치의과학박사 학위논문

Pain related fear of movement in Korean temporomandibular disorder patients

한국인 측두하악장애 환자의
통증과 연관된 운동공포증 특성에 관한 연구

2018년 8월

서울대학교 대학원
치의과학과 구강내과 · 진단학 전공
박인희

Pain related fear of movement in Korean temporomandibular disorder patients

한국인 측두하악장애 환자의 통증과 연관된 운동공포증 특성에 관한 연구

지도교수 정 진 우

이 논문을 치의과학 박사학위논문으로 제출함

2018년 5월

서울대학교 대학원

치의과학과 구강내과·진단학 전공

박 인 희

박인희의 치의과학 박사학위논문을 인준함

2018년 7월

위 원 장 (인)

부 위 원 장 (인)

위 원 (인)

위 원 (인)

위 원 (인)

ABSTRACT

Pain related fear of movement in Korean temporomandibular disorder patients

In-Hee Park, D.D.S., M.S.D.

Program in Oral Medicine and Oral Diagnosis, Department of Dental Science, Graduate School, Seoul National University

(*Directed by Professor* **Jin-Woo Chung**, D.D.S., M.S.D., Ph.D.)

Objectives: The aims of this study were to analyze the characteristics of pain related fear of movement and to evaluate the validity of Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK-TMD) in patients with temporomandibular disorder (TMD).

Methods: A total 335 consecutive patients diagnosed with TMD and 98 control subjects without TMD symptoms were evaluated. Pain related fear of movement was evaluated of all subjects using the Korean version of TSK-TMD. The patients were performed both clinical examination based on the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) and radiographic evaluations were performed to classify the patients into pain-free and arthrogenous, myogenous, and mixed pain subgroups. The RDC/TMD Axis II profiles, trauma history, and psychological status including Beck's depression index (BDI) were evaluated.

Results: TMD patients showed significantly higher scores in all subscales of TSK-TMD compared to the control group. Women showed significantly higher scores in all TSK-TMD subscales compared to men in the TMD patient group, but there were no significant gender differences in the control group. In TMD patients,

mixed pain group showed significantly higher TSK-TMD scores compared to the pain-free subgroup. TMD patients with disc displacement did not show significant differences in all subscales of TSK-TMD compared to the normal disc position group. The TMD patients with trauma history showed significant higher TSK-TMD scores compared to the patients without trauma history. There were significant differences in TSK-TMD scores between low disability and high disability groups of Graded Chronic Pain (GCP) Scale. The TSK-TMD scores were significantly correlated with most of the RDC/TMD Axis II psychological profiles. In multivariate linear regression analysis, TSK-TMD scores were associated with age, gender, pain intensity, mouth opening limitation, and depression scale of RDC/TMD Axis II, but not associated with trauma history and somatization scale of RDC/TMD Axis II.

Conclusions: TMD patients showed higher level of fear of movement compared to the control group. In tests of convergent validity, the TSK-TMD score showed fair to moderate positive relationships with RDC/TMD Axis II indices. Pain related fear of movement was significantly associated with age, gender, pain intensity, mouth opening limitation, and depression in TMD patients.

Key words: Fear of movement, Psychological profile, Research Diagnostic Criteria for Temporomandibular Disorders, Tampa Scale for Kinesiophobia, Temporomandibular disorders

Student Number: 2010-31194

Pain related fear of movement in Korean temporomandibular disorder patients

In-Hee Park, D.D.S., M.S.D.

Program in Oral Medicine and Oral Diagnosis, Department of Dental Science, Graduate School, Seoul National University

(*Directed by Professor* **Jin-Woo Chung**, D.D.S., M.S.D., Ph.D.)

한국인 측두하악장애 환자의 통증과 연관된 운동공포증의 특성에 관한 연구

서울대학교 대학원 치의과학과 구강내과 · 진단학 전공

(지도교수 **정 진 우**)

박 인 희

- CONTENTS -

I. INTRODUCTION

Temporomandibular disorders (TMD) are musculoskeletal disorder that occurs in the orofacial region, and pain and dysfunction of temporomandibular joint (TMJ) and/or masticatory muscles occur. Signs and symptoms of TMD include jaw pain, joint noise, mouth opening limitation, deviation of mandibular movements, and chewing disability. These symptoms may be self-limited or persist, showing a recurring or chronic nature, and are frequently related with psychological variables.[1)]

TMD is a chronic disease that is accompanied by many psychological factors as well as pathological diseases. Patients with chronic TMD exhibit more psychological problems and pain-related disability than healthy controls,[2-4)] and objective factors cannot explain these difference. Among the many psychological factors associated with chronic musculoskeletal disorders, pain-related fear has recently received attention. The importance of pain-related fear is shown well in the fear-avoidance model of chronic pain.[6)] In this model, a prolonged pain experience is interpreted in a catastrophic way, leading to pain-related fear and behavioral avoidance. Avoidance causes negative psychological complications.[7,8)] Fear of movement, also known as kinesiophobia, is an excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or (re)injury.[9)] The fear of movement in patients with chronic pain can be assessed with the Tampa Scale for Kinesiophobia

(TSK).[9] There are good evidences that level of kinesiophobia measured with TSK is a strong predictor of disability in patients with low back pain[10-15], fibromyalgia[11], and osteoarthritis[16].

Despite of the fact that TMD patients share substantial similarities with other chronic musculoskeletal disease patients, there are only few researches about the fear-avoidance model in TMD. Among the psychological factors of TMD persistence, there are increasing evidences that fear of movement are predictive of future disability.[17] A previous study reported that catastrophizing may play an important role in TMD pain problems, both as reported by patients and as assessed during clinical examination.[18] Recently the Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK-TMD) was developed for evaluating fear of movement in TMD patients.[19] Several studies have shown the validity and reliability of TSK-TMD.[19,20] The TSK-TMD was translated into various languages including English[19], Chinese[20], and Brazilian Portuguese[21]. Recently we translated the TSK-TMD into an official Korean version and conducted reliability tests.[22] This Korean version of the TSK-TMD can be used to identify the characteristics of Korean TMD patients.

However, until now, there are no researches on fear of movement in TMD patients diagnosed according to the RDC/TMD criteria. As TMD is a collective term representing heterogenous conditions of the TMJ and masticatory muscles, it is necessary to compare patients according to the RDC/TMD criteria in order to

make comparisons depending on the exact condition of the disease.[23)]

The aims of this study were to conduct a validity test of the Korean TSK-TMD and to analyze various psychological features, especially characteristics of fear of movement of Korean TMD patients with diagnosis based on the RDC/TMD criteria.

II. REVIEW OF LITERATURE

1. Clinical features of TMD

TMD are common and divergent combination of disorders that affect the muscular, soft tissue, and bony components of the TMJ and/or the masticatory muscles. The symptoms of TMD are variable which may include pain, joint noise, mouth opening limitation, deviation of the mandible on opening and closing, headaches, earaches, and muscle tenderness. TMD are the most common cause of non-odontogenic pain in the orofacial region. The diagnosis of TMD often involves history taking, clinical examination, and imaging of the TMJ.[24)]

The prevalence of TMD signs and symptoms in the general population is high and ranges from 16% to 88%.[25)] This wide range of prevalence rate is considered among research method and diagnostic criteria. The epidemiologic predilection of TMD in women is well-known. In the general population, TMD are two times more prevalent in women than in men, whereas in patient populations these diseases have a women-to-men preponderance as high as 10:1.[26-28)] The reasons for this marked sexual dimorphism and age distribution remain unclear. TMD prevalence varies with age, with peak prevalence occurring between the ages of 20 and 40, and lower prevalence observed in childhood and in older adults.[29,30)]

The etiology of TMD is considered to be multifactorial, with factors such as general health, systemic diseases, psychological, psychosocial, and gender factors, together with local factors such as overload due to bruxism, contributing to the

overall risk. It has also been reported that indirect trauma caused by a whiplash trauma can be a contributing factor.[31] And recently psychological and cognitive factors are considered important etiologic causes. Fillingim et al. reported that several psychological variables predicted increased risk of TMD onset, including somatic symptoms, psychosocial stress, and affective distress.[32]

2. **Whiplash injury and TMD**

The term whiplash describes a hyperextension–flexion trauma to the neck. A whiplash injury is the result of the sudden deceleration or acceleration of the thorax independently of head movement.[33] This type of injury is commonly associated with motor vehicle collisions, specifically when a car is impacted from the rear.[34] As a result of the acceleration/deceleration motion, it is thought that patients may sustain bony or soft tissue injuries.

Although most individuals recover from an acute whiplash injury, a substantial number of patients, about one in three individuals, will develop long-lasting problems termed whiplash-associated disorders(WAD).[35] The symptoms following whiplash trauma are heterogeneous and relate both to mechanical injuries to the neck, pain sensitization, and psychological and social factors.[36] In addition to persisting neck pain, neck stiffness, and headaches, common symptoms are dizziness, sleep problems, cognitive problems, and a generally reduced quality of life.[37]

Although the link between TMD and whiplash injury has been controversial in the past, recent studies confirm that jaw pain following whiplash injury is a significant concern for patients. Multiple articles published in the recent years have suggested that the prevalence of TMD is increased following whiplash injuries, compared with that in the general population.[38] There are studies that are reported that the prevalence and incidence of TMD pain are increased after whiplash trauma.[39-41]

In addition to the increased prevalence of TMD in patients with whiplash injuries, recent studies have also found that the severity of TMD symptoms is increased in TMD patients those who suffered whiplash trauma.[40-42] Kim et al. compared 34 patients with TMD with a trauma history and 340 patients with TMD without a trauma history and they concluded that patients with TMD with a trauma history had more severe subjective, objective, and psychological dysfunction compared with typical patients with TMD.[43] Numerous studies suggest a less favorable treatment outcome for WAD patients group compared to TMD pain patients without a history of trauma.[39,44-46]

Different explanatory models for the etiology of TMD pain after whiplash trauma have been suggested. An early model advocated that acceleration deceleration of the head-neck induced overstretching or compression of the TMJ, causing a “mandibular whiplash”.[47] This concept was later refuted,[48] and instead an indirect mechanism was suggested. There is a strong functional linkage

between the jaw and craniocervical motor systems,[49] and an association has been shown between neck pain and dysfunction and deranged jaw function in chronic WAD.[50] The development of pain and dysfunction in the jaw region may reflect spread of pain related to close sensorimotor linkage between the jaw and neck, as well as lowered sensory and pain thresholds due to central sensitization.

Activation in the trigeminal region can produce symptoms in the cervical region, and vice versa.[51] These findings suggest that there is convergence of trigeminal and cervical sensory afferent projections in the upper cervical segments within the trigeminal subnucleus caudalis. Additionally, in patients with whiplash injuries, lowered sensory and pain thresholds are often observed to be linked to central sensitization phenomenon that includes comorbidity of pain at different locations with associated allodynia and hyperalgesia.[52,53]

3. Psychological aspect of TMD patients

Chronic TMD patients exhibit greater psychological maladjustment, on average, compared to healthy controls. Individuals with TMD differ considerably in levels of psychosocial dysfunction and pain-related disability.[2-4] Within TMD cohorts, levels of depression and/or somatic complaints are associated with chronicity of the disorder,[54] palpation tenderness in the orofacial area,[55] non-symptomatic pain tolerance,[56] and comorbid pain conditions[57]. More generally, levels of depressive/anxious symptoms in TMD appear to be elevated as compared with

healthy controls but comparable to other chronic pain conditions.[58,59] Fillingim et al. have found a number of psychosocial factors that are associated cross sectionally with chronic TMD, including levels of depression, anxiety, and somatization.[60] In a representative study, Kinney et al. found that over 85% of chronic TMD patients meet criteria for a psychological disorder (i.e. Axis I clinical syndrome) according to Diagnostic and Statistical Manual of Mental Disorders third edition-revised criteria (DSM-IIIR; American Psychiatric Association, 1987).[61]

Of interest to clinicians treating TMD, psychosocial characteristics have generally been found to be important predictors of treatment outcomes. For instance, levels of depression, catastrophizing, and somatic complaints are strong predictors of a worse response to standard treatment.[62-64] Psychological dysfunction is associated with greater severity and persistence of TMD-related clinical symptoms. For example, in cross-sectional studies, scores on measures of psychological distress were positively correlated with reported TMD pain and pain-related disability.[65-67] Further, in studies involving patients with existing TMD, psychological factors, such as somatic symptoms and depression, predict long-term persistence of TMD pain.[68-70]

Psychological factors had been implicated in several aspects of masticatory pain and dysfunction problems. First, stress-related muscle hyperactivity and oral habits had been suggested as etiological factors. Secondly, psychological factors

have been suggested to explain why some patients seem to be more bothered by symptoms and why only a small percentage of patients with symptoms actually seek treatment. Finally, psychological conditions, such as depression and secondary pain, have been implicated to explain why some patients do not respond to conventional therapy.[71] It is essential that psychological conditions, if present, are identified early in the initial management of TMD, as failure to do so may result in treatment non-success and worsening of the patient's condition.[72]

The common psychological factors in TMD patients are anxiety, depression, somatization, coping strategy and catastrophizing.

