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ORIGINAL ARTICLE

Clinical and psychological characteristics of TMD patients with trauma history

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OBJECTIVE: The purpose of this study was to investigate clinical and psychological characteristics of temporomandibular disorders (TMD) patients with trauma history.

MATERIALS AND METHODS: The clinical and psychological characteristics of 34 TMD patients with trauma history were compared with those of 340 TMD patients without trauma history. Craniomandibular index (CMI) was used for clinical characteristics of TMD patients. Symptom severity index (SSI) was used to assess the multiple dimensions of pain. Symptom checklist-90-revision (SCL-90-R) was used for psychological evaluation.

RESULTS: Temporomandibular disorders patients with trauma history displayed significantly higher CMI and palpation index. TMD patients with trauma history also exhibited higher values in duration, sensory intensity, affective intensity, tolerability, scope of symptom, and total SSI score. In addition, these patients showed significantly higher values in symptom dimensions of somatization, depression, anxiety, phobic anxiety, and paranoid ideation. Among the symptom dimensions of SCL-90-R, somatization showed the most significant correlations with CMI and SSI.

CONCLUSIONS: Temporomandibular disorders patients with trauma history displayed more severe subjective, objective, and psychological dysfunction than those without trauma history. Pain of myogenous origin, history of physical trauma, and psychosocial dysfunction were all closely related.

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Keywords: temporomandibular disorders; trauma; psychological characteristics

Introduction

Temporomandibular disorders (TMD) are a collective term embracing a number of clinical problems of the

masticatory system composed of the masticatory musculature and temporomandibular joint (TMJ) (McNeill, 1993). The etiology of TMD is complex and multifactorial. Major etiologic factors associated with TMD are the occlusal condition, trauma, psychological distress, deep pain input, and parafunctional activities. Personality, social circumstances, and genetic and developmental factors have also been implicated as having a role in the development and outcome of orofacial pain disorders including TMD (Okeson, 2008). It is generally accepted that traumatic stressors applied to the orofacial region have an important role in the initiation or precipitation of TMD and orofacial pain (McNeill, 1993). Some studies have reported that TMD patients experience more psychological distress from life events than healthy controls or patients with other illnesses (Moody et al, 1982; Korszun, 2002).

Trauma is generated from events such as traffic accidents, falling-down injuries, blows in the facial area. and violence-related injuries. A number of patients with trauma history display an aggregation of symptoms such as repeated and unwanted experiencing of the event, hyperarousal, anxiety, and a persistent sense of current threat. These symptoms may be enough to meet the diagnostic criteria for posttraumatic stress disorder (PTSD), and capable of impairing social and occupational functioning for extended periods. Furthermore, orofacial trauma is worthy of special emphasis because it is applied to an anatomical region that largely defines perception of self-image and identity (Bronheim et al, 1991) and is often associated with persistent disabilities (Shepherd, 1992). It has been reported that head-injured patients suffer from disrupted social relationships for as long as 2 years after trauma (Oddy and Humphrey, 1980).

Although the influence of psychological factors on orofacial pain disorders including TMD has long been recognized, treatments of orofacial pain caused by physical trauma have been mainly focused on the physical manifestations of the injury, with little consideration of the psychosocial sequelae. Many previous studies on TMD-related trauma have investigated the epidemiological and psychological properties of PTSD patients among orofacial pain patients including those with TMD (De Leeuw *et al*, 2005a,b;

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Sherman et al, 2005; Bertoli et al, 2007). Most studies which dealt with psychological properties of TMD have described characteristics of psychosocial functioning and psychological distress in TMD patients regardless of the physical trauma experienced (Yap et al, 2003; Manfredini et al, 2004). Although trauma has obvious additional adverse effects on the psychological aspects of patients with TMD, referred to as 'chronic pain condition', little is known about the clinical and psychosocial profiles of TMD patients with trauma history, or how these are related. The aim of this study was to investigate the clinical and psychological characteristics of TMD patients with trauma history. The relationship between symptom severity and psychosocial dysfunction was also investigated. We hypothesized that TMD patients with trauma history would have more psychological problems and more severe dysfunction than those without trauma history.

Materials and methods

Subjects

A total of 374 patients who visited the TMJ & Orofacial Pain Clinic of Seoul National University Dental Hospital were included in this study. The experimental group comprised 34 consecutive TMD patients with trauma history (10 males, mean age, 29.3 ± 8.5 years; 24 females, mean age, 36.8 ± 13.6 years) and the control group comprised 340 TMD patients without trauma history (100 males, mean age, 26.8 ± 12.5 years; 240 females, mean age, 31.0 ± 13.6 years). All of the experimental group had reported occurrence of TMD symptoms following physical trauma on their orofacial area. Types of trauma were car accidents (n = 24), injuries during military service (n = 4), falling-down injuries (n = 3), injuries from athletic devices (n = 2), and violent attack (n = 1). The average duration of pain in the experimental group (15.8 \pm 24.7 months) was similar to that in the control group (15.3 \pm 32.5 months). The research protocol was approved by the Institutional Review Board of the University Hospital (#CRI07019).

