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Comparison of subjective symptoms among three diagnostic subgroups of adolescents with temporomandibular disorders

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Aim. To compare subjective symptoms among three diagnostic subgroups of young patients with temporomandibular disorders (TMDs).

Design. We comprehensively examined 121 patients with TMDs (age ≤20 years; 90 female patients and 31 male patients) who completed self-reported forms for assessing subjective symptoms, which consisted of five items on pain intensity in the orofacial region and six items on the level of difficulty in activities of daily living (ADL) (rating scale, 0–10). They were divided into three diagnostic subgroups: temporomandibular joint (TMJ) problem (JT) group, masticatory muscle pain (MM) group, and the group with a combination of TMJ problems and masticatory muscle pain (JM group). Their symptoms were compared using the Kruskal–Wallis and Mann–Whitney *U*-tests.

Results. The intensity of jaw or face tightness and difficulty in talking and yawning were not significantly different among the groups. However, the MM and JM groups had a significantly higher rating for jaw or face pain, headache, neck pain, tooth pain, and difficulty in eating soft foods ($P < 0.01$).

Conclusions. Young patients with MM or JM report more intense pain in the orofacial region and have more difficulties in ADL than those with JT problems alone.

Introduction

Temporomandibular disorders (TMDs) is a collective term that embraces a number of clinical problems that involve the masticatory muscles, the temporomandibular joint (TMJ), and the associated structures[1]. Although the prevalence of TMDs tends to be lower in children and adolescents than in adults, the signs and symptoms of such disorders are frequently observed in young populations[1]. Previous studies have shown that the most frequent symptoms of TMDs in children are TMJ clicking and myofascial pain in the masticatory muscles and that the prevalence of these symptoms increases with age[2]. The findings indicate that patients with TMDs pose many varied diagnostic problems, including internal derangements and myogenic disorders[3]. These patients can therefore be divided into diagnostic subgroups on the basis of problems related to the TMJs alone and/or problems related to the masticatory muscles. Among the patients seeking treatment for TMDs, 26% have an internal derangement and 33% have a muscular disorder[4]. Dworkin and LeResche[5] developed the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) to allow the standardization and replication of research into the most common forms of muscle- and joint-related TMD (Table 1). In addition to the physical diagnosis (Axis I), they also recommended a psychosocial assessment of TMD patients on Axis II. Axis II of the RDC/TMD assesses and classifies the global severity of the pain condition with regard to (1) the characteristic pain intensity, (2) the disability attributed to TMD pain, (3) depression, and (4) nonspecific physical symptoms[5]. To determine the appropriate therapeutic approach, it is crucial to carefully evaluate the multiple problems

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Table 1. Research diagnostic criteria for temporomandibular disorders (RDC/TMD). Axis I: Clinical TMD conditions.

Group I: Muscle disorders
a. Myofascial pain
b. Myofascial pain with limited opening
Group II: Disc displacements
a. Disc displacement with reduction
b. Disc displacement without reduction, with limited opening
c. Disc displacement without reduction, without limited opening
Group III: Arthralgia, arthritis, arthrosis
a. Arthralgia
b. Osteoarthritis of the TMJ
c. Osteoarthrosis of the TMJ

and symptoms of TMD patients. Only then can diagnosis-specific management strategies be developed.

Many studies have compared the symptoms of adult patients with TMDs by assigning them to diagnostic subgroups[6–9]. Some have reported that patients with chronic TMDs in the masticatory muscle pain subgroup (RDC/TMD, Axis I, Group I) exhibit more dysfunctional behaviour and have higher pain intensity scores than those in the intracapsular pain subgroup (RDC/TMD, Axis I, Group II or III)[6,7]. Epker and Gatchel[8] investigated the biopsychosocial differences among these diagnostic subgroups and found that as compared to patients with intracapsular pain, patients with masticatory muscle pain show higher levels of psychological difficulties and exhibit more dysfunctional behaviour. Dahlström *et al.*[9] evaluated the psychosocial and behavioural parameters associated with chronic pain in subgroups of patients with TMDs by using the Multidimensional Pain Inventory. They reported that patients having a chronic TMD associated with predominately muscular pain show more psychological distress than those in the other subgroups. Although many studies have been conducted to assess the pain and/or quality of life among young patients with TMDs[10–13], few studies have focused on the diagnostic subgroups of children and young adults with TMDs.

