Prevalence of Temporomandibular Disorder Subtypes, Psychologic Distress, and Psychosocial Dysfunction in Asian Patients

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Aims: *To use the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) to investigate the physical diagnoses, psychologic distress, and psychosocial dysfunction in Asian TMD patients. The RDC/TMD Axis I and II findings were compared to those of Swedish and American TMD patients.* ***Methods:*** *One hundred ninety-one patients (53 male and 138 female) referred to 2 institutionalized TMD clinics in Singapore were enrolled in the study. The mean age of the predominantly Chinese population (83.2%) was 33.6 ± 9.3 years. Data from a RDC/TMD history questionnaire and clinical examination were fed directly by patients and clinicians into a computerized diagnostic system (NUS TMDv1.1). Axis I and II findings were generated on-line, based on RDC/TMD rule engines. Data were automatically exported to SPSS for statistical analysis.* ***Results:*** *Group I (muscle) disorders were found in 31.4% of the patients; Group II (disc displacement) disorders were found in 15.1% and 15.7% of the patients in the left and right temporomandibular joints, respectively; and Group III (arthralgia, arthritis, and arthrosis) disorders were found in 12.6% and 13.0% of the patients in the left and right joints, respectively. Axis II assessment of psychologic status showed that 39.8% of patients experienced moderate to severe depression and 47.6% had moderate to severe nonspecific physical symptom scores. Psychosocial dysfunction was observed in only 4.2% of patients based on graded chronic pain scores.* ***Conclusion:*** *Axis I and II findings of Asian TMD patients were generally similar to their Swedish and American cohorts. In all 3 populations, women of child-bearing age represented the majority of patients. Muscle disorders were the most prevalent type of TMD. A substantial portion of TMD patients were depressed and experienced moderate to severe somatization.*

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Temporomandibular disorders (TMD) refer to a collection of medical and dental conditions affecting the temporomandibular joint (TMJ) and/or the muscles of mastication, as well as contiguous tissue components. Although specific etiologies underlie some TMD, as a group these conditions have no common etiology or biologic explanation. They comprise a heterogeneous group of health problems, the signs and symptoms of which are overlapping but not necessarily identical.[1] Despite differences in methodologies, several epidemiologic studies have shown that signs and symptoms of TMD are common in the Caucasian population.[2–4]

Two of the critical inadequacies that severely limit the generalization of these studies are *(1)* the lack of operational criteria with demonstrated scientific reliability for measuring or assessing clinical signs and symptoms, and *(2)* absence of clearly specified diagnostic criteria for the muscle and/or joint conditions of subtypes of TMD.[5] The presence of negative or maladaptive behavioral, emotional, and psychosocial factors in patients may complicate the diagnosis of TMD. Although no definitive psychologic profiles have been identified in TMD patients, elevations in anxiety, depression, and somatization have been consistently found.[6,7] Somatization refers to a predisposition to perceive nonspecific physical symptoms as troublesome and for which treatment is often sought.[8] Because TMD represent a chronic pain condition and all chronic pain conditions are associated with psychologic, behavioral, and social factors in addition to physical pathology, complete assessment of TMD patients should include the evaluation of these biobehavioral factors.[7] There are, however, few attempts to integrate biobehavioral findings into a coherent diagnostic or assessment for chronic pain. These include the multiaxial classification system developed by the International Association for the Study of Pain[9] (IASP) and the Multidimensional Pain Inventory (MPI) developed by Turk and Rudy.[10] Although the IASP classification system accounts for physical and behavioral factors on its separate axes, it lacks the specificity necessary to distinguish the different types of TMD. The MPI is limited to classification of only behavioral or psychosocial factors and pain, and classifies pain patients according to the level and type of psychosocial functioning. The MPI does not simultaneously incorporate classification of pain patients according to physical or pathophysiologic findings.