(1) Anxiety

Anxiety is a relatively permanent state of worry and nervousness characterized by physical symptoms, which are usually accompanied by compulsive behaviors or panic attacks.[59] Anxiety levels are correlated with facial pain, and TMD patients who are more anxious seem to be at greater risk of developing chronic pain.[73,74] Elevated levels of anxiety about pain and fear of pain contribute to disability and interfere with life activities.[75] Mongini et al. studied role of anxiety in orofacial pain. After examining 649 patients with facial pain divided into four diagnostic subgroups, they found that anxiety increases the likelihood of muscle tenderness and that patients with myogenous and facial pain had higher anxiety and muscle tenderness scores.[76] Moreover, numbers of research suggests that

anxiety and mood disorders are particularly elevated in TMD populations,[77,78] and Kight et al. found that over 30% of acute and chronic TMD patients met criteria for a DSM-IV (American Psychiatric Association, 1994) anxiety disorder.[79,80]

(2) Depression

Depression is an affective disorder characterized by a pessimistic sense of inadequacy and a despondent lack of activity. Moderate and severe depressions are very common psychological disorders in the general population. Women in non-clinical samples have more symptoms, or a more severe type of depression, than men.[81] Depression plays a very important role in chronic pain syndromes, because it increases pain-perception thresholds[82,83] and is associated with the onset of some chronic pain conditions.[84] The prevalence of depression in the population of patients with chronic pain has been estimated to be 30–54%.[77]

Previous psychologic surveys in patients with TMD have indicated that various psychologic variables, such as affective disturbance, somatization, and cognitive control, can be elevated in patients with TMD compared to control subjects.[85,86] Korszun et al. investigated comorbidity of depression in TMD patients, and reported 53 % of patients fulfilling criteria for a diagnosis of major or minor depression and a further 22% of patients reporting depressive symptoms.[87] Reiter et al. reported higher rates of severe depression, anxiety, somatization, and comorbidity were reported by using the SCL-90-R in TMD patients as compared

to existing comorbidity studies in primary general care patients.[54)]

(3) Somatization

Somatization is a tendency to experience and communicate psychological distress in the form of somatic symptoms and to seek medical help for them.[88)] Somatization and depression are examples of global psychological symptoms. A recent study, which examined TMD patients of different cultures from widely separated clinical sites, reported a prevalence of severe somatization of 28.5%. Prevalence of severe depression increased with the rate of pain-related impairment, ranging from 16.7% in TMD patients with no disability to 53.8% in patients with high disability and severely limiting impairments.[66)]

(4) Coping and Catastrophizing

Coping strategies are defined as constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands.[89,90)] Coping strategies marked by a passive attitude, exaggeration of catastrophism, and a limited use of distraction strategies constitute a dysfunctional style of coping, which is associated with greater levels of distress.[91)]

Catastrophizing is defined as expecting or worrying about major negative consequences of a situation, even one of minor importance.[89,92)] A numerous of research has demonstrated that pain-related catastrophizing is associated

significantly with pain intensity, disability, and psychological distress among patients with a variety of chronic pain syndromes.[93] Turner et al. reported that patient catastrophizing may play an important role in TMD pain problems, both as reported by patients and as assessed during a clinical examination.[18] Recent findings in chronic TMD patients indicated that treatment non-responders report more psychiatric symptoms, poorer coping, and higher levels of catastrophizing than patients who responded to treatment.[64]

4. Research Diagnostic Criteria for Temporomandibular Disorders

As TMD has complex and various symptom and sign, Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) was developed in 1992.[23] RDC/TMD has known as the most successful diagnostic protocol for TMD. The RDC/TMD diagnostic system is the only available TMD diagnostic system that is empirically-based, uses operationally defined measurement criteria for the most common TMD forms, and provides specifications for conducting a standardized clinical physical examination. The content validity and the construct validity of the RDC/TMD are generally accepted. RDC/TMD has been formally translated/back-translated into more than 20 languages and is the common diagnostic method used by the 45-member consortium of RDC/TMD-based international researchers.[94]

The RDC/TMD use clinical examination and history-gathering methods with

scientifically demonstrated reliability for gathering clinical signs of TMD, and also include assessment of behavioral, psychologic, and psychosocial factors. This dual-axis system allows a physical diagnosis based on pathophysiology to be placed on one axis (Axis I) and assessment of TMD-related parafunctional behaviors, psychologic distress, and psychosocial function on the second axis (Axis II). The RDC/TMD Axis I protocol is a standardized series of diagnostic tests based on clinical signs and symptoms. Diagnostic algorithms using different combinations of clinical and questionnaire measures are used to differentiate eight RDC/TMD-defined Axis I diagnoses for TMD. These diagnoses include myofascial pain (Ia), myofascial pain with limited opening (Ib), disc displacement with reduction (IIa), disc displacement without reduction with limited opening (IIb), disc displacement without reduction without limited opening (IIc), arthralgia (IIIa), osteoarthritis (IIIb), and osteoarthrosis (IIIc).[92] A person/TMJ may be assigned a diagnosis from each of the three main groups, and thus, multiple diagnosed per person are possible. However, diagnoses within each main group are mutually exclusive.

Axis II is used to assess behavioral, psychological, and psychosocial factors which can affect the prognosis of TMD or can be the results from chronic orofacial pain.[26,70,78,96,97] The Axis II profile consists of several components derived from self-reported ratings on Likert scales and endorsement of symptoms or limitations on categorical scales. The profile measures perceived pain intensity,

pain-related disability, resulting limitations, depression, and nonspecific physical symptoms suggesting somatization tendencies.

Axis II includes the assessment of patients' TMD pain–related behavioral functioning, psychological status, and adaptation to pain. The Graded Chronic Pain (GCP) scale were used to assess psychosocial function, and the Depression Scale and Vegetative Symptom Scale from the Symptom Checklist-90-Revised (SCL-90-R) and a jaw disability checklist were used for assessment of psychological status.[96,98] All the scales listed earlier are based on questionnaires that are completed by the patient. The GCP scale assesses chronic pain severity and provides a qualitative index for assessing the psychosocial impact of chronic pain. It is a useful clinical measure to assess the impact of TMD on patients in population-based studies. The GCP scale with functional TMD defined as grades I and II, which is indicative of no significant disability due to TMD. Dysfunctional chronic pain is defined as grades III and IV on the GCP scale.[68] The SCL-90-R depression scale is used to identify patients with chronic pain who may be experiencing significant depression, anxiety, and somatization.[99]

The RDC/TMD criteria for both Axis I and Axis II have been used in numerous clinical research studies to characterize the physical, psychological, and psychosocial factors associated with TMD as well as to elucidate the relationship among these factors. The RDC/TMD has been suggested as a model system for the diagnosis and assessment of all chronic pain conditions.[23,70,78,96,100]

5. Fear-avoidance beliefs, catastrophizing

Catastrophizing is one cognitive factor that involves an exaggeration or magnification of the perceived threat of pain sensations.[101] Catastrophizing has been associated with higher affective ratings of pain,[18,102-104] depressive symptoms,[105,106] and general affective distress.[107]

High levels of pain catastrophizing are related to a greater intensity of pain[108,109] and have been proposed to be a key element in the processes of central sensitization.[110] Pain catastrophizing has also been revealed as an element of considerable importance in the processes of pain chronicity and is related to another key variable in this process: fear of movement or kinesiophobia, which has been proposed as a mediator between catastrophism and pain.[111,112]

The pain and pain disability are not only influenced by organic pathology, if found, but also by biological, psychological and social factors.[10] Highly fear-avoidant individuals interpret pain as a sign of harmful bodily processes and any physical activity that results in pain as dangerous. In people with chronic pain, this construct has traditionally been measured using the Tampa Scale for Kinesiophobia (TSK).[9] The importance of pain-related fear has been stressed in the fear-avoidance model of chronic pain.[6] Based on the fear-avoidance model, a cognitive-behavioral oriented model for chronic pain has been proposed.[113] According to this model, catastrophic thoughts about pain may lead to an increase

of pain-related fear, which is in turn associated with avoidance behaviors and hypervigilance to bodily sensations and pain. Depression and disuse (i.e., a state of inactivity) may evolve, which in turn are associated with decreased pain tolerance and subsequently promote the painful experience.[12] In the acute pain situation, avoidance of daily activities that increase pain is a spontaneous and adaptive reaction of the individual and it usually allows the healing process to occur.[114] In chronic pain patients, however, avoidance behavior appears to persist beyond the expected healing time, and may subsequently lead to the 'disuse' syndrome.[115] The disuse syndrome is a detrimental condition, associated with physical deconditioning, in which performance of physical activities leads more easily to pain and physical discomfort, which in turn makes avoidance more likely.

Vlaeyen et al. suggested the ways pain-related fear mediates disability.[10,116] Fear urges escape from the object of threat and instigates avoidance behavior. It is documented that the anticipation of pain in clinical pain populations often results in poor behavioral performance which cannot be accounted for by pain severity.[117] An immediate consequence of avoidance is that daily activities expected to produce pain are not accomplished anymore, leading to increased disability. Pain-related fear interferes with cognitive functioning. Fearful patients will attend more to possible signals of threat and will be less able to attend away from pain-related information.[118-121] As a consequence, other cognitive activities cannot be efficiently processed and the voluntary recruitment of coping strategies

might be hampered.[122,123] Since avoidance occurs in anticipation of pain rather than as a response to pain, avoidance may easily persist because fewer opportunities exist to correct the wrongful expectancies and beliefs about pain as a function of physical activity. Fear of pain may become dissociated from actual pain experiences. Longstanding avoidance and physical inactivity is known to detrimentally affect various physiological systems. Hence, avoidance and physical inactivity may further worsen the pain problem.[11]

Numerous researches have supported the relation between pain catastrophizing and pain-related fear, and pain-related fear and disability. Vlaeyen et al.[10,124] and Crombez et al.[11] reported that pain-related fear is associated with impaired physical performance and increased self-reported disability in chronic back pain patients. In the open population study, pain-related fear predicts future disability and health status.[125-127] Previous studies found catastrophizing has also been related to poor behavioral performance experimental pain responses. Vlaeyen et al. inducted study to examine fear of movement/(re)injury is related to behavioral performance in chronic low back pain patients. In this study, subjects who report a high degree of fear of movement/(re)injury show more fear and escape/avoidance when exposed to a simple movement.[10] McCracken et al. found that patients with high pain-related fear overpredicted pain intensity during a straight leg raising test.[117] Crombez et al. found the correlations among the pain-related fear and behavioral performance with chronic back pain patients.[11]

6. The Tampa Scale for Kinesiophobia

The kinesiophobia is fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or reinjury.[9] There are numerous studies that have found positive moderate correlations between kinesiophobia and pain catastrophizing in patients with chronic pain such as CM, TMD, and fibromyalgia.[128-132]

In 1990, Kori and colleagues developed the TSK questionnaire to measure fear of movement/(re)injury in chronic pain patients.[9] The TSK is a 17-item questionnaire that is aimed at the assessment of fear of (re)injury due to movement. Each item is provided with a four-point Likert scale with scoring alternatives ranging from 'strongly agree' to 'strongly disagree'. Four items (i.e., items 4, 8, 12 and 16) are inversely phrased. There is good evidence from cross-sectional and longitudinal studies to suggest that fear of movement and injury, tapped with the TSK is a robust predictor of disability in musculoskeletal disease patients.[10-16] The TSK has good internal consistency ($\alpha = 0.68 – 0.80$), test–retest reliability up to 50 days (intra-class correlation coefficient (ICC) = 0.72), and construct validity.[12,15,132-135]

Although, a variety of one-, two-, and four-factor structure models have been used to describe the TSK, recent confirmatory factor analytic studies suggest that a two-factor model provides the best fit to the data across diverse patient

samples.[13,14,16] This model includes subscales of activity avoidance and somatic focus. The first factor, activity avoidance (AA), reflected the belief that activity may result in (re)injury or increased pain and the second factor, somatic focus (SF), reflected a belief in underlying and serious medical problems. In this two-factor model, the four inversely phrased items showed weak associations with the TSK total score and were omitted.[134]

7. Kinesiophobia in temporomandibular disorders

Pain-related catastrophizing may be potentially powerful contributing factor on symptoms and functioning among TMD patients. In a study of women with TMD, catastrophizing was greater among those with chronic pain than among those with recent onset of pain.[136] Other studies found that catastrophizing was associated with patient reported TMD symptom severity[4] and patient failure to respond to conservative therapy[91]. Turner et al. found that catastrophizing was associated significantly with patient-reported pain related activity interference, depression, and non-masticatory jaw-activity limitations.[137] In another study with painful TMD patients, Turner et al. suggested that patient catastrophizing may play an important role in TMD pain problems, both as reported by patients and as assessed during a clinical examination.