Therefore, we undertook the current study to compare the self-reported subjective symptoms in terms of the intensity of pain and the level of difficulty in performing activities of daily living (ADL) among three diagnostic subgroups of young patients with TMDs. We aimed to test the hypothesis that young patients having a TMD associated with masticatory muscle pain experience more intense pain for longer and have more difficulties in performing ADL than those with TMJ problems alone.

Methods

Study population

This cross-sectional study comprised consecutive patients who visited the University of California San Francisco (UCSF) Center for Orofacial Pain, a university-based specialty clinic for TMDs and orofacial pain, from March 2001 to March 2005. Only patients aged 20 years or younger were enrolled. We selected 121 patients with TMDs and collected data from their charts. This study was approved by the UCSF Committee on Human Research and the Ethical Review Board of the School of Life Dentistry, Nippon Dental University, Japan.

Diagnostic procedures

All the patients were assessed with a standardized comprehensive examination protocol routinely used in the UCSF Center for Orofacial Pain. This assessment was performed by two examiners who were Diplomates of the American Board of Orofacial Pain and had good inter-rater reliability. Before the initial consultation, all patients completed several forms collecting data on demographic and health history information and a subjective symptom form on their physical problems and symptoms (Fig. 1). Before the standardized comprehensive examination, a detailed history of the patients' chief complaint(s), associated symptoms, trauma, treatments undergone for the chief complaint(s), and psychosocial factors were recorded. The clinical examination included the measurement of mandibular and cervical range of motion; the determination of TMJ noise and provocation testing of the TMJ; and the examination of the masticatory and cervical muscles, cranial nerve, and intra-oral parameters. If necessary, additional diagnostic

Physical problems & Symptoms

Please rank your physical problem(s) during this past week:

1.
2.
3.
4.
5.
6.

Circle the number that best represents your pain this past week:

	None			Mild			Moderate			Severe		Most pain imaginable
Jaw/face pain	0	1	2	3	4	5	6	7	8	9	10	
Jaw/face tightness	0	1	2	3	4	5	6	7	8	9	10	
Headache	0	1	2	3	4	5	6	7	8	9	10	
Neck pain	0	1	2	3	4	5	6	7	8	9	10	
Tooth pain	0	1	2	3	4	5	6	7	8	9	10	

Circle the number that best represents the difficulty/discomfort with the following activities:

	None			Mild			Moderate			Severe		Extremely difficult
Talking	0	1	2	3	4	5	6	7	8	9	10	
Yawning	0	1	2	3	4	5	6	7	8	9	10	
Prolonged jaw opening	0	1	2	3	4	5	6	7	8	9	10	
Eating soft foods	0	1	2	3	4	5	6	7	8	9	10	
Eating hard foods	0	1	2	3	4	5	6	7	8	9	10	
Sleeping	0	1	2	3	4	5	6	7	8	9	10	
Other	0	1	2	3	4	5	6	7	8	9	10	

Please describe other difficult activity:

Fig. 1. Subjective symptom form.

tests were performed, including imaging, physical therapy evaluation, and other medical consultation. The patients were evaluated according to the guidelines set forth by the RDC/TMD[5]. The primary and secondary diagnoses were used to classify patients into the diagnostic subgroups. According to the history, clinical findings, and additional diagnostic data, the patients were divided into three diagnostic subgroups:

1. Patients with joint-related problems under RDC/TMD Axis I, Group II (disc derangement disorders) or Group III (inflammatory disorders and osteoarthritis) were classified into the TMJ problem (JT) group.
2. Patients with myofascial pain in the masticatory muscles under RDC/TMD Axis I, Group Ia (myofascial pain) or Group Ib (myofascial pain with limited opening) were classified into the masticatory muscle pain (MM) group.
3. Patients fulfilling the criteria of both the above groups were classified into the combined TMJ problem and masticatory muscle pain (JM) group.

Patients with neuropathic pain, generalized pain such as fibromyalgia or neurovascular

headache (e.g., cluster headache or migraine), or a psychiatric disorder were excluded.

Measurement of subjective symptoms

Subjective symptoms were measured using the subjective symptom form (Fig. 1). The form consisted of five factors related to pain in the orofacial region (i.e., jaw or face pain, jaw or face tightness, headache, neck pain, and tooth pain) and six factors related to difficulty in performing ADL (i.e., talking, yawning, prolonged jaw opening, eating soft foods, eating hard foods, and sleeping). The patients scored these factors on an 11-point numeric rating scale (NRS) from 0 (minimum) to 10 (maximum). The patients circled the rating that best represented their symptoms, based on which the pain intensity and level of difficulty in performing ADL were evaluated. The chronicity of symptoms (i.e., duration from the first manifestation of the symptoms to the first visit to the clinic) was determined by recording patient history.