Evaluation of clinical characteristics

Craniomandibular index (CMI) was used to evaluate the clinical characteristics of TMD. The CMI developed by Fricton and Schiffman (Fricton and Schiffman, 1986, 1987) is a reliable, valid instrument for assessing jaw pain and dysfunction, and provides a standard measure of severity of signs and symptoms in mandibular movement, TMJ noise, and joint and muscle pain/tenderness in epidemiological and clinical outcome studies. CMI is divided into the palpation index (PI) and the dysfunction index (DI). The PI includes items related to tenderness with palpation of intraoral and extraoral jaw muscles, and neck muscles. The DI includes items related to limits in range of motion, deviation in movements, pain in range of motion, TMJ noise in range of motion, and palpation of TMJ capsule.

Symptom severity index

Among 374 subjects, 24 TMD patients with trauma history (seven males, mean age, 28.4 ± 6.6 years; 17 females, mean age, 35.9 ± 14.0 years) and 178 TMD patients without trauma history (53 males, mean age, 22.8 ± 7.6 years; 125 females, mean age, 28.1 ± 11.2 years) who answered the Symptom severity index (SSI) questionnaire completely were included. The SSI is a valid and reliable instrument for assessing of multidimensions of pain and consists of five subscales and scope of symptom. The five subscales that are assessed by means of visual analog scales (VAS) include frequency, duration, sensory intensity, affective intensity, and tolerability of pain. The scope of symptom is the ratio that is the numbers of symptoms marked by subjects divided by total number of symptoms on the checklist. The total SSI score is the average of the five subscales and the scope of symptom. The scores of SSI range between 0 and 1, with 1 being the most severe score (Fricton, 1990).

Evaluation of psychological characteristics

Symptom checklist-90-revision (SCL-90-R) (Derogatis, 1977) was used to evaluate the psychological characteristics of patients with TMD. The SCL-90-R is a 90-item self-report measure that has been used to assess psychological symptoms; it comprises nine symptom dimensions, including somatization (SOM), obsessive-compulsive (O-C), interpersonal sensitivity (I-S), anxiety (ANX), depression (DEP), hostility (HOS), phobic anxiety (PHOB), paranoid ideation (PAR), and psychoticism (PSY), and three global indices of functioning, including global severity index (GSI), positive symptom distress index (PSDI), and positive symptom total (PST).

Evaluation of contributing factors

The questionnaire was used to evaluate the contributing factors of TMD patients; it consists of four sections, including emotions, behaviors, cognitions, and socialities (Fricton and Chung, 1988).

Statistical analysis

The Student *t*-test was used to analyze the differences in clinical and psychological characteristics between the two groups. The Pearson's correlation analysis with Bonferroni's correction was performed to investigate the relationships between CMI, SSI, and SCL-90-R. *P*-values < 0.05 were considered statistically significant.

Results

Craniomandibular index

Temporomandibular disorders patients with trauma history displayed significantly higher CMI (P < 0.01) and PI (P < 0.001) than TMD patients without trauma. There was no significant difference in DI between the two groups (Figure 1).

Symptom severity index

Temporomandibular disorders patients with trauma history exhibited higher values in duration (P < 0.01),

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Figure 1 Comparison of PI, DI, and CMI of TMD patients with and without trauma history PI, palpation index; DI, dysfunction index; CMI, craniomandibular index **P < 0.01, ***P < 0.001

sensory intensity (P < 0.01), affective intensity (P < 0.01), tolerability (P < 0.01), scope of symptom (P < 0.001), and total SSI score (P < 0.01) (Figure 2).

Symptom checklist-90-revision

Temporomandibular disorders patients with trauma history showed significantly higher T-scores in symptom dimensions of SOM (P < 0.001), DEP (P < 0.05), ANX (P < 0.05), PHOB (P < 0.05), and PAR (P < 0.05) than those without trauma history. Also, those with trauma history presented with higher global indices of GSI and PSDI than those without trauma (P < 0.05) (Figure 3a, b).