Recently TSK-TMD were developed for evaluating fear of movement in TMD patients.[19] Since TMD has distinctive features from other musculoskeletal

disorders, TSK undergone appropriate modification procedures for adapting in TMD patients. In the modification procedure, general terms used in the original TSK were adapted to meet the more localized complaints of patients with a TMD, and one item concerning dislocation of the TMJ as added (item 18). Through the above process, the TSK was modified to be used in TMD patients and the Dutch TSK-TMD was also formally translated into English. Through confirmatory factor analysis, the authors recommend that the original 18-item instrument be reduced to the indicated 12 items for routine assessment in TMD, with activity avoidance and somatic focus as subscales.[19] They also reported fear of movement was related to pain, joint sounds, and jaw locking in TMD patients. Among these factors, mechanical jaw problems such as joint sounds and locking exhibited a stronger association with fear of movement than pain in chronic TMD patients.[19] The TSK-TMD was translated into various language [19-21], and widely used in fear of movement in TMD patients.

III. METHODS

1. Subjects

The subjects were consecutive patients who visited the Orofacial Pain Clinic, of the Department of Oral Medicine in Seoul National University Dental Hospital with the complaint of TMD symptom. A total of 340 patients were recruited, but 5 patients who did not complete the TSK-TMD questionnaire were excluded. Therefore, 335 patients (220 women and 115 men, mean age: 35.8 ± 13.4 years) were analyzed. There was no statistical significant difference in gender and age between the excluded subjects and the participants. The exclusion criteria were as follows: diagnosis of other systemic musculoskeletal disease, such as rheumatic arthritis, ankylosing spondylitis, and gout, and diagnosis of psychological disorders that may affect study results.

Symptom-free controls were recruited through local advertisement. One hundred subjects without any symptoms and signs of TMD on clinical examination participated in the study. One subject refused to participate in the study, and 1 subject did not complete the questionnaire. Therefore, a total of 98 controls were evaluated in this study. Participants were consisted of 53 women and 45 men, and the mean age was 27.5 ± 4.7 years. The control group completed the TSK-TMD questionnaire. The study protocol was approved by the Institutional Review Board of Seoul National University Dental Hospital (#CRI14012). Each subject gave informed consent.

2. Clinical assessment

Clinical examination was performed in accordance with the RDC/TMD.[22] The examination was performed by calibrated examiners who are specialists of TMD and orofacial pain. Physical examination included examination of the oral cavity with teeth and supporting structures, palpation of masticatory and neck muscles and TMJ capsule, and assessment of TMJ movements. TMJ related assessments consisted of maximum mouth opening (MMO), mouth opening limitation (MOL) and presence of joint noises. MOL was considered to be present when the MMO was less than 40mm. Radiologic tests including orthopantomogram, TMJ tomogram, and transcranial radiograph were also performed.

In order to investigate the clinical characteristics accurately, the patient group was divided into several subgroups according to the RDC/TMD Axis I guidelines. Firstly, the TMD patients were examined and divided into a pain-free group and three pain subgroups. Myogenous pain group included patients who mainly feel pain in the masticatory muscles during resting, jaw functioning, or muscle palpation. Arthrogenous pain group included patients who mainly feel pain in the TMJ area during resting, jaw functioning, or joint palpation regardless of the presence of disc displacement and/or degenerative change of the mandibular condyle. Mixed pain group included patients with both myogenous pain and arthrogenous pain, who feel pain in both TMJ area and muscles areas of the

orofacial and/or head regions during resting, jaw functioning, or palpation on joints and muscles. The diagnostic criteria for the TMD pain subgroups are shown in Table 1. Secondly, patients were classified according to the state of internal derangement: normal disc position, anterior disc displacement (ADD) with reduction, and ADD without reduction subgroups.

3. Data collection

On the first visit of the patient, an examiner who was a specialist in TMD and orofacial pain, briefly introduced the questionnaire before the patients completed. All patients filled out the questionnaire about demographic and past medical and dental history: age, gender, trauma history, and contributing factors. The clinical parameters were also collected with pain duration, present pain intensity (PPI), worst pain intensity (WPI), and joint locking history. Pain intensity was scored by the patient on a visual analog scale (VAS) and calculated according to the GCP scales.

The Korean version of TSK-TMD, the RDC/TMD Axis II, the Beck Depression Index (BDI), and the Symptom Checklist-90-Revision (SCL-90-R) were administered to each subject for psychosocial assessment.[98,138)]

The TSK-TMD questionnaire

The original TSK-TMD is a Dutch-language instrument contains 18 items to

assess fear of movement in patients with TMD.[19] The answer of each question is scored on a 4-point Likert scale with higher scores reflecting more severe degrees of kinesiophobia. Through confirmatory factor analysis, the original 18-item instrument proposed to be reduced to the 12 items for assessment in TMD patients. The TSK-TMD were divided into two domains which is evaluate activity avoidance (AA) that are reflected the belief that activity may result in injury or increased pain (items 1, 2, 10, 13, 15, 17 and 18) and somatic focus (SF), reflected a belief in underlying and serious medical problems (items 3, 5, 6, 7 and 11). And fear of movement (FM) was sum of AA and SF subscale. Previous study showed that 12-item version of the TSK-TMD has generally good reliability and validity and more suitable for assessing TMD patients.[19]

We translated the original TSK-TMD into Korean version and measured the test-reliability.[22] The Korean TSK-TMD was found to be a reliable instrument. The internal consistency of Korean TSK-TMD was 0.858, using the Cronbach's alpha coefficient, and test-retest reliability of the TSK-TMD measured by the intra-class correlation coefficient (ICC) was 0.752.[22]

The RDC/TMD Axis II

The Korean RDC/TMD Axis II questionnaire was administered to each patients.[138] The RDC/TMD Axis II assesses pain intensity, pain related disability, depression, and nonspecific physical symptoms and classifies the global severity

of the pain condition. The RDC/TMD Axis II questionnaire consisted of 31 questions covering information devoted to demographics and psychosocial assessment. The parameters of psychological profiles including depression, somatization (including or excluding pain items), jaw disability, pain intensity, disability days, disability score, and GCP scale were analyzed.[23)]

Psychosocial functioning was assessed through the GCP scale. The GCP scale is composed of 7 questions, including characteristic pain intensity, disability score, and disability days. According to the total score, the GCP severity is classified into four grades (Grade 1, low disability and low intensity; Grade 2, low disability and high intensity; Grade 3, high disability and moderately limiting; Grade 4, high disability and severely limiting). The GCP score reflecting the severity and impact of TMD on interference with usual functioning because of TMD pain.[139)]

The Korean version of RDC/TMD Axis II questionnaire showed good internal consistency and test-retest reliability. The internal consistency reliability of pain intensity, disability score, jaw disability, and psychosocial status were 0.92, 0.94, 0.68, and 0.94, respectively using the Cronbach's alpha coefficient. And ICC for each subscale ranged from 0.81 to 0.93. Test-retest reliability coefficient of the GCP scale was 0.63.[138)]

The Beck Depression Inventory (BDI)

The BDI is commonly used measures of depressive symptomatology and

assesses the frequency and severity of variety symptoms of depression.[140] Each question is scored on a 4-point scale, and higher scores reflecting more severe symptoms. The BDI has been shown to be a reliable and valid index of depressive symptomatology in general and clinical populations.[141] It correlates highly with the diagnosis of depression using structured clinical interviews.[142] The Korean version of BDI instrument has demonstrated good internal consistency. Cronbach's alpha values were greater than 0.94.[143]

The Symptom Checklist-90-Revision (SCL-90-R)

The SCL-90-R is a useful tool for self-assessment of psychological profiles and evaluates a broad range of psychological symptoms by on a five-category scale. It is composed of a total of 90 items, with 9 symptomatological dimensions: somatization (SOM), obsessiveness-compulsiveness (O-C), interpersonal sensitivity (I-S), depression (DEP), anxiety (ANX), hostility (HOS), phobic anxiety (PHOB), paranoid ideation (PAR) and psychoticism (PSY), and 3 global distress indices: the Global Severity Index (GSI), Positive Symptom Total (PST) and Positive Symptom Distress Index (PSDI). The SCL-90-R has demonstrated good internal consistency with Cronbach's alpha for subscales ranging from 0.77 to 0.90 and test-retest reliability, which ranged from 0.78 to 0.90.[98]

4. Statistical analyses

Kolmogorov-Smirnov test was performed to verify the normal distribution. TSK-TMD is normal distribution among the measured variables, and parametric analysis is performed. Other parameters are analyzed by nonparametric test.

An independent t-test and analysis of covariance (ANCOVA) with controlled age and gender were performed to compare the TSK-TMD subscale sum of the patient and control groups.

One-way ANOVA were used for analyzing differences of each sum of FM, AA, and SF subscales among RDC/TMD pain group, ADD group, and each group of GCP scale, respectively. Post hoc analyses were performed using the Scheffe test to examine mean differences between subgroups. The independent t-test were used for analyzing the differences of each subscale of TSK-TMD according to gender, presence of trauma history, presence of trauma history, MOL, joint noise and locking, and low and high group of GCP scale, respectively.

Various symptoms associated with TMD were divided into categories and analyzed by patient group. The pain duration, PPI, and WPI were considered to represent subjective symptoms, and MMO, MOL, joint noise, locking, and number of positive palpation of masticatory muscle and joint capsule were representative of objective signs. The RDC/TMD Axis II, the BDI, the GCP scale and T-score of SCL-90-R were used to represent psychological characteristics.

These elements used nonparametric analysis because they did not follow a normal distribution. Kruskall Wallis tests were used for analyzing the differences

of continuous variable (i.e., subjective symptoms and psychological profiles, and objective parameter including MMO, number of positive palpation of muscle and joint capsule, and number of contributing factors) according to RDC/TMD pain group, ADD group, and each group of GCP scales including and Mann-Whitney U tests were used for according to gender, trauma history, and low and high group of GCP scales, respectively. Chi square test were performed to analyze differences in gender, MOL, joint noise, and locking.

To investigate whether each subscale of the TSK-TMD have correlation between subscale of the RDC/TMD Axis II, the BDI, and T-score of SCL-90-R, we conducted a Spearman's correlation analysis. To examine the associations of the TSK-TMD with the clinical examination and psychological profiles, multivariate linear regression analyses were done. The statistical significance was set at $p < 0.05$.

These statistical analyses were performed using SPSS software program (version 12.0).

IV. RESULTS

1. Subject characteristics

A total 335 TMD patients and 98 controls were participated in this study. All the participants fully completed the Korean version of TSK-TMD questionnaires. The demographic features of the subjects are shown in Table 2. Clinical examinations were performed on all patients, but there were some patients who were unresponsive to SCL-90-R, GCP scale and history of trauma, joint noise and locking. Statistical analyses were performed except for those items.

The patient group were 220 women (mean age: 38.1 ± 13.4 years) and 115 men (mean age: 31.5 ± 12.4 years), and the women were significantly older than men ($p<0.001$). The control group consisted of 53 women (mean age: 27.0 ± 4.6 years) and 45 men (mean age: 28.1 ± 4.9 years). There was no significant age difference between gender in control group ($p=0.252$). The demographic feature was presented in Table 2.

When the trauma history was examined, 28 of the 335 respondents were unresponsive, and 56 (18.2%, 34 women and 22 men) of the remaining 307 responded that they had an existing trauma. There was no statistically significant difference in the age and gender between patients who experienced trauma and those who did not. (Data were not shown in the table)

2. Comparison of TSK-TMD score between TMD patients and control group

There was a statistically significant difference in TSK-TMD scores between the TMD patient and control groups. FM, AA, and SF were significantly higher in the TMD patient group compared to controls. Significant differences in TSK-TMD scores were maintained when age and gender were controlled and ANCOVA was performed. (Table 3)

3. Comparison between TSK-TMD according gender

Significantly higher scores in women patients were seen in all TSK-TMD subscales when compared according to gender. However, gender differences in TSK-TMD were not observed in the control group. (Table 4) Clinical parameters showed significant differences in PPI, WPI, MMO, numbers of positive palpations on joint capsules and masticatory muscles, presence of MOL and closed lock history. (Data were not shown in the table.) Psychological profiles showed significant differences only in RDC/TMD Axis II indices. There were no significant differences in each dimension of SCL-90-R. (Data were not shown in the table.)