Statistical analysis

We used multiple comparison tests to compare the variables among the subgroups. Before performing these multiple group comparisons, we assessed the differences between the female patients and male patients in each group by using Student's *t*-test for age and chronicity of symptoms and Mann–Whitney *U*-test for the intensity of pain and level of difficulty in performing ADL.

Analysis of variance (ANOVA) was used for analysing the differences in the age and chronicity of symptoms. A chi-square test was used to analyse the differences arising because of the gender ratio. A P value less than 0.05 was considered significant. We used the Kruskal–Wallis test for comparing the numerical values of the intensity of pain and the level of difficulty in performing ADL. If a significant difference was found, we tested a pair of variables from all three groups by using the Mann–Whitney *U*-test for numerical values. As three tests were performed, Bonferroni adjustment was applied with the alpha level set at $P = 0.0167$ (i.e., 0.05/3). All analyses were performed using SPSS 15.0J for Windows (SPSS Japan Inc., Tokyo, Japan).

Results

No significant differences were found in age, chronicity of symptoms, intensity of pain, and levels of difficulty in performing ADL between the females and males in each group. Hence, we did not perform any gender-based analyses and compared the variables among the three diagnostic subgroups.

Patient demographics

The demographics of the patients in the three diagnostic subgroups were studied (Table 2). The average patient age was 16.0 years, with no significant age differences among the subgroups (ANOVA: $P = 0.52$). Overall, 74% of the patients were females (90 females *vs* 31 males), with more females in the JM group (77%) than in the JT (71%) and MM groups (72%); however, the gender composition was not significantly different (chi-square test: $P = 0.73$). The average chronicity of symptoms for all three groups was 16.3 months.

Table 2. Demographics of the patients in the three diagnostic subgroups*.

	JT group (n = 41)	MM group (n = 18)	JM group (n = 62)	P-value†
Age (years)	15.9 ± 3.6	16.7 ± 2.6	15.9 ± 2.5	0.52
Gender ratio (female/male)	29/12	13/5	48/14	0.73
Chronicity of symptoms (months)	15.3 ± 17.9	12.2 ± 8.5	18.0 ± 16.6	0.48

*Data are shown as mean ± SD.

JT group: Patients with a joint-related diagnosis classified under RDC/TMD Axis I, Group II or Group III (disc derangement disorders, inflammatory disorders, and osteoarthritis); MM group: Patients with myofascial pain in the masticatory muscles fulfilling the RDC/TMD Axis I, Group Ia or Ib; JM group: Patients fulfilling the criteria of both the JT and MM groups.

†No significant differences among age, gender ratio or chronicity of symptoms among the three groups (ANOVA and chi-square test).

Although the chronicity of symptoms tended to be lesser in the MM group (12.2 months), the difference was again not significant (ANOVA: $P = 0.48$).

Measurement of subjective symptoms

First, we assessed the pain in the orofacial region in terms of the mean tightness and pain intensity in the diagnostic subgroups (Table 3). The intensity of jaw or face tightness was not significantly different among the subgroups (Kruskal–Wallis test: $P = 0.23$). However, significant differences were observed in the intensities of jaw or face pain, headache, neck pain, and tooth pain (Kruskal–Wallis test: $P < 0.001$, $P < 0.001$, $P = 0.001$ and $P = 0.001$, respectively). Analysis using the Mann–Whitney *U*-tests revealed that the patients in the MM and JM groups had scored all the pain intensity factors in a similar manner ($P = 0.21$ for jaw or face pain, $P = 0.06$ for headache, $P = 0.32$ for neck pain, and $P = 0.29$ for tooth pain). However, these scores were significantly higher than those of the JT group patients (Mann–Whitney *U*-test; JT *vs* MM: *P* values were 0.001 or less; JT *vs* JM: *P* values were 0.001 or less).

Next, we assessed the mean levels of difficulty in performing ADL in the three diagnostic subgroups (Table 4). Difficulties in talking and yawning were not significantly different

Table 3. Intensity of pain and tightness in the orofacial region (mean ± SD).

