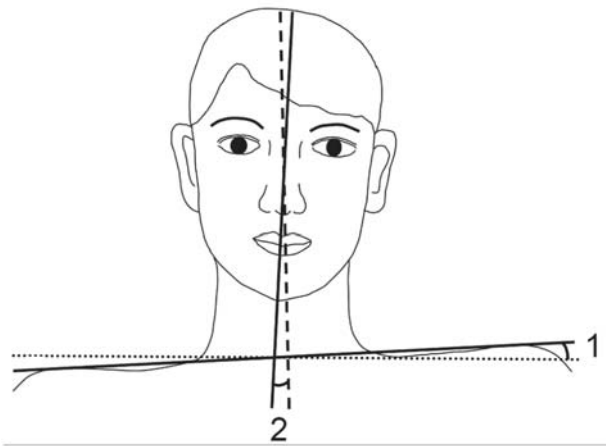


Fig. 2 The shoulder angle (SA): the angle between the line passing through the right and left acromions and the horizontal dotted line (1), and the cervical spine angle-coronal (CSA-c): the angle between the line passing through the glabella and pogonion and the vertical dotted line (2).

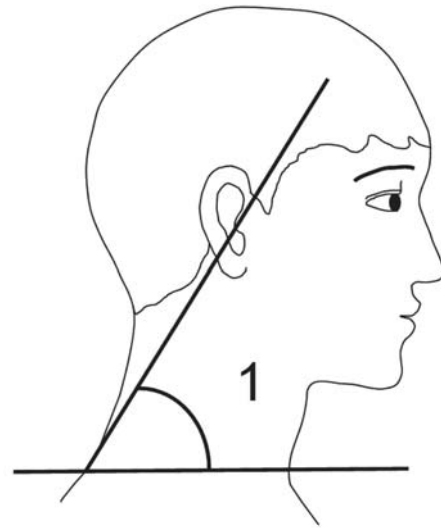


Fig. 3 Cervical spine angle-sagittal (CSA-s): the angle between the lines passing through the tragus and C7 and the horizontal line (1).

Table 2 Comparisons of variables in generalized estimating equations (GEE) models of VAS, SA, CSA-c and CSA-s.

Independent Variables	Dependent variables							
	VAS		SA		CSA-c		CSA-s	
	β (95% CI)	p Value	β (95% CI)	p Value	β (95% CI)	p Value	β (95% CI)	p Value
Age	-0.001(-0.05, 0.05)	0.97	0.02 (-0.04, 0.09)	0.48	0.03 (0.002, 0.05)	0.03*	0.017(-0.11, 0.15)	0.80
Sex								
Female	Ref.		Ref.		Ref.		Ref.	
Male	-0.61 (-1.90, 0.67)	0.35	-1.12 (-2.59, 0.35)	0.14	-0.92 (-1.72, -0.12)	0.02*	2.61 (-3.43, 8.65)	0.40
BMI	-0.04 (-0.28, 0.20)	0.73	-0.05 (-0.13, 0.03)	0.20	-0.01 (-0.07, 0.05)	0.75	-1.37 (-1.81, -0.92)	<0.001***
Trauma history								
No	Ref.		Ref.		Ref.		Ref.	
Yes	1.12 (-0.35, 2.58)	0.13	-0.01(-1.32, 1.30)	0.99	-0.46 (-1.22, 0.29)	0.23	2.29 (-2.67, 7.25)	0.37
Computer use	-0.007 (-0.16, 0.15)	0.93	0.02 (-0.10, 0.13)	0.78	0.009 (-0.07, 0.09)	0.82	-0.36 (-0.76, 0.04)	0.08
Treatment time-points								
T1	Ref.		Ref.		Ref.			
T2	-1.94 (-3.01, -0.86)	<0.001***	-1.28(-1.75, -0.80)	<0.001***	-0.08 (-1.12, -0.39)	<0.001***	2.86 (1.33, 4.39)	<0.001***
T3	-3.26(-4.23, -2.29)	<0.001***	-1.57(-2.34, -0.80)	<0.001***	-1.12(-1.66, -0.58)	<0.001***	2.20 (-0.21, 4.62)	0.07