4. Comparison between TMD pain group

When compared by TMD subgroup according to pain, TSK-TMD score showed significant differences. In FM and SF subscale, mixed pain group have significantly high score than pain-free patients group. There were no significant

differences in AA subscale among subgroup. (Table 5)

There were no statistically significant differences between age in each pain group, but there were significant differences in pain duration, pain intensity, clinical parameters including MMO, numbers of contributing factors, numbers of positive palpation on joint capsules and masticatory muscles, MOL, joint noise, and history of open lock. When psychological profiles were compared, there were significant differences among subgroups except GCP scales. (Table 6)

5. Comparison between TMD patients according to anterior disc displacement

When the TMD patient group was compared according to ADD, the TSK-TMD score did not show any significant differences in all subscales. (Table 7) Compared with clinical parameters, there were significant differences in pain intensity, and only in GCP scale among psychological profiles between the ADD with reduction group and without reduction groups. In comparison of SCL-90-R, there were no significant differences among groups in all symptom dimensions. (Data were not shown in the table.)

6. Comparison between TMD patients according to trauma history and clinical features

There was no statistically significant difference in age and gender according to

trauma history. When the TMD patient group was compared according to trauma history, all of the TSK-TMD score show significant differences. (Table 8) In comparison of clinical parameters and psychological profiles, pain duration was significantly longer and WPI was higher in the trauma group, but no significant difference was found in other items. In the comparison of SCL-90-R, there were significant difference only in SOM, ANX and HOS dimensions. (Data were not shown in the table.)

We assessed the difference in TSK-TMD according to the demographic features. We compared the differences in TSK-TMD scores according to presence or absence of MOL, joint noise, and joint locking. In all of TSK-TMD subscale, there was a statistically significant increase when patients had and MOL. However, the difference in TKS-TMD with or without joint noise and locking was not statistically significant. (Table 8)

7. Comparison between TMD patients according GCP scale

There was a significant difference in TSK-TMD score between low disability and high disability group when the patients were divided according to the GCP scale. Significant differences in TSK-TMD scores were also maintained when compared with each grade of the GCP scale. (Table 9) Compared with clinical parameters, TMD patients with high disability in GCP scale showed statistically significant longer pain duration, higher pain intensity both PPI and WPI,

respectively, with lower MMO, more positive palpation, and higher prevalence of MOL and closed lock. (Data were not shown in the table.) A comparison of psychological factors showed statistically significant differences between the BDI and all the RDC/TMD Axis II indices. In comparison of the SCL-90-R, high disability group was significantly higher score in SOM, I-S, DEP, ANX, HOS, PHOB and PSY dimension. (Data were not shown in the table.)

9. Correlations between the TSK-TMD and subjective symptom, clinical parameters and psychological profiles

Spearman correlation analysis was performed to determine the factors affecting the TSK-TMD score. The relationship between clinical parameters and TSK-TMD, psychological profile and TSK-TMD is shown in Table 10 and 11, respectively. The correlation coefficients of psychological profiles were showed higher tendency than those of clinical parameters. (Figure 1)

Table 12 showed the association of age, gender, trauma history, clinical parameter and psychological profiles on TSK-TMD subscales. Age, gender, pain intensity, and MOL were associated with FM and AA subscale and pain intensity were associated with SF subscale, respectively. Among psychological profiles, depression subscale of RDC/TMD Axis II indices were significantly associated with all subscale of TSK-TMD, but there was no significant relationship with somatization subscale of RDC/TMD Axis II indices and TSK-TMD score.

V. DISCUSSION

Pain-related fear has been regarded as an important mediator of chronic musculoskeletal disease. After TSK was introduced in 1990 to evaluate the pain-related fear in musculoskeletal disease patients, in 2010 TSK-TMD was developed to assess kinesiophobia of TMD patients. We translated the TSK-TMD questionnaire into the Korean language and investigated the reliability and internal consistency of the Korean TSK-TMD.[22] In this study, convergent validity was evaluated by correlating with scores of the TSK-TMD and RDC/TMD Axis II indices. In tests of convergent validity, the TSK-TMD score were evidenced fair to moderate positive relationships with RDC/TMD Axis II indices.[144] (r = 0.393 to 0.463) (Table 11) This is similar result to previous study investigated the convergent validity by comparison between the TSK-TMD and the global rating of oral health question, and showed good correlations.[20] These results suggested that the Korean version of TSK-TMD had adequate convergent validity for assessing fear of movement in TMD patients.

To the best of our knowledge, this study was the first study to investigate pain-related fear using TSK-TMD questionnaire in TMD patients divided into RDC/TMD criteria. Although, the importance of pain-related fear in chronic musculoskeletal diseases has been emphasized and some studies have been conducted, [137,145] until nowadays few results have been produced using the TSK-TMD questionnaire. As TMD has distinctive features from other musculoskeletal

disorders, it is important to use appropriate instrument to assess fear of movement in TMD patients. Also, TMD is a collective term representing heterogenous conditions of TMJ and masticatory muscle disorder, it is necessary to compare patients according to RDC/TMD criteria in order to make comparisons depending on the exact condition of the disease.[23] In this regard, the present study investigated the pain related fear of TMD patients according to the RDC/TMD criteria, and accordingly, it seems that appropriate studies have been conducted.

Our results showed significant differences in the TSK-TMD score between the TMD patients and the control group. All of FM, AA, and SF values were significantly higher in the TMD patient group than in control group. Statistical significance was maintained when ANCOVA was performed under age and gender were controlled. (Table 3) These results suggest that pain-related fear is higher in TMD patients than control group. The results are similar to those of previous studies. There is study revealed women with chronic TMD showed higher levels of pain catastrophizing compared to asymptomatic controls.[112] Other study showed that fear of pain and distress are elevated in orofacial pain patients compared to matched controls.[80] Pain-related fear and catastrophizing may be potentially powerful contributing factor on symptoms and functioning among patients with TMD. Therefore, to the clinician, evaluating the patient's pain-related fear prior to initiation of treatment will be of great help in predicting future treatment outcomes. As with the use of TSK in the evaluation of fear of

movement in musculoskeletal disorders, the TSK-TMD can also be used to evaluate pain catastrophizing and kinesiophobia in TMD patients, which is expected to result in overall improved outcomes.

When the TMD patients group was divided into pain subgroup based on the RDC/TMD criteria, there were no significant differences in TSK-TMD score between each pain group patients, but significant differences were existed when compared with pain-free group. Particularly, differences were observed between mixed pain group and pain-free group. These results need to be compared with the results of previous study investigated kinesiophobia in chronic TMD patients and showed no significant difference in TSK score between joint pain group, muscle pain group, and mixed pain group.[145] Similarly, our results did not show any difference for each pain group, but only the TSK-TMD score differed between the mixed pain group and the pain-free group. Compared to pain free group, mixed pain group had longer pain duration, higher pain intensity and psychological profiles including the BDI and the RDC/TMD Axis II were also higher. In the correlation analysis, the TSK-TMD score was associated with pain duration, pain intensity, and psychological profile. Therefore, we suggest that these factors may have influenced the combined TSK-TMD score.

When we compared TMD patients according to internal derangement, there was no significant difference in TSK-TMD score among subgroup. Also, there were no significant differences in among ADD subgroups except for pain

intensity, and GCP scale. Among the various evaluation criteria of TMD, internal derangement is more objective and anatomical pathologic factor. The absence of differences in TSK-TMD when divided by physiological criteria suggests that the objective biomedical disease state has little impact on kinesiophobia. Similar results can be found in other musculoskeletal disorders. Previous study reported daily functioning was not related with objective joint damage but were significantly associated with level of pain and pain-related fear in osteoarthritis patients.[16] Therefore, we suggest that pain-related fear have little relationship with objective physiologic condition in TMD patients. We diagnosed disc displacement according to the RDC/TMD criteria after clinical examination, but the exact location of the disc can be determined by magnetic resolution imaging (MRI). Therefore, there may be some errors in the disc displacement that we have diagnosed. Further studies using MRI should be needed to evaluate the exact relationship between disc displacement and kinesiophobia in TMD patients.

In our study, TSK-TMD scores in women were significantly higher compared to men in TMD patients, but there was no gender difference in control group. To date, there have been only a few studies on gender differences in kinesiophobia measured by TSK questionnaires, and these results are equivocal.[146-150] Further research is needed to determine whether gender differences exist precisely in pain-related fear of movement. Our study also showed women patients had significantly higher pain intensity, more severe clinical symptoms, and higher

psychological factors. TMD is more prevalent and women patients with TMD complain of more severe symptoms[151] And women diagnose show higher stress and depression scores compared to men in TMD patients.[72,137,152,153] There is a high likelihood that the characteristics with more severe symptoms in women TMD patients affected gender differences in TSK-TMD. Further research is needed to determine whether these gender differences of TSK-TMD are present in patients with similar levels of symptoms.

Compared with the trauma history, the trauma group had a significantly higher TSK-TMD score. In clinical factors, there was a difference only in pain duration and WPI, but all of the RDC/TMD Axis II indices were higher in trauma group. These result are consistency of previous study that patients who reported sudden traumatic onset of pain showed higher level of kinesiophobia measure by TSK compared with patients who reported pain started gradually.[11] Trauma has been reported to be associated with TMD in many aspect. Previous study reported that patients with TMD with a trauma history had more severe symptoms and psychological dysfunction compared with general patients with TMD.[43] Because we focused on pain-related fear of movement, we investigated only the presence of trauma and did not know in detail what kind of trauma patients had experienced. Therefore, the relationship between trauma and kinesiophobia cannot be concluded through this study. Further research is needed to determine what characteristics of fear of movement are associated with trauma history in TMD

patients.

Previous study reported fear of movement were related to pain, joint noise, and locking, and mechanical jaw problems exhibited a stronger association than pain in TMD patients.[19] However, in our study, the TSK-TMD score was strongly correlated with pain intensity, and there was no significant difference in score with or without joint locking and noise. In previous study, symptoms with jaw pain, noise, and locking (i.e., stuck feeling) were investigated using a simple symptom check list in TSK questionnaire. We divided the pain intensity into present and worst pain intensity and investigated the relationship by examining the VAS scale. In other words, there is a large difference in the study method between the comparison of level of kinesiophobia with presence or absence of pain and the degree of pain. And in our study, joint noise was diagnosed by the clinician in accordance with the RDC/TMD criteria, which may be different from the patient's self-reported symptom check list. There is no agreement between the patient's awareness of joint noise and the presence of actual noise. These methodological differences would have caused the difference in results. Also the difference on result may also be related to the linguistic characteristics of Korean. In Korean language, jaw locking uses the same terms as normal mandibular sliding movement and pathological open and closed locks. In this study, we did not investigated whether the Korean patient who responded most of the jaw locking signals the actual pathological symptoms or whether the normal sliding

movement feels locking. In order to avoid confusion of these terms, it may be necessary to supplement the evaluation with more accurate terms.

FM, AA and SF showed a weak but significant correlation with clinical parameters and psychological profiles. The correlation between TSK-TMD and psychological profiles was much stronger. Recent studies have shown that psychological profiles have a greater effect on the treatment of TMD patients than on the objective diagnosis of TMD. Many investigators have alluded to the importance of assessing both physical and psychological factors in patients with pain disorders.[23,91] This finding is supported by the result that the TSK-TMD score differs according to GCP scale rather than according to the objective biomedical diagnostic criteria of TMD. The GCP scale is one of the representative measures of psychological status of TMD patients. Taken together, kinesiophobia is more relevant to psychological factors than objective diagnosis or pain intensity in TMD patients.

Along with other psychological factors, pain catastrophizing and kinesiophobia can cause disease to become more chronic and aggravate symptoms. Fear of movement may lead to avoid physical activities. Avoidance and physical inactivity may worsen the pain problem.[115] In TMD patients, kinesiophobia might prevent adequate joint activities, thus cause symptoms of muscle splinting, muscle contracture, joint adherences and adhesions consequently resulting in poor treatment outcomes. Adequate jaw movement is essential for integrity of

masticatory system. TMD patients should be encouraged to use the jaw within the painless limits so that the proprioceptors and mechanoreceptors in the musculoskeletal system are stimulated. This activity seems to encourage a return to normal muscle function.[154] Therefore, evaluating level of the pain catastrophizing and kinesiophobia in TMD patients at initial treatment and, if necessary, introducing adequate interventions-such as behavioral treatment, relaxation therapy including biofeedback, and cognitive therapy to alleviate fear of movement may be of great help in improving overall treatment outcomes.

There are some limitations in our study. Firstly, gender and age were not matched in comparison between the TMD patient group and the controls. The control group was younger and the men ratio was higher than the patient group. This difference in age and gender may have affected the TSK-TMD score. It is a methodological limitation caused by differences in the recruitment methods of the patient group and the controls. The groups of patients sequentially recruited patients who came to the hospital for treatment, but the controls recruited through local advertising, making it somewhat difficult to compare gender and age. The controls also considered to be a person without symptoms by self-response without performing any clinical tests by experts. In future studies, it seems to be somewhat complementary.