The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were developed to address the above-mentioned shortcomings.[5] Data for the development of the RDC/TMD were gathered in longitudinal studies of TMD and other pain conditions conducted collaboratively by the Department of Oral Medicine, University of Washington, and the Group Health Cooperative (GHC) of Puget Sound, a large health maintenance organization (HMO) comprising approximately 500,000 enrollees in the Pacific North region of the United States. 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 are usually administered by pen and paper. The data collected are then entered manually and batch processed by a mainframe statistical package to obtain Axis I and II findings. A time lag between patient history taking/clinical examination and the generation of diagnoses is thus inevitable. As psychologic factors have been implicated in the predisposition, initiation, and perpetuation of TMD,[11–14] knowledge of a patient's Axis II profile is important for the initial management of TMD.

Most past and current TMD research had been conducted on Caucasian populations and little is known about TMD subtypes and psychosocial profiles in Asian patients.[15,16] A project to create an on-line computerized diagnostic tool based on the RDC/TMD was undertaken by the Faculty of Dentistry and School of Computing, National University of Singapore.[15] This computerized diagnostic system (NUS TMDv1.1) allows for direct data input by patients/clinicians, chairside generation of Axis I and II findings, and automatic archiving of data in SPSS or other tab-delimited format for data-mining and global exchange. This system was used in the present study, the objectives of which were to (a) determine the prevalence of different types of TMD, psychologic distress, and psychosocial dysfunction in Asian TMD patients; (b) compare data between Asian and Swedish and American TMD patients; (c) evaluate gender differences in physical diagnoses, depression, somatization, and psychosocial dysfunction; and (d) explore the usefulness of the RDC/TMD for gathering research-relevant and clinically relevant data in international cross-cultural studies.

Materials and Methods

Data were collected on 202 consecutive patients referred to the TMD clinics at the National Dental Center and National University Hospital, Singapore. The patients were referred from general and specialist dental or medical practitioners in the community to the TMD clinics, which are the only institutionalized resource for diagnosis and management of TMD in Singapore. The comparison groups were 82 TMD subjects referred to the TMD Center in Linköping, Sweden, and 261 TMD subjects referred for treatment to the

Orofacial Pain Clinic, Department of Oral Medicine, University of Washington. Data comparing the Swedish and American TMD samples were reported in an earlier paper.[17] Exclusion criteria for the Asian group were identical with those from the comparison samples, namely: (a) patients younger than age 18 years (because several questions were difficult to understand or inappropriate) and (b) patients with medically diagnosed polyarthritis. Of the 202 consecutive referrals, 11 were excluded from the present study because of age (younger than 18 years old). The mean age of the 191 patients selected was 33.6 ± 9.3 years; 138 patients (72.3%) were women and 53 (23.7%) were men. The patients were predominantly Chinese (83.2%), with Malays and Indians making up the bulk of the remaining patients.