BMI= body mass index; CI= confidence interval; CSA-c= cervical spine angle-coronal; CSA-s= cervical spine angle-sagittal; Ref.= reference; SA= shoulder angle; T1= prior to the treatment; T2= 2-week follow-up; T3= 4-week follow-up; VAS= visual analogue scale.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

average BMI of the female subjects was 21.29 ± 4.13 kg/m², and that of the male subjects was 24.08 ± 2.64 kg/m².

VAS scores decreased after treatment; the VAS values at T1, T2, and T3 are shown in Table 3. VAS scores decreased by 1.94 at the 2-week follow-up and decreased by 3.26 at the 4-week follow-up, compared to the values

before treatment. These data suggested significant improvements in VAS scores ($p < 0.001$) (Table 2).

After treatment, an improvement was observed in the three posture angles SA, CSA-c, and CSA-s. A poor SA was associated with behavioral habits such as repeatedly carrying heavy packages with one hand or on one shoulder.

Table 3 The relationship between angles of the head-neck-shoulder, and VAS, at T1, T2, and T3.

Dependent variable: VAS		
Independent variable	β (95% CI)	<i>p</i> Value
Age	0.000014 (-.043, .043)	1.00
Sex		
Female	Ref.	
Male	0.59 (-0.78, 1.97)	0.40
BMI	-0.34 (-0.57, -0.11)	.003**
Trauma history		
No	Ref.	
Yes	1.66 (0.08, 3.24)	.040*
Computer use	-0.10 (-0.27, 0.06)	.22
Treatment time-points		
T1	Ref.	
T2	-1.32 (-2.78, 0.13)	0.07
T3	-1.85 (-3.35, -0.35)	0.02*
Angles of the head-neck-shoulder		
SA	0.17 (-0.27, 0.60)	0.45
CSA-c	-0.14 (-0.80, 0.52)	0.68
CSA-s	-0.18 (-0.29, -0.07)	0.002**

BMI= body mass index; CI= confidence interval; CSA-c= cervical spine angle-coronal; CSA-s= cervical spine angle-sagittal; Ref.= reference; SA= shoulder angle; T1= prior to the treatment; T2= 2-week follow-up; T3= 4-week follow-up; VAS= visual analogue scale.

* $p < 0.05$.

** $p < 0.0$

der, but showed improvement after treatment at both T2 and T3 ($p < 0.001$) (Table 2). The ideal SA is 180° ; thus, we calculated the difference between the subject's SA, and 180° . Therefore, a difference of 0 represents the ideal angle. The results showed that the SA decreased by 1.28° on average at the 2-week follow-up, and by 1.57° at the 4-week follow-up, compared to the corresponding values prior to treatment.

Poor CSA-c was associated with behavioral habits such as resting the chin in the hand while sitting, and had improved after treatment, at both T2 and T3 ($p < 0.001$) (Table 2). The CSA-c was also compared with an ideal angle, 90° , to derive the difference; a difference of 0 representing the ideal angle. CSA-c was decreased by 0.08° on average at the 2-week follow-up and by 1.12° at the 4-week follow-up, compared to the corresponding values prior to treatment.

The CSA-s was defined as the severity of forward head position, and improved after treatment at T2 ($p < 0.001$) (Table 2). BMI was significantly associated with

CSA-s ($p < 0.001$), and increasing one unit (kg/m^2) of BMI was associated with a decrease of 1.37° in CSA-s. The CSA-s is greater when the patients are in a balanced posture than when they are in a forward head posture, but the details of this association have not been clearly defined. In this study, the CSA-s had increased by 2.86° on average at the 2-week follow-up, and by 2.20° at the 4-week follow-up, compared to the corresponding values prior to treatment.