Correlation between CMI, SSI, and SCL-90-R

Craniomandibular index showed significant correlations with total SSI score (r = 0.325, P < 0.001). PI showed a significant correlation with scope of symptom among six items of SSI. DI displayed significant correlations with sensory intensity, affective intensity, and tolerability (Table 1). Somatization showed significant correlations with all of PI, DI, and CMI. Depression and global indices showed significant correlations with PI and CMI (Table 2). Scope of symptom showed significant correlations with almost all symptom dimensions



Figure 2 Comparison of symptom severity index (SSI) between TMD patients with and without trauma history Freq, frequency; Dur, duration; Sens, sensory intensity; Affect, affective intensity; Toler, tolerability; Scope of Sx., scope of symptom **P < 0.01, ***P < 0.001



Figure 3 (a) Comparison of symptom dimensions of symptom checklist-90-revision (SCL-90-R) between TMD patients with and without trauma history SOM, somatization; O-C, obsessive-compulsive; I-S, interpersonal sensitivity; DEP, depression; ANX, anxiety; HOS, hostility; PHOB, phobic anxiety; PAR, paranoid ideation; PSY, psychoticism *P < 0.05, ***P < 0.001 (b) Comparison of global indices of symptom checklist-90-revision (SCL-90-R) between TMD patients with and without trauma history GSI, global severity index; PSDI, positive symptom distress index; PST, positive symptom total *P < 0.05

and global indices of SCL-90-R. Among the symptom dimensions, somatization showed significant correlations with almost all items of SSI (Table 3).

Contributing factors

Temporomandibular disorders patients with trauma history expressed a significantly more negative attitude for the four behavioral factors, including activity level, sleep, eating habits, and social activity, for the cognitive factor of 'How healthy do you feel you are?', for two social factors of 'How often is the problem an excuse not to do something?' and 'How much does the problem prevent you from doing what you want?' than those without trauma history.

Discussion

This study was performed to examine the influence of physical trauma on clinical and psychological characteristics of TMD patients. The female-to-male ratio of TMD patients with trauma history was 2.4:1 and the gender distribution of the control group was established according to this ratio. Although the subjects in both groups were consecutively recruited from our clinic, it was interesting to find that the distributions of age and pain period in both groups were similar. Actually,

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n = 202	Frequency	Duration	Sensory intensity	Affective intensity	Tolerability	Scope of symptom	Total SSI score	
PI	0.085	0.194	0.200	0.170	0.132	0.442***	0.236 [*]	
DI	0.139	0.144	0.252**	0.294***	0.272 ^{**}	0.198	0.295 ^{***}	
CMI	0.139	0.207	0.276**	0.282**	0.244 ^{**}	0.392***	0.325 ^{***}	

Table 1 Correlation between CMI and SSI

Correlation was analyzed by the Pearson's correlation test with Bonferroni's correction.

*P < 0.05, **P < 0.01, ***P < 0.001

PI, palpation index; DI, dysfunction index; CMI, craniomandibular index; SSI, symptom severity index.

Table 2 Correlation between CMI and SCL-90-R

n = <i>374</i>	SOM	0-С	I-S	DEP	ANX	HOS	РНОВ	PAR	PSY	GSI	PSDI	PST
PI	0.334 ^{***}	0.125	0.080	0.189 ^{**}	0.164	0.097	0.165	0.126	0.107	0.191 ^{**}	0.170^{*}	0.183 [*]
DI	0.203 ^{***}	0.071	0.052	0.117	0.074	0.060	0.066	0.099	0.063	0.111	0.086	0.105
CMI	0.322 ^{****}	0.119	0.081	0.185 [*]	0.144	0.093	0.137	0.136	0.103	0.183 [*]	0.155	0.173 [*]

Correlation was analyzed by the Pearson's correlation test with Bonferroni's correction.

*P < 0.05, **P < 0.01, ***P < 0.001.

PI, palpation index; DI, dysfunction index; CMI, craniomandibular index; SCL-90-R, symptom checklist-90-revision; SOM, somatization; O-C, obsessive-compulsive; I-S, interpersonal sensitivity; DEP, depression; ANX, anxiety; HOS, hostility; PHOB, phobic anxiety; PAR, paranoid ideation; PSY, psychoticism; GSI, global severity index; PSDI, positive symptom distress index; PST, positive symptom total.