At the initial appointment, before undergoing treatment, patients used the NUS TMDv1.1 to answer the RDC/TMD history questionnaire. The questionnaire, which was modified for the Asian population, includes 31 questions covering information devoted to demographics and Axis II psychosocial assessment. Modifications involved only patient demographics (race, origin of ancestry, education, and household income) and did not affect RDC/TMD diagnostic rules. Psychologic status was assessed through the depression and nonspecific physical symptom scores measured with subscales of the Symptom Checklist-90 (SCL-90).[18] Psychosocial functioning was assessed through the graded chronic pain scale, which yields a score of 0 to IV (0 = no TMD pain, I = low disability/low intensity pain, II = low disability/high intensity pain, III = high disability/moderately limiting, and IV = high disability/severely limiting), reflecting the severity and impact of TMD on interference with usual functioning at home, work, or school, and disability days because of TMD pain. After the electronic questionnaires were completed, clinical examinations were carried out by 3 RDC/TMD calibrated clinicians whose reliability as RDC/TMD clinical examiners had been previously established. The latter was conducted as part of an international collaborative oral health research planning project funded by the US National Institute of Dental and Craniofacial Research. Examinations were conducted according to specifications detailed in the RDC/TMD.[5] The RDC/TMD clinical examination involves clinical assessment of TMD signs and symptoms including (a) pain site, (b) mandibular range of motion and associated pain, (c) TMJ sounds, and (d) muscles and joint palpation or tenderness. The RDC/TMD group the most common forms of TMD into 3 diagnostic categories or groups (muscle disorders, disc displacements, and other joint conditions [arthralgia, osteoarthritis, and osteoarthrosis]) and allow multiple Axis I diagnoses to be made for a given patient. The input data were fed into a hard-coded rules engine which formalizes the computational aspect of Axis I diagnosis and Axis II status based on the RDC/TMD.[19] The input data goes through 3 phases in the rules engine. Data cleaning is performed to handle missing and conflicting data elements correctly so as to uphold data integrity. Filtered data is then channeled to the core decision-making process in the rules engine where diagnoses are derived. The generated diagnostic data were automatically archived in SPSS format. Frequency distributions and descriptive statistics were obtained through the use of SPSS version 10 for Windows (SPSS, Chicago, IL), and chi-square (2-sided) statistical analyses were performed ($P < .05$) to evaluate gender differences.

Results

The age-gender distribution of Asian TMD patients is shown in Fig 1. The mean age of the patients was 34.8 years for the women (range from 18 to 65 years) while the mean age was 30.6 years for the men (range from 18 to 50 years). The Asian group consisted of significantly more women. The female-to-male gender ratio of 3.1:1 compares with Swedish and American ratios of 3.6:1 and 5.0:1, respectively. For all 3 groups, women between the ages of 25 and 44 constituted the majority of patients. Approximately 50% of the Asian patients had tertiary education and the majority of the remaining (45%) were moderately educated (secondary to pre-university education).

The distributions of RDC/TMD Axis I diagnoses of Asian TMD patients are shown in Figs 2a and 2b together with comparable Swedish and American data. Group I disorders were found in 31.4% of the Asian patients. Approximately 13% exhibited myofascial pain and 18% exhibited myofascial pain with limited opening (Fig 2a). The percentage of patients with Group I disorders was substantially higher in the Swedish and American cohorts (approximately 76% for both groups). As can be seen from Figs 2a and 2b, muscle disorders were the most common type of TMD in all 3 populations. Group II (disc displacement) disorders were found in 15.1% of the left TMJs and 15.7% of the right TMJs in Asian patients. Specific distributions of the various Group II subtypes are shown in Fig 2b. The most common form of disc

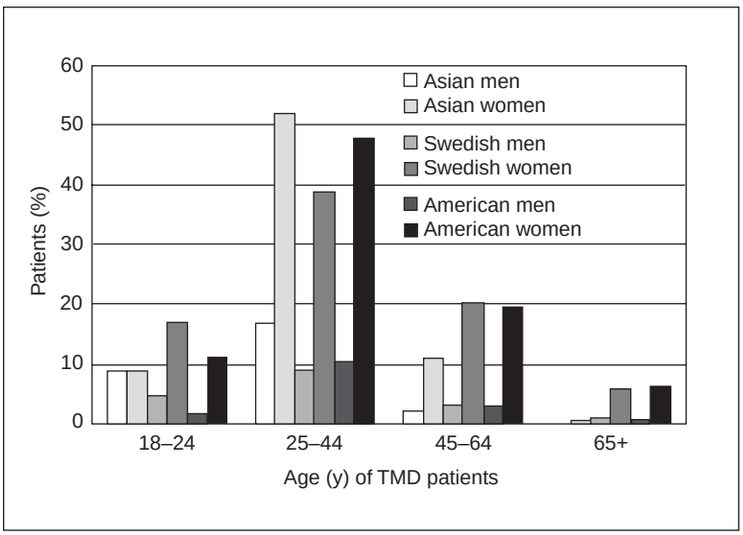


Fig 1 Distribution of Asian (n = 191), Swedish (n = 82), and American (n = 261) TMD patients by age and gender.