CSA-s was strongly associated with VAS scores ($p < 0.01$) (Table 3). The other two angles of the head-neck-shoulder investigated were not significantly associated with VAS scores. On average, increasing one unit (kg/m^2) of BMI decreased VAS scores by 0.34 ($p < 0.01$).

DISCUSSION

The female:male ratio of temporomandibular disorder patients seeking care has been reported as ranging from 2:1 to as high as 9:1,^{2,9} and in our study it was approximately 2:1. In our study, there was no significant difference between males and females with regard to pain score. The higher proportion of women with TMD, as observed in our study and others, may be attributable to greater awareness of health among women,⁹ or comparative muscle weakness in women.

In our study, we found that increasing one unit (kg/m^2) of BMI could decrease 1.37° of CSA-s, on average (Table 2). In other words, the heavier subjects tended to exhibit a greater forward head position. On the other hand, increases of one BMI unit (kg/m^2) were associated with decreases in VAS scores of 0.34, suggesting that thinner subjects are more likely to experience myofascial pain resulting from TMJ.

Poor posture may develop in conjunction with factors such as hunching with a forward head position while sitting, standing, or walking, and especially while using a computer or reading. Other poor postural habits include resting the chin in the hand while sitting, sitting cross-legged, standing with one's weight on only one foot, leaning against walls, or repeatedly carrying heavy packages with one hand or on one shoulder. In this study, 85% of subjects reported maintaining a constant posture for a long duration while performing activities related to daily living, and 54% reported having had poor posture for extended periods. We speculate that the MPDS of TMJ is strongly associated with postural habits and occupation, particularly in office workers. Over time, the body may adapt to poor posture, and in turn, the muscles may develop stiffness due to maintaining the same posture over

extended periods, consequently leading to severe pain due to an overload on the muscles. In our study, posture correction and training significantly improved the angle of the head-neck-shoulder. We speculate that the observed decreases in VAS scores associated with improvement of the angle of the head-neck-shoulder, especially the sagittal angle of cervical spine and correction of forward head position, may have important implications for the treatment of myofascial pain associated with TMJ. A previous study has shown that the pain associated with bad posture can be partially relieved by posture training,⁶ as was evident in our study.

Many studies have demonstrated that trauma is a risk factor for TMD.¹⁰ In our study, we found that 38% of the subjects had a history of trauma, including leg length discrepancy, scoliosis, pelvic obliquity, and herniated intervertebral disc. Imbalance between the skeletal bones and muscles results in poor posture, which in turn can lead to certain muscles being under-utilized during exercise, and others being over-utilized. Support imbalance along core muscle groups in or related to the head and neck can cause pain in the shoulders, neck, head, and masticatory muscles.

Photographing the patients in a standing posture at each follow-up and facilitating an enhanced understanding of the changes in posture via self-training could improve the correction of posture and the success of the treatment. Our study used 3 measurements that were not difficult to obtain: SA, CSA-c, and CSA-s. The SA and CSA-c have absolute values and can be compared directly. On the other hand, CSA-s is associated with age, and its "normal" values may vary from approximately 32° to 58°, as has been reported in previous studies,^{11,12} and thus, changes in the CSA-s following treatment or intervention are more important than absolute CSA-s values. Although the results showed there is strongly associated of CSA-s and VAS scores ($p < 0.01$), we need further study of more participants to make the more accurate speculations.

This study shows that posture correction training combined with the use of a muscle relaxant drug can constitute effective intervention for patients with MPDS of TMJ. An improvement in pain score may be associated with correction of forward position achieved via postural training.

The results of this study may suggest further treatment options to clinicians, with regard to posture correction to reduce the impact of poor posture on the severity of MPDS. We suggest that clinicians should be aware of the influence of forward head posture on MPDS. Postural

correction and training should be an integral component of the management of patients with MPDS of TMJ. Future studies should explore the effects of muscle relaxant drugs, simple posture corrections, and combined muscle relaxant drug use and posture correction in patients with MPDS of TMJ.

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DISCLOSURE

The authors declare that this study has no conflict of interest.

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