	JT group (n = 41)	MM group (n = 18)	JM group (n = 62)	*P*-value*
Jaw/face pain	2.5 ± 2.7[a]	6.5 ± 2.7[b]	5.6 ± 2.8[b]	< 0.001
Jaw/face tightness	1.5 ± 2.4	2.7 ± 4.3	2.8 ± 3.3	0.23
Headache	1.8 ± 2.6[a]	5.4 ± 3.2[b]	3.8 ± 3.1[b]	< 0.001
Neck pain	0.9 ± 2.1[a]	3.8 ± 3.5[b]	2.8 ± 3.2[b]	0.001
Tooth pain	0.1 ± 0.5[a]	2.5 ± 3.2[b]	1.7 ± 2.6[b]	0.001

JT group: Patients with a joint-related diagnosis classified under RDC/TMD Axis I, Group II or Group III (disc derangement disorders, inflammatory disorders, and osteoarthritis); MM group: Patients with myofascial pain in the masticatory muscles fulfilling the RDC/TMD Axis I, Group Ia or Ib; JM group: Patients fulfilling the criteria of both the JT and MM groups.

**P* value; Kruskal–Wallis test.

[a,b] Values indicated with the same superscript letter imply that *post hoc* comparison revealed no significant difference between the group means. Values indicated with different superscript letters imply that *post hoc* comparison revealed significant differences between the group means at $P < 0.0167$.

Table 4. Level of difficulty in performing activities of daily living (mean ± SD).

	JT group (n = 41)	MM group (n = 18)	JM group (n = 62)	*P*-value*
Talking	1.0 ± 1.6	1.7 ± 3.2	1.7 ± 2.6	0.40
Yawning	2.8 ± 3.4	2.5 ± 3.6	4.0 ± 3.9	0.17
Prolonged jaw opening	3.8 ± 3.1[a]	5.0 ± 3.6[a,b]	6.0 ± 3.4[b]	0.008
Eating soft foods	1.4 ± 1.8[a]	3.8 ± 2.9[b]	3.6 ± 3.3[b]	0.001
Eating hard foods	3.3 ± 2.9[a]	4.8 ± 3.4[a,b]	6.2 ± 3.1[b]	< 0.001
Sleeping	1.2 ± 2.0[a]	3.4 ± 3.2[b]	2.5 ± 3.1[a,b]	0.016

JT group: Patients with a joint-related diagnosis classified under RDC/TMD Axis I, Group II or Group III (disc derangement disorders, inflammatory disorders, and osteoarthritis); MM group: Patients with myofascial pain in the masticatory muscles fulfilling the RDC/TMD Axis I, Group Ia or Ib; JM group: Patients fulfilling the criteria of both the JT and MM groups.

**P* value; Kruskal–Wallis test.

[a,b] Values indicated with the same superscript letter imply that *post hoc* comparison revealed no significant difference between the group means. Values indicated with different superscript letters imply that *post hoc* comparison revealed significant differences between the group means at $P < 0.0167$.

among the subgroups (Kruskal–Wallis test: $P = 0.40$ and $P = 0.17$, respectively). However, the difficulty in prolonged jaw opening, eating soft foods, eating hard foods, and sleeping was significantly different (Kruskal–Wallis test: $P = 0.008$, $P = 0.001$, $P < 0.001$, and $P = 0.016$, respectively). Mann–Whitney *U*-tests revealed that, as compared to the patients in the JT group, the patients in the JM group gave significantly higher scores to difficulty in prolonged jaw opening, eating soft foods, and eating hard foods ($P = 0.002$, $P < 0.001$, and $P < 0.001$, respectively) and those in the MM group gave significantly higher scores to eating soft foods and sleeping ($P = 0.002$ and $P = 0.006$, respectively). On the other hand, the MM and JM groups gave similar overall scores to the difficulty in performing ADL (Mann–Whitney *U*-test: $P = 0.32$ for prolonged jaw opening, $P = 0.75$ for eating soft foods, $P = 0.13$ for eating hard foods, and $P = 0.24$ for sleeping).

Discussion

This cross-sectional study compared the demographics and the self-reported subjective symptoms of young patients with TMDs among three diagnostic subgroups. Unexpectedly, the patients in the MM group showed lesser chronicity of symptoms as compared to the patients in the other subgroups, but this difference was not significant. The patients in the JT and JM groups showed a comparatively wider range of chronicity. The primary diagnosis of some patients in the JT and JM groups was asymptomatic disc displacement with reduction. However, none of the patients in the MM group were diagnosed thus. The chronicity may be longer in patients with asymptomatic disorders, and this may affect the distribution of the chronicity of symptoms in the two subgroups.