Secondly, self-rating questionnaires were used for the psychological analysis of TMD patients, and no examination or diagnosis by experts was made. These

instruments were not intended for reaching a psychiatric diagnosis, but to assess psychological distress levels.[155] However, it is considered that the questionnaires used in the assessment would have been suitable for the psychological assessment as reliability and validity are already secured through the existing studies. Also, since many types of questionnaires were used for the assessment, it cannot be ruled out that duplicate questions may have existed and may have influenced the relation analysis of the results. Attention should be paid to interpretation of results in this area.

Further work may be necessary to carry out longitudinal studies on the effects of the kinesiophobia evaluated by TSK-TMD on the therapeutic outcomes. Also, additional studies need to find cut-off points representing kinesiophobia in patients with TMD. And it is necessary to find out what psychological factors, along with the fear of treatment, may affect the outcome of the therapy. Further research will be needed to determine what prognostic changes may occur when appropriate psychological interventions are performed.

VI. CONCLUSIONS

With physiologic features and other psychologic factors, pain-related fear of movement has been regarded as an important factor for TMD. TMD patients showed higher level of fear of movement compared with symptom free control group. In tests of convergent validity, the TSK-TMD score were evidenced fair to moderate positive relationships with RDC/TMD Axis II indices (r = 0.393 to 0.463). There was a significant difference in TSK-TMD according to gender, trauma history and GCP scale, but there was no difference in objective diagnosis of ADD, and there was a slight difference only with no pain group according to RDC/TMD Axis I. The TSK-TMD scores were associated psychological profiles rather than clinical parameters.

Collectively, our results suggest that evaluating level of the kinesiophobia in TMD patients at initial treatment may be of great help in improving overall treatment outcomes.

REFERENCES

1. Cooper BC, Kleinberg I. Examination of a large patient population for the presence of symptoms and signs of temporomandibular disorders. *Cranio* 2007;25:114-126.
2. Butterworth JC, Deardorff WW. Psychometric profiles of craniomandibular pain patients: identifying specific subgroups. *Cranio* 1987;5:225-232.
3. Rudy TE, Turk DC, Zaki HS, Curtin HD. An empirical taxometric alternative to traditional classification of temporomandibular disorders. *Pain* 1989;36:311-320.
4. Suvinen TI, Hanes KR, Gerschman JA, Reade PC. Psychophysical subtypes of temporomandibular disorders. *J Orofac Pain* 1997;11:200-205.
5. Dworkin SF. Behavioral characteristics of chronic temporomandibular disorders: Diagnosis and assessment. In: Sessle BJ, Bryant PS, Dionne RA (eds). Temporomandibular Disorders and Related Pain Conditions. Seattle: IASP Press; 1995. pp. 175-192.
6. Lethem J, Slade PD, Troup JD, Bentley G. Outline of a fear-avoidance model of exaggerated pain perceptions. *Behav Res Ther* 1983;21:401-408.
7. Westman AE, Boersma K, Leppert J, Linton SJ. Fear-Avoidance Beliefs, catastrophizing, and distress: a longitudinal subgroup analysis on patients with musculoskeletal pain. *Clin J Pain* 2011;27:567-577.
8. Geisser ME, Haig AJ, Wallbom AS, Wiggert EA. Pain-related fear, lumbar

flexion, and dynamic EMG among persons with chronic musculoskeletal low back pain. *Clin J Pain* 2004;20:61-69.

9. Kori SH, Miller RP, Todd DD. Kinesiophobia: a new view of chronic pain behavior. *Pain Manag* 1990;3:35-43.
10. Vlaeyen JW, Kole-Snijders AM, Boeren RG, van Eek H. Fear of movement/(re) injury in chronic low back pain and its relation to behavioral performance. *Pain* 1995;62:363-372.
11. Crombez G, Vlaeyen JW, Heuts PH, Lysens R. Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. *Pain* 1999;80:329-339.
12. Roelofs J, Goubert L, Peters ML, Vlaeyen JW, Crombez G. The Tampa Scale for Kinesiophobia: further examination of psychometric properties in patients with chronic low back pain and fibromyalgia. *Eur J Pain* 2004;8:495-502.
13. Goubert L, Crombez G, van Damme S, Vlaeyen JW, Bijttebier P, Roelofs J. Confirmatory factor analysis of the Tampa Scale for Kinesiophobia: invariant two-factor model across low back pain patients and fibromyalgia patients. *Clin J Pain* 2004;20:103-110.
14. Swinkels-Meewisse IE, Roelofs J, Verbeek AL, Oostendorp RA, Vlaeyen JW. Fear of movement/(re)injury, disability and participation in acute low back pain. *Pain* 2003;105:371-379.

15. Swinkels-Meewisse EJ, Swinkels RA, Verbeek AL, Vlaeyen JW, Oostendorp RA. Psychometric properties of the Tampa Scale for Kinesiophobia and the fear-avoidance beliefs questionnaire in acute low back pain. *Man Ther* 2003;8:29-36.
16. Heuts PH, Vlaeyen JW, Roelofs J, de Bie RA, Aretz K, van Weel C, van Schayck OC. Pain-related fear and daily functioning in patients with osteoarthritis. *Pain* 2004;110:228-235.
17. Swinkels-Meewisse IE, Roelofs J, Schouten EG, Verbeek AL, Oostendorp RA, Vlaeyen JW. Fear of movement injury predicting chronic disabling low back pain: a prospective inception cohort study. *Spine (Phila Pa 1976)* 2006;31:658-664.
18. Turner JA, Brister H, Huggins K, Mancl L, Aaron LA, Truelove EL. Catastrophizing is associated with clinical examination findings, activity interference, and health care use among patients with temporomandibular disorders. *J Orofac Pain* 2005;19:291-300.
19. Visscher CM, Ohrbach R, van Wijk AJ, Wilkosz M, Naeije M. The Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK-TMD). *Pain* 2010;150:492-500.
20. He S, Wang J, Ji P. Validation of the Tampa Scale for Kinesiophobia for Temporomandibular Disorders (TSK-TMD) in patients with painful TMD. *J Headache Pain* 2016;17:109.

21. Aguiar AS, Bataglion C, Visscher CM, Bevilaqua Grossi D, Chaves TC. Cross-cultural adaptation, reliability and construct validity of the Tampa Scale for Kinesiophobia for Temporomandibular Disorders(TSK/TMD-Br) into Brazilian Portuguese. *J Oral Rehabil* 2017;44:500-510.
22. Park IH, Jang JH, Chung JW. Reliability of the Korean version of Tampa Scale for Kinesiophobia for Temporomandibular Disorders. *J Oral Med Pain* 2018. Accepted for publication.
23. Dworkin SF, Leresche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. *J CraniomandibDisord* 1992;6:301-355.
24. John MT, Reismann DR, Schierz O, Wassell RW. Oral health related quality of life in patients with temporomandibular disorders. *J Orofac Pain* 2007;21:46-54.
25. Manfredini D, Guarda-Nardini L. Fundamentals of TMD management. In: Manfredini D, editor. Current concepts on temporomandibular disorders. Berlin: Quintessence Publishing; 2010. pp. 305-317.
26. Dworkin SF, LeResche L, DeRouen T, Von Korff M. Assessing clinical signs of temporomandibular disorders: reliability of clinical examiners. *J Prosthet Dent* 1990;63:574-579.
27. Von Korff M, Dworkin SF, Le Resche L, Kruger A. An epidemiologic comparison of pain complaints. *Pain* 1988;32:173-183.

28. Solberg WK. Epidemiology, incidence, and prevalence of temporomandibular disorders: a review. Presented at the President's Conference on the Examination, Diagnosis, and Management of Temporomandibular Disorders; Chicago. 1982.

29. Drangsholt M, LeResche L. Temporomandibular disorder pain. In: Crombie IK, Croft PR, Linton SJ, LeResche L, Von Korff M, editors. Epidemiology of Pain. Seattle: IASP Press;1999. pp.203-233.

30. LeResche L. Epidemiology of temporomandibular disorders: implications for the investigation of etiologic factors. *Crit Rev Oral Biol Med* 1997;8:291-305.

31. Burgess JA, Kolbinson DA, Lee PT, Epstein JB. Motor vehicle accidents and TMDS: assessing the relationship. *J Am Dent Assoc* 1996;127:1767-1772.

32. Fillingim RB, Ohrbach R, Greenspan JD, Knott C, Diatchenko L, Dubner R, Bair E, Baraian C, Mack N, Slade GD, Maixner W. Psychological factors associated with development of TMD: the OPPERA prospective cohort study. *J Pain* 2013;14:Supplement T75-90.

33. Gray R, Al-Ani Z. Risk management in clinical practice. Part 8. Temporomandibular disorders. *Br Dent J* 2010;209:433-449.

34. Epstein JB, Klasser GD. Whiplash-associated disorders and temporomandibular symptoms following motor-vehicle collisions.

Quintessence Int 2011;42:e1-e14.

35. Freeman M, Croft A, Rossignol A, Weaver D, Reiser M. A review and methodological critique of the literature refuting whiplash syndrome. *Spine (Phila Pa 1976)* 1999;24:86-96.
36. Treleaven J. Dizziness, unsteadiness, visual disturbances, and postural control: implications for the transition to chronic symptoms after a whiplash trauma. *Spine (Phila Pa 1976)* 2011;36:S211-217.
37. Sterner Y, Gerdle B. Acute and chronic whiplash disorders-A review. *J Rehabil Med* 2004;36:193-209.
38. Landzberg G, El-Rabbany M, Klasser GD, Epstein JB. Temporomandibular disorders and whiplash injury: a narrative review. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2017;124:e37-e46.
39. Haggman-Henrikson B, List T, Westergren HT, Axelsson SH. Temporomandibular disorder pain after whiplash trauma: a systematic review. *J Orofac Pain* 2013;27:217-226.
40. Haggman-Henrikson B, Rezvani M, List T. Prevalence of whiplash trauma in TMD patients: a systematic review. *J Oral Rehabil* 2014;41:59-68.
41. Sale H, Hedman L, Isberg A. Accuracy of patients' recall of temporomandibular joint pain and dysfunction after experiencing whiplash trauma: a prospective study. *J Am Dent Assoc* 2010;141:879-886.
42. Marini I, Paduano S, Bartolucci ML, Bortolotti F, Bonetti GA. The

prevalence of temporomandibular disorders in patients with late whiplash syndrome who experience orofacial pain: a case-control series study. *J Am Dent Assoc* 2013;144:486-490.

43. Kim HI, Lee JY, Kim YK, Kho HS. Clinical and psychological characteristics of TMD patients with trauma history. *Oral Dis* 2010;16:188-192.
44. Burgess JA, Dworkin SF. Litigation and post-traumatic TMD: How patients report treatment outcome. *J Am Dent Assoc* 1993;124:105-110.
45. Romanelli G, Mock D, Tenenbaum H. Characteristics and response to treatment of posttraumatic temporomandibular disorder: a retrospective study. *Clin J Pain* 1992;8:6-17.
46. Krogstad BS, Jokstad A, Dahl BL, Soboleva U. Somatic complaints, psychologic distress, and treatment outcome in two groups of TMD patients, one previously subjected to whiplash injury. *J Orofac Pain* 1998;12:136-144.
47. Weinberg S, Lapointe H. Cervical extension-flexion injury (whiplash) and internal derangement of the temporomandibular joint. *J Oral Maxillofac Surg* 1987;45:653-656.
48. Howard RP, Bowles AP, Guzman HM, Krenrich SW. Head, neck, and mandible dynamics generated by 'whiplash'. *Accid Anal Prev* 1998;30:525-534.

49. Eriksson PO, Haggman-Henrikson B, Nordh E, Zafar H. Coordinated mandibular and head-neck movements during rhythmic jaw activities in man. *J Dent Res* 2000;79:1378-1384.

50. Eriksson PO, Häggman-Henrikson B, Zafar H. Jaw neck dysfunction in whiplash-associated disorders. *Arch Oral Biol* 2007;52:404-408.

51. Piovesan EJ, Kowacs PA, Oshinsky ML. Convergence of cervical and trigeminal sensory afferents. *Curr Pain Headache Rep* 2003;7:377-383.

52. Davis CG. Mechanisms of chronic pain from whiplash injury. *J Forensic Leg Med* 2013;20:74-85.

53. Wiesinger B, Malker H, Englund E, Wanman A. Does a dose response relation exist between spinal pain and temporomandibular disorders? *BMC Musculoskelet Disord* 2009;10:28.

54. Reiter S, Emodi-Perlman A, Goldsmith C, Friedman-Rubin P, Winocur E. Comorbidity between depression and anxiety in patients with temporomandibular disorders according to the research diagnostic criteria for temporomandibular disorders. *J Oral Facial Pain Headache* 2015;29:135-143.

55. Sherman JJ, LeResche L, Huggins KH, Mancl LA, Sage JC, Dworkin SF. The relationship of somatization and depression to experimental pain response in women with temporomandibular disorders. *Psychosom Med* 2004;66:852-860.