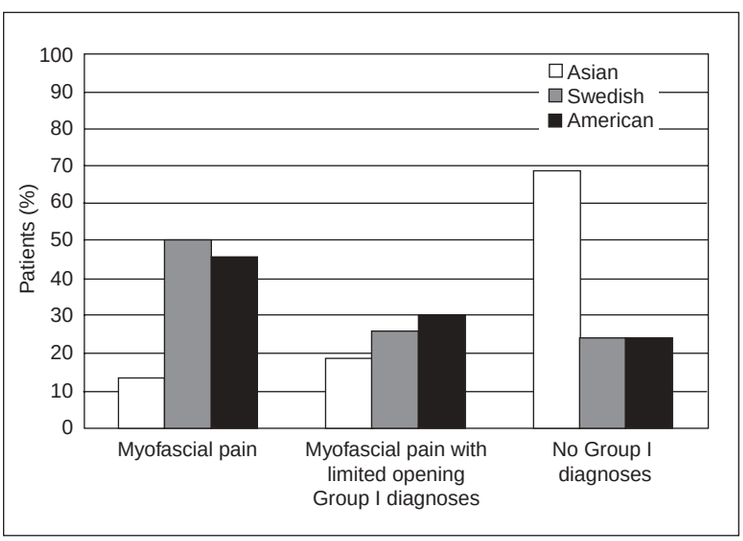
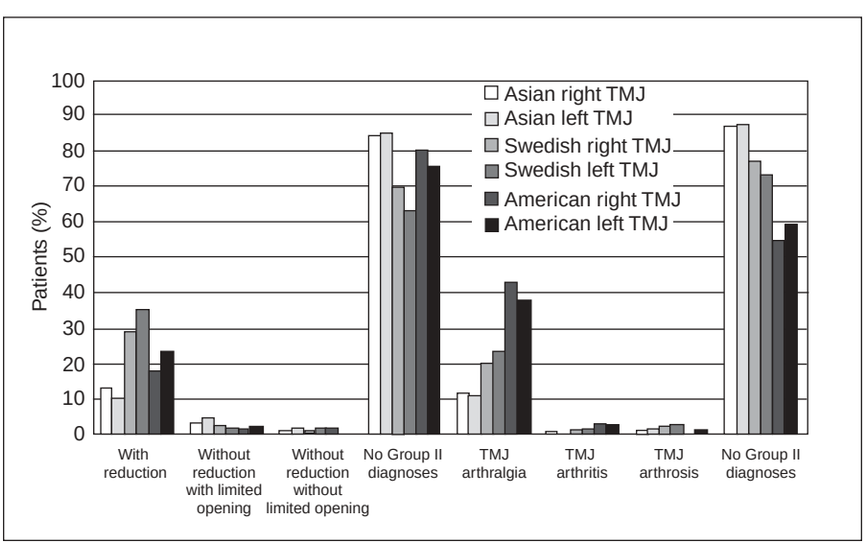


Fig 2a *(left)* Distribution of RDC/TMD Axis I diagnoses– Group I: Muscle disorders.

Fig 2b *(below)* Distribution of RDC/TMD Axis I Group II and III diagnoses.