Table 3 Correlation between SSI and SCL-90-R

n = 202	SOM	<i>0-C</i>	I-S	DEP	ANX	HOS	РНОВ	PAR	PSY	GSI	PSDI	PST
Frequency	0.021	-0.029	-0.050	0.003	0.019	-0.057	0.029	-0.060	-0.041	-0.015	-0.002	-0.017
Duration	0.292^{**}	0.073	0.095	0.137	0.174	0.164	0.208	0.077	0.079	0.175	0.200	0.151
Sensory intensity	0.274^{**}	0.051	0.056	0.087	0.080	0.084	0.144	-0.009	0.049	0.118	0.106	0.134
Affective intensity	0.376***	0.199	0.174	0.214	0.226	0.228	0.208	0.127	0.145	0.265^{**}	0.237	0.278^{**}
Tolerability	0.329***	0.175	0.150	0.197	0.188	0.212	0.197	0.104	0.153	0.239	0.185	0.269^{**}
Scope of symptom	0.517^{***}	0.331***	0.238	0.407^{***}	0.396***	0.266^{**}	0.393***	0.233	0.313***	0.430***	0.376***	0.408^{***}
Total SSI score	0.337***	0.125	0.101	0.178	0.193	0.147	0.219	0.057	0.101	0.207	0.194	0.211

Correlation was analyzed by the Pearson's correlation test with Bonferroni's correction.

*P < 0.05, **P < 0.01, ***P < 0.001.

SSI, symptom severity index; SCL-90-R, symptom checklist-90-revision; SOM, somatization; O-C, obsessive-compulsive; I-S, interpersonal sensitivity; DEP, depression; ANX, anxiety; HOS, hostility; PHOB, phobic anxiety; PAR, paranoid ideation; PSY, psychoticism; GSI, global severity index; PSDI, positive symptom distress index; PST, positive symptom total.

several previous studies have reported that there are no significant differences in age, pain period, and parafunctional habits between orofacial pain patients including those with TMD with or without traumatic history; furthermore, in these studies, women were also the predominant gender (De Boever and Keersmaekers, 1996; De Leeuw *et al*, 2005a,b; Bertoli *et al*, 2007).

This study showed that TMD patients with trauma history presented with higher CMI and PI than the control group. As there was no significant difference in DI between the groups, the difference in CMI was due to the PI which measures the degree of muscle tenderness in the stomatognathic system. In other words, it seems to be that TMD patients with trauma history display much more pain and dysfunction from a myogenous origin than those without trauma history. A higher prevalence of muscle pain in TMD patients caused by trauma is supported by some previous studies, which have, moreover, shown that muscle pain patients reported more exposure to traumatic events than joint pain patients (De Leeuw *et al*, 2005a,b). Several studies have also reported a more severe intensity of psychosocial dysfunction and stressful condition in TMD patients with pain from a myogenous origin than those suffering pain from an arthrogenous one (Schiffman *et al*, 1992; Auerbach *et al*, 2001; Lindroth *et al*, 2002; Vazquez-Delgado *et al*, 2004). Our study also showed that PI had a significant correlation with depression and a higher correlation with somatization than DI in SCL-90-R.

This study also revealed that TMD patients with trauma history had higher VAS values in the pain lasting period (duration), sensory intensity, affective intensity, and tolerability of SSI than patients without trauma history. Pain frequency was the only characteristic of the subscales of SSI that was not significantly different between patients with and without trauma. These findings suggested that TMD patients with a history of trauma have a tendency to express 191

psychological distress more severely than those without trauma history, because all the subscales of SSI are related with the subjective feelings of pain that reflect psychological state of an individual.

The results of this study also demonstrated that there were higher levels of psychological dysfunction in TMD patients with trauma history as measured by the SCL-90-R, in which almost all symptom dimensions were of significance. These results were very similar to those of recent clinical studies (De Leeuw et al, 2005a; Bertoli et al, 2007). These recent clinical studies reported that PTSD patients with TMD displayed higher values in almost all symptom dimensions of SCL-90-R. This is supported in this study by the finding that the global indices of GSI and PSDI, which measure overall psychological distress and the intensity of symptoms, respectively, were higher in TMD patients with trauma history. As expected, we could also find that TMD patients with trauma history had behavioral, cognitive, and social contributing factors suggesting secondary gain. The fact that somatization among symptom dimensions showed the most significant correlations with SSI also supported these results. The above factors should therefore be taken into consideration in the evaluation and management of TMD patients with trauma history.

In conclusion, TMD patients with trauma history displayed more severe subjective, objective, and psychological dysfunction compared with those without trauma history. Pain of myogenous origin, trauma history, and psychosocial dysfunction were closely related. Multidisciplinary and comprehensive approaches are mandatory for long-term success of TMD patients with trauma history.

Author contributions

Dr. Hyung-II Kim collected and analysed data, and drafted paper. Dr. Jeong-Yun Lee analysed data and drafted paper. Dr. Young-Ku Kim designed the study and revised the manuscript. Dr. Hong-Seop Kho as a corresponding author designed the study, collected and analysed data, and revised the manuscript critically.

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