56. Koutris M, Visscher CM, Lobbezoo F, Naeije M. Comorbidity negatively influences the outcomes of diagnostic tests for musculoskeletal pain in the orofacial region. *Pain* 2013;154:927-932.

57. Dahan H, Shir Y, Velly A, Allison P. Specific and number of comorbidities are associated with increased levels of temporomandibular pain intensity and duration. *J Headache Pain* 2015;16:528.

58. Dworkin SF, Massoth DL. Temporomandibular disorders and chronic pain: disease or illness? *J Prosthet Dent* 1994;72:29-38.

59. Giannakopoulos NN, Keller L, Rammelsberg P, Kronmuller KT, Schmitter M. Anxiety and depression in patients with chronic temporomandibular pain and in controls. *J Dent* 2010;38:369-376.

60. Fillingim RB, Ohrbach R, Greenspan JD, Knott C, Dubner R, Bair E, Baraian C, Slade GD, Maixner W. Potential psychosocial risk factors for chronic TMD: descriptive data and empirically identified domains from the OPPERA case-control study. *J Pain* 2011; 12:T46-T60.

61. Kinney RK, Gatchel RJ, Ellis E, Holt C. Major psychological disorders in chronic TMD patients: implications for successful management. *J Am Dent Assoc* 1992;123:49-54.

62. Fricton JR, Olsen T. Predictors of outcome for treatment of temporomandibular disorders. *J Orofac Pain* 1996;10:54-65.

63. Velly AM, Look JO, Carlson C, Lenton PA, Kang W, Holcroft CA, Fricton

JR. The effect of catastrophizing and depression on chronic pain: a prospective cohort study of temporomandibular muscle and joint pain disorders. *Pain* 2011;152:2377-2383.

64. Litt MD, Porto FB. Determinants of pain treatment response and nonresponse: identification of TMD patient subgroups. *J Pain* 2013;14:1502-1513.
65. Burris JL, Cyders MA, De LR, Smith GT, Carlson CR. Posttraumatic stress disorder symptoms and chronic orofacial pain: an empirical examination of the mutual maintenance model. *J Orofac Pain* 2009;23:243-252.
66. Manfredini D, Winocur E, Ahlberg J, Guarda-Nardini L, Lobbezoo F. Psychosocial impairment in temporomandibular disorders patients. RDC/TMD axis II findings from a multicentre study. *J Dent* 2010;38:765-772.
67. Yatani H, Studts J, Cordova M, Carlson CR, Okeson JP. Comparison of sleep quality and clinical and psychologic characteristics in patients with temporomandibular disorders. *J Orofac Pain* 2002;16:221-228.
68. Epker J, Gatchel RJ. Coping profile differences in the biopsychosocial functioning of patients with temporomandibular disorder. *Psychosom Med* 2000;62:69-75.
69. Garofalo JP, Gatchel RJ, Wesley AL, Ellis E 3rd. Predicting chronicity in acute temporomandibular joint disorders using the research diagnostic

criteria. *J Am Dent Assoc*1998;129:438-447.

70. Ohrbach R, D workin SF. Five-year outcomes in TMD: relationship of changes in pain to changes in physical and psychological variables. *Pain* 1998;74:315-326.

71. Rugh JD. Psychological factors in the etiology of masticatory pain and dysfunction. In: The President' s Conference on the Examination, Diagnosis and Management of Temporomandibular Disorders (eds D. Laskin, W. Greenfield, E. Gale, J. Rugh, P. Neff, C. Alling & W. A. Ayer), Chicago: American Dental Association; 1982. pp. 85-94.

72. Yap AU, Tan KB, Hoe JK, Yap RH, Jaffar J. On-line computerized diagnosis of pain-related disability and psychological status of TMD patients: a pilot study. *J Oral Rehabil* 2001;28:78-87.

73. Wright AR, Gatchel RJ, Wildenstein L, Riggs R, Buschang P, Ellis E 3rd. Biopsychosocial differences between high-risk and low-risk patients with acute TMD-related pain. *J Am Dent Assoc* 2004;135:474-483.

74. Monteiro DR, Zuim PRJ, Pesqueira AA, Ribeiro PP, Garcia AR. Relationship between anxiety and chronic orofacial pain of temporomandibular disorder in a group of university students. *J Prosthodont Res* 2011;55:154-158.

75. McCracken LM, Zayfert C, Gross RT. The Pain Anxiety Symptoms Scale: development and validation of a scale to measure fear of pain. *Pain*

1992;50:67-73.

76. Mongini F, Ciccone G, Ceccarelli M, Baldi I, Ferrero L. Muscle tenderness in different types of facial pain and its relation to anxiety and depression: a cross-sectional study on 649 patients. *Pain* 2007;131:106-111.

77. Banks SM, Kerns RD. Explaining high rates of depression in chronic pain: a diathesis-stress framework. *Psychol Bull* 1996;119:95-110.

78. Gatchel RL, Garofalo JP, Ellis E, Holt C. Major psychological disorders in acute and chronic TMD: an initial examination. *J Am Dent Assoc* 1996;127:1365-1374.

79. Kight M, Gatchel RJ, Wesley L. Temporomandibular disorders: evidence for significant overlap with psychopathology. *Health Psychol* 1999;18:177-182.

80. McNeil DW, Au AR, Zvolensky MJ, McKee DR, Klineberg IJ, Ho CC. Fear of pain in orofacial pain patients. *Pain* 2001;89:245-252.

81. Hildebrandt MG, Stage KB, Kragh-Soerensen P. Gender and depression: a study of severity and symptomatology of depressive disorders (ICD-10) in general practice. *Acta Psychiatrica Scandinavica* 2003;107:197-202.

82. Dickens C, McGowan L, Dale S. Impact of depression on experimental pain perception: a systematic review of the literature with meta-analysis. *Psychosom Med* 2003;65:369-375.

83. Lautenbacher S, Spernal J, Schreiber W, Krieg JC. Relationship between

clinical pain complaints and pain sensitivity in patients with depression and panic disorder. *Psychosom Med* 1999;61:822-827.

84. Von Korff M, Le Resche L, Dworkin SF. First onset of common pain symptoms: a prospective study of depression as a risk factor. *Pain* 1993;55:251-258.

85. Dahlström L. Psychometrics in temporomandibuiar disorders. An overview. *Acta OdontolScand* 1993;51:339-352.

86. Suvineti TI, Reade PC. Temporomandibular disorders: A critical review of the nature of pain and its assessment. *J Orofac Pain* l995;9:317-339.

87. Korszun A, Hinderstein B, Wong M. Comorbidity of depression with chronic facial pain and temporomandibular disorders. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996;82:496-500.

88. Lipowski ZJ. Somatization: the concept and its clinical application. *Am J Psychiatry* 1988;45:1358-1368.

89. Turner JA, Jensen MP, Romano JM. Do beliefs, coping, and catastrophizing independently predict functioning in patients with chronic pain? *Pain* 2000;85:115-125.

90. Lazarus RS, Folkman S. Stress, Appraisal, and Coping. New York: Springer Publishing Company; 1984. p.177.

91. Suvinen TI, Reade PC, Sunden B, Gerschman JA, Koukounas E. Temporomandibular disorders. Part II: a comparison of psychologic profiles

in Australian and Finnish patients. *J Orofac Pain* 1997;11:147-157.

92. Fillingim RB, Slade GD, Diatchenko L, Dubner R, Greenspan JD, Knott C, Ohrbach R, Maixner W. Summary of findings from the OPPERA baseline case-control study: implications and future directions. *J Pain* 2011;12:T102-107.
93. Sullivan MJ, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA, Lefebvre JC. Theoretical perspectives on the relation between catastrophizing and pain. *Clin J Pain* 2001;17:52-64.
94. John MT, Dworkin SF, Mancl LA. Reliability of clinical temporomandibular disorder diagnoses. *Pain* 2005:118;61-69.
95. Look JO, Schiffman EL, Truelove EL, Ahmad M. Reliability and validity of Axis I of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) with proposed revisions. *J Oral Rehabil* 2010;37:744-759.
96. Von Korff M, Ormel J, Keefe FJ, Dworkin SF. Grading the severity of chronic pain. *Pain* 1992;50:133-149.
97. Rudy TE. Psychophysiological assessment in chronic orofacial pain. *Anesth Prog* 1990;37:82-87.
98. Derogatis L. The SCL-90-R. administration, scoring and procedures manual. Minneapolis, MN: National Computer Systems, Inc; 1994.
99. Stern I, Greenberg MS. Clinical Assessment of Patients with Orofacial Pain

and Temporomandibular Disorders. *Dent Clin North Am* 2013;57:393-404.

100. List T, Dworkin SF. Comparing TMD diagnoses and clinical findings at Swedish and US TMD Centers using Research Diagnostic Criteria for Temporomandibular Disorders. *J Orofac Pain* 1996;10:240-253.

101. Turner JA, Aaron LA. Pain-related catastrophizing: what is it? *Clin J Pain* 2001;17:65-71.

102. Fillingim RB, Maixner W, Kincaid S, Sigurdsson A, Harris MB. Pain sensitivity in patients with temporomandibular disorders: relationship to clinical and psychosocial factors. *Clin J Pain* 1996;12:260-269.

103. Gracely RH, Geisser ME, Giesecke T, Grant MA, Petzke F, Williams DA, Clauw DJ. Pain catastrophizing and neural responses to pain among persons with fibromyalgia. *Brain* 2004;127:835-843.

104. Sullivan MJ, Lynch ME, Clark AJ. Dimensions of catastrophic thinking associated with pain experience and disability in patients with neuropathic pain conditions. *Pain* 2005;113:310-315.

105. Alschuler KN, Theisen-Goodvich ME, Haig AJ, Geisser ME. A comparison of the relationship between depression, perceived disability, and physical performance in persons with chronic pain. *Eur J Pain* 2008;12:757-764.

106. Madland G, Feinmann C, Newman S. Factors associated with anxiety and depression in facial arthromyalgia. *Pain* 2000;84:225-232.

107. Li X, Gignac MA, Anis AH. Workplace, psychosocial factors, and

depressive symptoms among working people with arthritis: a longitudinal study. *J Rheumatol* 2006;33:1849-1855.

108. Buenaver LF, Edwards RR, Haythornthwaite JA. Pain-related catastrophizing and perceived social responses: inter-relationships in the context of chronic pain. *Pain* 2007;127:234-242.

109. Day MA, Thorn BE. The relationship of demographic and psychosocial variables to pain-related outcomes in a rural chronic pain population. *Pain* 2010;151:467-474.

110. Salomons TV, Moayedi M, Erpelding N, Davis KD. A brief cognitive-behavioural intervention for pain reduces secondary hyperalgesia. *Pain* 2014;155:1446-1452.

111. Leeuw M, Goossens ME, Linton SJ, Crombez G, Boersma K, Vlaeyen JW. The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *J Behav Med* 2007;30:77-94.

112. Gil-Martínez A, Grande-Alonso M, La Touche R, Lara-Lara M, López-López A, Fernández-Carnero J. Psychosocial and somatosensory factors in women with chronic migraine and painful Temporomandibular disorders**.** *Pain Res Manag* 2016; Epub.

113. Vlaeyen JW, Linton SJ. Fear avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain* 2000;85:317-332.

114. Wall PD. On the relation of injury to pain. *Pain* 1979;6:253-264.

115. Bortz WM 2nd. The disuse syndrome, *West J Med* 1984;141:691-694.

116. Crombez G, Vervaet L, Lysens R, Baeyens F, Eelen P. Avoidance and confrontation of painful, back straining movements in chronic back pain patients. *Behav Modif* 1998;22:62-77.

117. McCracken LM, Gross RT, Sorg PJ, Edmands TA. Prediction of pain in patients with chronic low back pain: effects of inaccurate prediction and pain-related anxiety. *Behav Res Ther* 1993;31:647-652.

118. Pearce J, Morley S. An experimental investigation of the construct validity of the McGill Pain Questionnaire. *Pain* 1989;39:115-121.

119. Asmundson GJ, Kuperos JL, Norton GR. Do patients with chronic pain selectively attend to pain-related information?: preliminary evidence for the mediating role of fear. *Pain* 1997;72:27-32.

120. Eccleston C, Crombez G, Aldrich S, Stannard C. Attention and somatic awareness in chronic pain. *Pain* 1997;72:209-215.

121. Crombez G, Eccleston C, Baeyens F, Eelen P. Attentional disruption is enhanced by the threat of pain. *Behav Res Ther* 1998;36:195-204.

122. McCracken LM, Gross RT. Does anxiety affect coping with pain? *Clin J Pain* 1993;9:253-259.

123. Crombez G, Eccleston C, Baeyens F, Eelen P. When somatic information threatens, catastrophic thinking enhances attentional interference. *Pain* 1998;75:187-198.

124. Vlaeyen JW, Kole-Snijders AMJ, Rotteveel AM, Ruesink R, Heuts PH. The role of fear of movement/(re)injury in pain disability. *J Occup Rehabil* 1995;5:235-252.