Our hypothesis that young patients with MM experience more pain is supported by the present findings. Patients in both the MM and JM groups scored jaw or face pain as more than moderate (NRS score = 6.5 and 5.6, respectively), and the patients in all three subgroups scored jaw or face tightness lower than jaw or face pain. These findings possibly indicate that young patients with TMDs focus more on the pain itself, but less on the tightness in the muscles or the presence of trigger points, which may also be responsible for their pain. In general, myofascial pain arises from trigger points that present as local areas of firm, hypersensitive bands of muscle tissue[14]. Headache, neck pain, and tooth pain were scored as painful more often by the MM and JM patients than JT patients. This is probably because the former patients also had myofascial pain in other muscles such as the sternocleidomastoid, posterior cervical, and suboccipital muscles.

In our study, as compared to the patients in the JT group, those in the MM and JM groups gave a higher score for the level of difficulty in eating soft and hard foods. Haketa *et al.*[15] compared the subjective difficulty in food intake among three subgroups of adult patients with TMDs and found that patients having disc displacement with or without reduction experienced more difficulty than those having myofascial pain; this is inconsistent with our result. In that study, all the patients having disc displacement with or without reduction experienced pain in the TMJ and may have experienced pain during clicking or locking, leading to limited jaw opening. In our study, all the patients were 20 years old or younger, and those having pain-free asymptomatic disc displacement with reduction were classified into the JT group. Therefore, the presence of patients with limited jaw opening may have caused the difference in these results. Yap *et al.*[16] investigated TMD pain-related disability in 107 adults and found that the 3 most frequent jaw disabilities were eating hard foods (78%), yawning (76%), and chewing (65%). We found that among ADL, patients experienced the severest difficulty in prolonged jaw opening in the JT and MM groups and in eating hard foods in the JM group. Yap *et al.* did not include the difficulty in prolonged jaw opening in their jaw disability checklist, and their patients were not divided into diagnostic subgroups. Even so, our result is partially consistent with their findings. We believe that the ability to chew hard or soft foods should

be considered in the management of patients with different TMD subtypes.

Interestingly, the patients in the MM group gave significantly higher scores to the level of difficulty in sleeping than those in the JT group. Carlson *et al.*[17] found that patients with masticatory muscle pain report a greater degree of depression and sleep dysfunction than pain-free individuals. Korszun *et al.*[18] examined the co-morbidity of depressive disorders and TMDs and found that 28% of the patients with TMDs met the criteria for the diagnosis of depression. Further, Bonjardim *et al.*[19] evaluated the relationship between anxiety and depression and the signs and symptoms of TMDs in adolescents. They found that the frequency of pain in the muscle groups on palpation increased in proportion to the frequency of reported anxiety symptoms, and they therefore concluded that anxiety is an important factor in the perception of pain. On the basis of these studies and our findings, we recommend that healthcare providers evaluate the psychological dimension of muscle tenderness and the disability associated with it; this evaluation could provide valuable information for the appropriate management of patients with muscle pain.

Several studies on young patients with TMDs have focused on the psychological factors involved[11,12,20,21]. Vanderas *et al.*[20] investigated the relationship between TMDs and emotional stress, as indicated by the levels of urinary catecholamines, in children aged 6–8 years and found that emotionally stressful states increase the probability of children developing TMJ tenderness. Wahlund *et al.*[21] reported that adolescents with TMD pain have significantly greater sensitivity to aversive and pleasant somatic stimuli than controls; they concluded that chronic TMD pain in adolescents is accompanied by an increase in bodily symptoms, with the involvement of the nociceptive and cognitive systems. We did not objectively assess the emotional state of the young patients with TMDs in our study, which is a limitation of our cross-sectional study. Because of this limitation, we cannot describe the causal relationships between psychological factors and various types of pain in the orofacial region and difficulties in performing ADL among adolescents. However, it is crucial to understand the causative factors of these TMDs in young populations and develop successful long-term management strategies. In the future, we intend to conduct a longitudinal study to investigate the psychological aspects and background factors associated with this condition; we will also examine the effectiveness of strategies developed to manage the intensity of pain and the difficulty in performing ADL.

What this paper adds

- Even in young populations, patients with masticatory muscle pain alone and masticatory muscle pain combined with temporomandibular joint problems experience more self-reported pain in the orofacial region than those with temporomandibular joint problems alone.
- The higher pain intensity in young patients with masticatory muscle pain alone and masticatory muscle pain combined with temporomandibular joint problems has an effect on their ability to eat hard and soft foods.
- Patients with masticatory muscle pain alone appear to have a slightly significant difficulty in sleeping.

Why this paper is important to paediatric dentists

- Dentists should carefully consider the characteristics of the diagnostic subgroups of young patients with TMDs when developing appropriate diagnosis-specific management strategies.

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