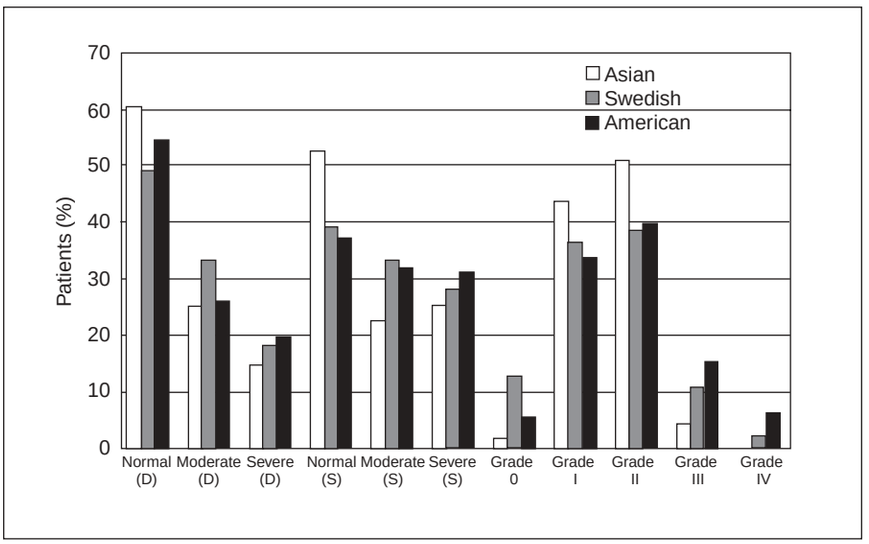


Fig 3 Distribution of depression (D) and somatization (S) scale scores and graded chronic pain status.

displacement in Asian subjects was Group IIa (disc displacement with reduction), while disc displacement without reduction showed fairly low prevalence rates. These findings parallel those for the comparison groups, although overall higher rates of disc displacements with reduction were observed for both Swedish and American cohorts compared to the Asian sample. A similar distribution pattern for Group III subtypes was found when Asian, Swedish, and American TMD cohorts were compared. Group III (arthralgia, arthritis, and arthrosis) disorders were found in 12.6% of the left TMJs and 13.0% of the right TMJs of Asian patients. Higher rates of TMJ arthralgia were also observed for Swedish and American patients. The prevalence of TMJ arthritis and arthrosis was generally low in all 3 populations.

The distributions of depression and somatization scale scores are shown in Fig 3. Asian patients experienced moderate to severe depression (39.8%), and 47.6% had moderate to severe somatization scores. Data for Swedish and American patients were quite similar (Fig 3). The distributions of graded chronic pain status of TMD patients are also shown in Fig 3. Psychosocial dysfunction was observed in only 4.2% of Asian patients, based on graded chronic pain scores. The percentages of Swedish and American TMD patients that were psychosocially dysfunctional were much higher.

For the Asian cohort, no significant gender difference was observed for physical diagnoses, depression, and somatization (Table 1). Male patients were, however, more likely to be psychosocially dysfunctional (Table 1). Despite the female-to-male ratio of 3.1:1, 75% of the patients with high disability that was moderately limiting were men.

Discussion

Patients younger than 18 years were excluded from the study, as several questions may be difficult to understand or inappropriate and because the RDC/TMD have been calibrated to date only for those over 18 years of age. Pow et al[20] estimated the prevalence of self-reported symptoms associated with TMD and treatment-seeking in adult Chinese in Hong Kong. Only 1% of the Hong Kong Chinese population had TMD-related jaw pain that was of moderate or severe intensity and occurred frequently. Only 0.6% of the population had sought treatment for jaw pain, impaired jaw opening, or joint clicking. No gender-related difference in treatment-seeking behavior was observed. Their result is contradictory to that of the present study, where a female-to-male ratio of 3.1:1 in treatment-seeking was observed. The latter ratio is consistent with other clinical studies around the world, which report female-to-male ratios of 3:1 to 9:1 in persons seeking care for TMD.[17,21] The predominance of women seeking treatment may be due in part to their greater health awareness.[22] In

Table 1 Gender Differences for Physical Diagnoses, Depression, Somatization, and Psychosocial Function