125. Picavet HS, Vlaeyen JW, Schouten JS. Pain catastrophizing and kinesiophobia: predictors of chronic low back pain. *Am J Epidemiol* 2002;156:1028-1034.

126. Severeijns R, van den Hout MA, Vlaeyen JW, Picavet HS. Pain catastrophizing and general health status in a large Dutch community sample. *Pain* 2002;99:367-376.

127. Buer N, Linton SJ. Fear-avoidance beliefs and catastrophizing: occurrence and risk factor in back pain and ADL in the general population. *Pain* 2002;99:485-491.

128. Gómez-Pérez L, López-Martínez AE, Ruiz-Párraga GT. Psychometric properties of the Spanish version of the Tampa Scale for Kinesiophobia (TSK). *J Pain* 2011;12:425-435.

129. García Campayo J, Rodero B, Alda M, Sobradiel N, Montero J, Moreno S. Validation of the Spanish version of the Pain Catastrophizing Scale in fibromyalgia. *Med Clin (Barc)* 2008;131:487-492.

130. La Touche R, Pardo-Montero J, Gil-Martínez A, Paris-Alemany A, Angulo-Díaz-Parreño S, Suárez-Falcón JC, Lara-Lara M, Fernández-Carnero J. Craniofacial pain and disability inventory (CF-PDI): development and

psychometric validation of a new questionnaire. *Pain Physician* 2014;17:95-108.

131. Burwinkle T, Robinson JP, Turk DC. Fear of movement: factor structure of the Tampa Scale of Kinesiophobia in patients with fibromyalgia syndrome. *J Pain* 2005;6:384-391.

132. Hapidou EG, O'Brien MA, Pierrynowski MR, de Las Heras E, Patel M, Patla T. Fear and avoidance of movement in people with chronic pain: Psychometric properties of the 11-item Tampa Scale for Kinesiophobia (TSK-11). *Physiother Can* 2012;64:235-241.

133. Cleland JA, Fritz JM, Childs JD. Psychometric properties of the Fear-Avoidance Beliefs Questionnaire and Tampa Scale of Kinesiophobia in patients with neck pain. *Am J Phys Med Rehabil* 2008;87:109-117.

134. French DJ, France CR, Vigneau F, French JA, Evans RT. Fear of movement/(re)injury in chronic pain: a psychometric assessment of the original English version of the Tampa Scale for Kinesiophobia (TSK). *Pain* 2007;127:42-51.

135. Houben RM, Leeuw M, Vlaeyen JW, Goubert L, Picavet HS. Fear of movement/injury in the general population: factor structure and psychometric properties of an adapted version of the Tampa Scale for Kinesiophobia. *J Behav Med* 2005;28:415-424.

136. LeResche L, Dworkin SF, Wilson L, Ehrlich K. Effect of

temporomandibular disorder pain duration on facial expressions and verbal report of pain. *Pain* 1992;51:289-295.

137. Turner JA, Dworkin SF, Mancl L, Huggins KH, Truelove EL. The roles of beliefs, catastrophizing, and coping in the functioning of patients with temporomandibular disorders. *Pain* 2001;92:41-51.

138. Sohn BJ, Park MW, Park JW, Chung SC, Chung JW. Reliability of the Korean version of research diagnostic criteria for temporomandibular disorders (RDC/TMD). *J Oral Med Pain* 2008;33:323-331.

139. Yap AU, Dworkin SF, Chua EK, List T, Tan KB, Tan HH. Prevalence of temporomandibular disorder subtypes, psychologic distress, and psychosocial dysfunction in Asian patients. *J Orofac Pain* 2003;17:21-28.

140. Beck AT, Ward C, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961;4:561-571.

141. Beck AT, Steer RA, Carbin MG. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review* 1988;8:77-100.

142. Freedland KE, Skala JA, Carney RM, Raczynski JM, Taylor CB, Mendes de Leon CF, Ironson G, Youngblood ME, Krishnan KR, Veith RC. The Depression Interview and Structured Hamilton (DISH): Rationale, development, characteristics, and clinical validity. *Psychosom Med* 2002;64:897-905.

143. SY Lim, EJ Lee, SW Jeong, HC Kim, CH Jeong, TY Jeon, MS Yi, JM Kim, HJ Jo, and JB Kim. The validation study of Beck Depression Scale 2 in Korean version. *Anxiety and Mood* 2011;7:48-53.

144. Fayers PM. Quality of Life Assessment, Analysis and Interpretation. Chichester, UK: John Wiley and Sons, Inc; 2000. pp. 50-57.

145. Gil-Martínez A, Grande-Alonso M, López-de-Uralde-Villanueva I, López-López A, Fernández-Carnero J, La Touche R. Chronic temporomandibular disorders: disability, pain intensity and fear of movement. *J Headache Pain* 2016;17:103.

146. Burri A, Rice D, Kluger N, Kluger M. Ethnic- and sex-related differences in pain characteristics, psychological distress and pain-related disability in patients attending a New Zealand teaching hospital pain service. *N Z Med J* 2018;131:51-64.

147. Bränström H, Fahlström M. Kinesiophobia in patients with chronic musculoskeletal pain: differences between men and women. *J Rehabil Med* 2008;40:375-380.

148. Lundberg M, Larsson M, Östlund H, Styf J. Kinesiophobia among patients with musculoskeletal pain in primary healthcare. *J Rehab Med* 2006;38:37-43.

149. Verbunt JA, Sieben JM, Seelen HAM, Vlaeyen JW, Bousema EJ, van der Heijden GJ, Knottnerus JA. Decline in physical activity, disability and pain-

related fear in sub-acute low back pain. *Eur J Pain* 2005;9:417-425.

150. Verbunt JA, Seelen HA, Vlaeyen JW, van der Heijden GJ, Knottnerus JA. Fear of injury and physical deconditioning in patients with chronic low back pain. *Arch Phys Med Rehabil* 2003;84:1227-1232.

151. JH Jo, JW Chung. Gender differences in signs and symptoms of patients with temporomandibular disorders. Ph D prothesis, SNU, Seoul. 2015.

152. Huang GJ, LeResche L, Critchlow CW, Martin MD, Drangsholt MT. Risk factors for diagnostic subgroups of painful temporomandibular disorders (TMD). *J Dent Res* 2002;81:284-288.

153. Manfredini D, Landi N, Bandettini Di Poggio A, Dell'Osso L, Bosco M. A critical review on the importance of psychological factors in temporomandibular disorders. *Minerva Stomatol* 2003;52:321-330.

154. Okeson JP, Bell's orofacial pains. The clinical management of orofacial pain. Sixth Edition. Chicago: Quintessence publishing; 2005, pp 287-328

155. Dworkin SF, Sherman J, Mancl L, Ohrbach R, LeResche L, Truelove E. Reliability, validity, and clinical utility of RDC/TMD axis II scales: Depression, non-specific physic al symptoms, and graded chronic pain. *J Orofac Pain* 2002;16:207-220.

Table 1 Selection criteria for each TMD pain subgroup

Group	Diagnosis criteria
Myogenous pain group	1) Pain at facial, TMJ, temporal, preauricular and inner ear areas at rest or during function. And, 2) Pain during palpation at more than 3 sites among the 20 muscle sites. (1 of 3 sites must be on the pain side)
	Does not satisfy criteria of the arthrogenous pain group
Arthrogenous pain group	Pain and tenderness at the joint capsule or synovial lining
	1) Pain during palpation of joint area 2) Spontaneous pain at: TMJ (at maximum mouth opening, assisted maximum mouth opening, lateral movement)
	Does not satisfy criteria of the myogenous pain group
Mixed pain group	Satisfies all the criteria of the above groups

Table 2. Demographic features of subjects

		TMD patients (n=335)					Control (n=98)	P-value
		No pain (n=127)	Myogenous pain (n=81)	Arthrogenous pain (n=49)	Mixed pain (n=78)	Total		
Age (year)		33.6 ± 12.2	36.4 ± 12.7	36.0 ± 12.1	38.5 ± 16.2	35.8 ± 13.4	27.5 ± 4.7	0.000 [a]
Gender (number)	Women	66 (30.0%)	62 (28.2%)	31 (14.1%)	61 (27.7%)	220 (65.7%)	53 (54.1%)	0.037 [b]
	Men	61 (53.0%)	19 (16.5%)	18 (15.7%)	17 (14.8%)	115 (34.3%)	45 (45.9%)	

a: P-values were obtained by Mann-Whitney U test.

b: P-values were obtained by Chi-square test.

Table 3. Comparison of subscales of the TSK-TMD between TMD patients and control group adjusted for age and gender

	FM	AA	SF
TMD patients	29.46 ± 6.32	17.54 ± 4.21	11.92 ± 3.05
Control	22.15 ± 5.74	14.12 ± 3.97	8.03 ± 2.33
P-value [a]	0.000	0.000	0.000
P-value [b]	0.000	0.000	0.000

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

a: P-values were obtained from independent t-test.; mean ± SD

b: P-values were obtained from ANCOVA. (covariates= age, gender)

Table 4. Comparison of TSK-TMD scores between gender in each TMD patient and control group.

		FM	AA	SF
TMD patients	Women	30.24 ± 6.00	18.04 ± 4.12	12.20 ± 2.85
	Men	27.98 ± 6.67	16.59 ± 4.23	11.39 ± 3.33
	P-value	0.002	0.003	0.027
Control	Women	22.01 ± 4.97	14.15 ± 3.78	7.86 ± 1.76
	Men	22.31 ± 6.59	14.08 ± 4.22	8.22 ± 2.87
	P-value	0.808	0.939	0.474

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

P-values were obtained from independent t-test.

Table 5. Comparison of the subscales of the TSK-TMD between the subgroups of the TMD patients according to pain

	FM	AA	SF
No pain (0)	28.18 ± 6.19	16.95 ± 4.10	11.23 ± 2.99
Myogenous pain (1)	30.03 ± 6.00	17.61 ± 3.98	12.41 ± 3.03
Arthrogenous pain (2)	29.59 ± 6.01	17.69 ± 4.16	11.89 ± 2.75
Mixed pain (3)	30.93 ± 6.83	18.38 ± 4.61	12.55 ± 3.15
P-value	0.018	0.129	0.007
Multiple comparison	(0,3)		(0,3)

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

Results were obtained through one-way ANOVA.

Post-hoc analyses for multiple comparisons among the groups were performed by Scheffe test.

Significant difference : $P < 0.05$

Table 6 Comparison of subjective symptoms, clinical parameters and psychological profiles of TMD patients according to pain.

	No pain (0)	Myogenous pain (1)	Arthrogenous pain (2)	Mixed pain (3)	P-value
Pain duration (days) [a]	44.77 ± 68.73	43.46 ± 61.01	48.89 ± 63.80	64.89 ± 73.69	0.010
PPI [a]	2.96 ± 2.56	4.08 ± 2.54	4.65± 2.68	4.80 ± 2.59	0.000
WPI [a]	3.76 ± 3.02	5.67 ± 2.84	5.12 ± 2.78	5.74 ± 2.84	0.000
MMO [a]	48.04 ± 8.09	46.04 ± 7.67	41.93 ± 9.68	42.66 ± 8.43	0.000
MOL [b]	20 (15.7%)	13 (16.0%)	16 (32.7%)	26 (33.3%)	0.004
BDI [a]	7.37 ± 6.68	11.72 ± 8.77	8.85 ± 7.34	12.76 ± 11.14	0.000
GCP scale [a]	2.15 ± 1.08	2.35 ± 1.13	2.20 ± 1.08	2.57 ± 1.06	0.085
RDC/TMD Axis II					
DEP [a]	0.43 ± 0.65	0.84 ± 0.79	0.67 ± 0.65	1.04 ± 0.88	0.000
SOM P [a]	0.46 ± 0.61	0.82 ± 0.79	0.63 ± 0.68	1.08 ± 0.86	0.000
SOM N [a]	0.35 ± 0.57	0.70 ± 0.83	0.52 ± 0.65	0.89 ± 0.89	0.000
LIM MN [a]	0.25 ± 0.14	0.34 ± 0.18	0.36 ± 0.17	0.41 ± 0.21	0.000

PPI : Present pain intensity measure with VAS scale

WPI : Worst pain intensity measure with VAS scale

MMO : Maximum mouth opening

MOL : Number of patients with mouth opening limitation with 40 mm or less

BDI : Beck's depression index

GCP scale : Graded chronic pain scale

DEP : Depression scale of the RDC/TMD Axis II

SOM P : Somatization with pain scale of the RDC/TMD Axis II

SOM N : Somatization without pain scale of the RDC/TMD Axis II

LIM MN: Limitation related to mandibular functioning scale of the RDC/TMD Axis II

a: P-values were obtained through Kruskal-Wallis test.: mean±SD

b: P-values were obtained through Chi-square test.