	No. of patients		
	Males	Females	Differences
Axis I			
Group I: muscle disorders			
Myofascial pain	9	16	NS
Myofascial pain with limited opening	5	30	NS
No Group I diagnoses	39	92	NS
Group II: Disc displacements (right TMJ)			
With reduction	5	19	NS
Without reduction with limited opening	2	3	NS
Without reduction without limited opening	0	1	NS
No Group II diagnoses	46	115	NS
Group II: Displacements (left TMJ)			
With reduction	6	13	NS
Without reduction with limited opening	1	7	NS
Without reduction without limited opening	0	2	NS
No Group II diagnoses	46	116	NS
Group III: Other joint conditions (right TMJ)			
TMJ arthraglia	3	19	NS
TMJ arthritis	0	1	NS
TMJ arthrosis	0	2	NS
No Group III diagnoses	50	116	NS
Group III: Other joint conditions (left TMJ)			
TMJ arthraglia	2	19	NS
TMJ arthritis	0	0	NS
TMJ arthrosis	0	3	NS
No Group III diagnoses	51	116	NS
Axis II			
Depression scale scores			
Normal	34	81	NS
Moderate	9	39	NS
Severe	10	18	NS
Somatization scale scores			
Normal	34	66	NS
Moderate	11	32	NS
Severe	8	40	NS
Graded chronic pain status			
Grade 0	1	2	NS
Grade I	19	64	NS
Grade II	27	70	NS
Grade III	6	2	S

NS denotes no statistical difference; S denotes statistically significant gender differences (results of Chi-square tests [$P = .05$]).

the present study, for all 3 TMD cohorts, women of child-bearing age represented the majority of patients. The gender and age distribution suggests a possible link between TMD and the female hormonal axis.[23] The use of exogenous female reproductive hormones for postmenopausal hormone replacement therapy or oral contraceptives has been implicated as a risk factor for TMD.[24] A more recent study has, however, concluded that the use of exogenous estrogen may not place women at increased risk of developing TMD.[25]

Studies of patients seeking treatment for TMD have reported prevalences of 26% to 31% for arthrogenous conditions and 30% to 33% for myogenous disorders.[26] These findings are consistent with those of the present study. The most common type of TMD was muscle disorders in all 3 TMD patient cohorts, consistent with the higher prevalence of muscle disorders in the general population.[27] In contrast to Swedish and American TMD patients, more Asian patients suffered from myofascial pain that was associated with limited opening. This may be attributed in part to the generally smaller jaw structures, and thus smaller range of mandibular opening, of Asians. Several Asian subjects reported the presence of muscle pain in response to palpation but did not meet the RDC/TMD criteria for a muscle disorder diagnosis (3 or more tender muscle sites located on the same side of the face as the presenting orofacial pain complaint out of the 20 sites palpated). In the Swedish population, a higher proportion of subjects, as compared to the American sample, chose not to report pain per se but preferred to use "tired" or "stiffness" to describe their jaw muscle symptoms. It may be important to pursue whether these differences in symptom reporting are a function of cross-cultural differences when pain or related physical symptoms are reported. The most common Group II and III diagnoses in the present study were disc displacement with reduction and TMJ arthralgia, respectively. The present findings do not support the consensus that TMJ disc displacement and osteoarthritis occur concomitantly.[28,29] Because methods used to examine all 3 patient cohorts of the present study were identical, any differences in prevalence rates for TMD subtypes cannot be attributed to methodological differences. While there appears to be good agreement concerning the distribution of TMD subtypes based on the RDC/TMD definitions across the cohorts studied, the differences among cohorts observed in this study point to the need for further cross-cultural research to explore more fully how differences across cultural and ethnic groups, physical, and other structural factors contribute to the differential rates of expression of TMD subtypes.

Psychologic factors have been implicated in several aspects of TMD.[30] First, stress-related muscle hyperactivity and oral habits have been suggested as etiologic factors. Secondly, psychologic factors have been suggested to explain why some patients

seem to be more troubled by some symptoms and why only a small percentage of patients actually seek treatment. Finally, psychologic conditions have been used to explain why some patients do not respond to conventional therapy. In the present study, Axis II findings for depression and somatization were very similar between Asian and Caucasian TMD cohorts. When data were pooled, approximately 40% to 50% of patients were depressed and 50% to 60% experienced moderate to severe somatization. These results are consistent with findings from a careful study of psychiatric morbidity in American TMD patients[31] and those of Auerbach et al,[32] who also found that substantial portions of TMD patients were clinically depressed.