Table 7. Comparison of each subscale of TSK-TMD among subgroups of the TMD patients according to disc displacement.

	FM	AA	SF
Normal (n=108)	29.02 ± 6.63	17.31 ± 4.46	11.71 ± 3.11
ADD with reduction (n=178)	29.28 ± 6.15	17.48 ± 4.00	11.79 ± 3.10
ADD without reduction (n=49)	31.20 ± 6.23	18.32 ± 4.47	12.87 ± 2.57
P-value	0.114	0.364	0.059

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

ADD : Anterior disc displacement

Results were obtained through one-way ANOVA.

Table 8. Comparison of each subscale of the TSK-TMD of the TMD patients according clinical characteristics.

		FM	AA	SF
Trauma	Trauma (n=56)	31.50 ± 6.24	18.69 ± 4.52	12.80 ± 2.86
	No trauma (n=251)	28.93 ± 6.41	17.19 ± 4.20	11.73 ± 3.11
	P-value	0.007	0.018	0.019
MOL	MOL (n=75)	32.32 ± 6.06	19.45 ± 4.16	12.86 ± 2.72
	No MOL (n=260)	28.66 ± 6.19	17.00 ± 4.08	11.65 ± 3.08
	P-value	0.000	0.000	0.002
Joint noise	Noise (n=183)	29.49 ± 6.25	17.47 ± 4.20	12.01 ± 3.03
	No noise (n=152)	29.46 ± 6.46	17.65 ± 4.25	11.81 ± 3.07
	P-value	0.972	0.705	0.550
Joint locking	Locking (n=97)	30.26 ± 5.98	18.11 ± 3.89	12.15 ± 3.17
	No locking (n=235)	29.21 ± 6.42	17.36 ± 4.33	11.85 ± 2.96
	P-value	0.168	0.143	0.407

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

MOL : Mouth opening limitation with 40 mm or less

P-values were obtained through independent t-test.: mean ± SD

Table 9. Comparison of demographic features and the subscales of the TSK-TMD of the TMD patients according to GCP scale group

GCP scale	Age (year) [a]	Gender (number) [b]		FM [c]	AA [c]	SF [c]
		Women	Men			
Low disability						
Low intensity (Ⅰ) (n=94)	33.8 ± 13.0	60 (29.6%)	34 (40.0%)	28.21 ± 6.47	17.20 ± 4.28	11.01 ± 2.81
High intensity (Ⅱ) (n=56)	37.1 ± 12.6	39 (19.2%)	17 (20.0%)	29.78 ± 6.09	17.67 ± 4.12	12.10 ± 3.00
Subtotal (n=150)	35.0 ± 12.9	99 (48.8%)	51 (60.0%)	28.80 ± 6.35	17.38 ± 4.21	11.42 ± 2.92
High disability						
Moderate limiting (Ⅲ) (n=90)	38.2 ± 14.0	68 (33.5%)	22 (25.9%)	31.10 ± 5.51	18.28 ± 3.87	12.81 ± 2.80
Severely limiting (Ⅳ) (n=48)	37.5 ± 14.7	36 (17.7%)	12 (14.1%)	31.93 ± 5.90	18.77 ± 4.08	13.16 ± 3.13
Subtotal (n=138)	38.0 ± 14.2	104 (51.2%)	34 (40.0%)	31.39 ± 5.64	18.45 ± 3.93	12.93 ± 2.91
P-value [1]	0.067	0.308		0.001	0.120	0.000
P-value [2]	0.062	0.082		0.000	0.026	0.000

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

GCP scale : Graded chronic pain scale

a : P-values were obtained through Kruskal-Wallis test (between low and high disability group) and Mann-Whitney U test (between low disability and high disability group).: mean ± SD

b : P-values were obtained through Chi-square test.

c : P-values were obtained through independent t-test (between low disability and high disability group) and one-way ANOVA(between low disability and high disability group).: mean ± SD

P-value [1] : P-values between each GCP scale group

P-value [2] : P-values between low and high disability group

Table 10. Correlations between the subjective symptom, clinical parameters, and the subscales of the TSK-TMD

	Age	Pain Du	PPI	WPI	MMO	Palpation
FM	0.099	0.189**	0.240**	0.300**	-0.234**	0.207**
AA	0.048	0.146**	0.165**	0.234**	-0.223**	0.135*
SF	0.126*	0.192**	0.274**	0.306**	-0.183**	0.240**

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

Pain Du : pain duration (days)

PPI : Present pain intensity measured by VAS scale

WPI : Worst pain intensity measured by VAS scale

MMO : Maximum mouth opening

Palpation : Numbers of positive palpation on joint capsules and masticatory muscles

The appearing values are correlation coefficients of Spearman's rho.

* Correlation is significant at the 0.05 level.

** Correlation is significant at the 0.01 level.

Table 11. Correlations between the psychological profiles and the subscales of the TSK-TMD

	BDI	GCP scale	DEP	SOM P	SOM N	LIM MN
FM	0.343**	0.230**	0.463**	0.411**	0.393**	0.405**
AA	0.220**	0.146*	0.341**	0.298**	0.272**	0.354**
SF	0.400**	0.258**	0.483**	0.431**	0.431**	0.342**

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

BDI : Beck's depression index

GCP scale : Graded chronic pain scale

DEP : Depression scale of the RDC/TMD Axis II

SOM P : Somatization with pain scale of the RDC/TMD Axis II

SOM N : Somatization without pain scale of the RDC/TMD Axis II

LIM MN : Limitation related to mandibular functioning scale of the RDC/TMD Axis II

The appearing values are correlation coefficients of Spearman's rho.

* Correlation is significant at the 0.05 level.

** Correlation is significant at the 0.01 level.

Table 12. Association of age, trauma history, clinical parameters and psychological profiles on TSK-TMD subscales.

	FM		AA		SF	
	Standardized coefficient (β)	P-value	Standardized coefficient (β)	P-value	Standardized coefficient (β)	P-value
Age	-0.111	0.030	-0.145	0.008	-0.031	0.548
Gender	-0.111	0.033	-0.128	0.019	-0.052	0.320
Trauma history	0.087	0.082	0.093	0.078	0.053	0.299
WPI	0.163	0.003	0.137	0.019	0.151	0.007
MOL	0.174	0.001	0.199	0.000	0.085	0.096
DEP	0.315	0.000	0.287	0.001	0.258	0.002
SOM N	0.044	0.596	-0.046	0.600	0.156	0.067
Adjusted R^2	0.278		0.198		0.250	

TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

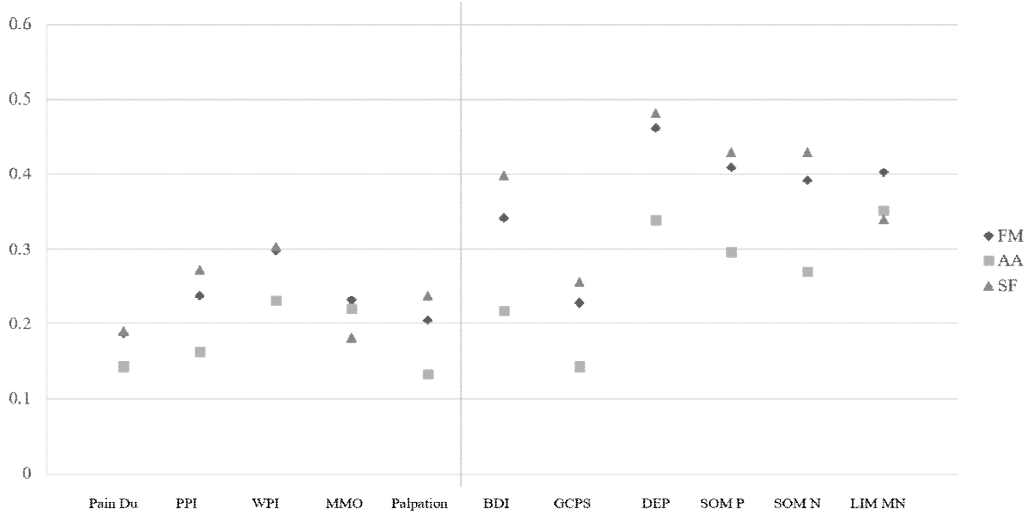
WPI : Worst pain intensity on VAS scale

DEP : Depression scale of the RDC/TMD Axis II

SOM N : Somatization without pain scale of the RDC/TMD Axis II

P-values were obtained from multivariate linear regression analysis.

Figure 1. Correlations between subjective symptom, clinical parameters, psychological profiles and the subscales of the TSK-TMD



TSK-TMD : Tampa Scale for Kinesiophobia for Temporomandibular Disorders

FM : Fear of movement scale of the TSK-TMD

AA : Activity of avoidance scale of the TSK-TMD

SF : Somatic focus scale of the TSK-TMD

Pain Du : pain duration (days)

PPI : Present pain intensity measured by VAS scale

WPI : Worst pain intensity measured by VAS scale

MMO : Maximum mouth opening

Palpation : Numbers of positive palpation on joint capsules and masticatory muscles

BDI : Beck's depression index

GCPS : Graded chronic pain scale

DEP : Depression scale of the RDC/TMD Axis II

SOM P : Somatization with pain scale of the RDC/TMD Axis II

SOM N : Somatization without pain scale of the RDC/TMD Axis II

LIM MN : Limitation related to mandibular functioning scale of the RDC/TMD Axis II

The appearing values are correlation coefficients of Spearman's rho.

국문초록

한국인 측두하악장애 환자의 통증과 연관된 운동공포증 특성에 관한 연구

서울대학교 대학원 치의과학과 구강내과 · 진단학 전공

(지도교수 **정 진 우**)

박 인 희

측두하악장애는 구강악안면 영역에서 가장 흔히 나타나는 만성동통장애의 하나로, 생리적 문제와 함께 심리적인 문제가 중요한 요소로 간주된다. 이 중에서도 통증과 연관된 운동공포증은 질환의 예후와 치료에 매우 중요한 요소로 부각되고 있다. 본 연구의 목적은 한국어판 탐파 운동공포증 척도 (Tampa Scale for Kinesiophobia for Temporomandibular Disorders, TSK-TMD) 설문지를 이용하여 측두하악장애 연구진단기준 (Research Diagnostic Criteria for Temporomandibular Disorders, RDC/TMD)에 기반한 측두하악장애 환자의 통증 근원과 임상적 특징 및 심리학적 특성에 따른 운동공포증의 특성을 평가하는데 있다. 총 335명의 측두하악장애 환자를 실험군으로 하고 98명의 측두하악장애 증상을 가지고 있지 않은 정상인을 대조군으로 하여 TSK-TMD 설문지를 작성하였으며, 측두하악장애 환자군은 임상검사 및 방사선 검사를 시행하고, RDC/TMD에 기반하여 무통증군, 관절성 통증군, 근육성 통증군, 복합성 통증군으로 분류하였다. 환자군의 심리학적 상태 평가를 위하여 RDC/TMD Axis II, 벡우울척도 (Beck's depression index)를 시행하여 결과를 비교하였다.

측두하악장애 환자군은 대조군에 비하여 유의하게 높은 TSK-TMD 점수를 보였다. 모든 TSK-TMD의 척도는 측두하악장애 환자군에서 남성에 비하여 여성에서 유의하게 높았으나, 대조군에서는 성별간 유의한 차이가 없었다. 측두하악장애 환자군에서 복합성 통증군은 무통증군에 비하여 TSK-TMD의 점수가 유의하게 높았다. 외상병력이 있는 측두하악장애 환자는 외상병력이 없는 환자보다 유의하게 높은 TSK-TMD 점수가 나타났다. 만성통증척도 (Graded chronic pain scale)의 비교에서 낮은 장애군은 높은 장애군에 비하여 유의하게 높은 TSK-TMD 점수가 나타났다. 측두하악장애의 임상적 요소, 심리학적 특성, TSK-TMD 점수 사이에 유의한 상관관계가 나타났으며, 임상적 요소보다는 심리학적 특성과 더 높은 상관계수를 보였다. 다변량선형회귀분석 결과에서 TSK-TMD 점수는 연령, 성별, 통증강도, 개구제한 유무, RDC/TMD Axis II 우울 척도와 유의한 상관관계를 보였으나, 외상병력, 신체화 척도와는 유의한 상관관계가 나타나지 않았다.

결론적으로 측두하악장애 환자는 측두하악장애 증상이 없는 대조군에 비하여 높은 수준의 운동공포증을 나타냈으며, 임상적 요소보다는 심리학적 특성과 더 높은 상관관계를 보였다. 측두하악장애 환자에서의 통증과 연관된 운동공포증은 연령, 성별, 통증강도, 개구제한, 우울증과 유의한 관련성을 보였다.

주제어: 측두하악장애, 운동공포증, 심리학적 특성, 탐파운동공포증 척도, 측두하악장애 연구진단기준

학 번: 2010-31194