For TMD patients who manifest appreciable psychologic disturbance, biomedical therapies aimed at alleviation of physical symptoms alone may be limited. Such a limited approach may perpetuate an unsatisfying search for dental, medical, surgical, pharmacologic, and other types of symptom management. It is therefore prudent that patients with abnormal psychologic profiles are identified at the initial visit. The on-line computerized diagnostic tool NUS TMDv1.1 allows the fore-mentioned to be achieved. Psychologically oriented referral should be introduced as part of the total management of patients with depression and somatization. Turk et al[33] have recommended the use of a cognitive behavioral approach to the education and treatment of TMD patients, and Dworkin et al have demonstrated their effectiveness.[34–36] This approach offers the dual benefit of teaching patients how to self-manage many of their symptoms, while enhancing the feeling of empowerment (locus of control) that comes from such skills.

Although no significant gender difference was observed for depression and somatization, male Asian patients were more likely to be psychosocially dysfunctional. The reason for this observation is not known and warrants further investigations involving more patients with psychosocial dysfunction. The percentage of Swedish and American TMD patients that were psychosocially dysfunctional was 3 to 5 times higher than that of Asian TMD patients. Sanders et al conducted a cross-cultural study on chronic back pain involving subjects from 6 countries in North and South America, Asia, and New Zealand.[37] Although no differences were observed in self-reported pain intensity or physical findings, significant differences in rates of psychosocial dysfunction were observed. American patients were found to be the most dysfunctional, as was the case in the present study. The bases for these observations are also not known. For the present study, again, it seems reasonable to conclude that the differences observed do not arise from variations in study methodology. It seems equally important to suggest that further research is needed to explore how differences in culture, ethnicity, and related variations in health care provision are possible factors influencing the differential expression of TMD in patients around the world. In this regard, it is especially crucial to remember that the values used to define depression, somatization, and graded chronic pain scales were based on normative values derived from a US population. Asian-derived standards must be established for accurate interpretation of results.

Results from this study support the usefulness of the RDC/TMD for gathering research and clinically relevant data in international cross-cultural studies. Comparisons can be made between different groups of TMD patients when the same set of examination procedures, the same clinical diagnostic algorithms, and the same history methods are used to assess behavioral, psychologic, and psychosocial factors. Axis I and II findings of Asian TMD patients were generally similar to their Swedish and American cohorts. In all 3 TMD populations, women of child-bearing age represented the majority of patients. Muscle disorders were the most prevalent type of TMD. A substantial portion of TMD patients were depressed and experienced moderate to severe somatization.

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References

1. National Institute of Health. Management of Temporomandibular Disorders. NIH Technological Statement, 1996 (Apr 29–May 1):1–31.
2. Helkimo M. Studies on function and dysfunction of the masticatory system II. Index for anamnestic and clinical dysfunction and occlusal state. Swed Dent J 1974;67: 101–121.
3. Dworkin SF, Huggins KH, LeResche L, et al. Epidemiology of signs and symptoms in temporomandibular disorders: Clinical signs and cases and controls. J Am Dent Assoc 1990;120:273–281.
4. Burakoff RP, Kaplan AS. Temporomandibular disorders: Current concepts of epidemiology, classification and treatment. J Pain Symptom Manage 1993;8:165–172.

5. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders. J Craniomandib Disord 1992;6:301–355.
6. Dahlstrom L. Psychometrics in temporomandibular disorders: An overview. Acta Odontol Scand 1993;51: 339–352.
7. Dworkin SF. Perspectives on the interaction of biological, psychological and social factors in TMD. J Am Dent Assoc 1994;125:856–863.
8. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, ed 4. Washington DC: American Psychiatric Association Press, 1994.
9. Merskey H. Classification of chronic pain - descriptions of chronic pain syndromes and definitions of pain terms. Pain 1986(3, suppl):S1–S226.
10. Turk DC, Rudy TE. Toward an empirically derived taxonomy of chronic pain patients: Integration of psychological assessment data. J Consult Clin Psychol 1988;56:1–6.
11. Sipila K, Veijola J, Jokelainen J, et al. Association between symptoms of temporomandibular disorders and depression: An epidemiological study of the Northern Finland 1966 birth cohort. Cranio 2001;19:183–187.
12. Rollman GB, Gillespie JM. The role of psychosocial factors in temporomandibular disorders. Curr Rev Pain 2000;4:71–81.
13. Michelotti A, Martina R, Russo M, Romeo R. Personality characteristics of temporomandibular disorder patients using MMPI. J Craniomand Pract 1998;16:119–125.
14. Rudy TE, Turk DC, Kubinski JA, Hussein SZ. Differential treatment responses of TMD patients as a function of psychological characteristics. Pain 1995;61:103–122.
15. Yap AUJ, Tan KBC, Hoe JKE, Yap RHC, 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.
16. Yap AUJ, Chua EK, Hoe JKE. Clinical TMD, pain-related disability and psychological status of TMD patients. J Oral Rehabil 2002;29:374–380.
17. 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.
18. Derogatis LR, Cleary PA. Confirmation of the dimensional structure of the SCL-90: A study in construct validation. J Clin Psychol 1977;33:981–989.
19. Carolyn W, Xianglian Z. A SAS computer program to evaluate the Research Diagnostic Criteria for classification of temporomandibular disorders. Technical report No. 9401. Seattle, WA: Regional Clinical Research Centre, University of Washington, 1994.
20. Pow EH, Leung KC, McMillan AS. Prevalence of symptoms associated with temporomandibular disorders in Hong Kong Chinese. J Orofac Pain 2001;15:228–234.
21. McNeill C. Temporomandibular Disorders: Guidelines for Classification, Assessment and Management. Chicago: Quintessence, 1993:19–38.
22. Randolph CS, Greene CS, Moretti R, Forbes D, Perry HT. Conservative management of temporomandibular disorders: A post treatment comparison between patients from a university clinic from a private practice. Am J Orthod Dentofac Orthop 1990;98:77–82.
23. Warren MP, Fried JL. Temporomandibular disorders and hormones in women. Cells Tissues Organs 2001;169: 187–192.
24. LeResche L, Suanders K, Von Korff MR, Barlow W, Dworkin SF. Use of exogenous hormones and risk of temporomandibular disorders. Pain 1997;69:153–160.
25. Hatch JP, Rugh JD, Sakai S, Saunders MJ. Is use of exogenous estrogen associated with temporomandibular signs and symptoms? J Am Dent Assoc 2001;132:319–326.
26. Lobbezzo-Scholte AM, Lobbezoo F, Steenks MH, De Leeuw JR, Bosman F. Diagnostic subgroups of craniomandibular disorders. Part I: Self-report data and clinical findings. J Orofac Pain 1995;9:24–36.
27. Schiffman E, Fricton JR, Harley D, Shapiro BL. The prevalence and treatment needs of subjects with temporomandibular disorders. J Am Dent Assoc 1990;120: 295–304.
28. de Bont LGM, Dijkgraaf LC, Stegenga B. Epidemiology and natural progression of articular temporomandibular disorders. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;83:72–76.
29. Westesson PL, Rohlin M. Internal derangement related to osteoarthrosis in temporomandibular joint autopsy specimens. Oral Surg Oral Med Oral Pathol 1984;57:17–22.
30. 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. Chicago: American Dental Association, 1982:85–94.
31. Gatchel RJ, 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.
32. Auerbach SM, Laskin DM, Frantsve LM, Orr T. Depression, pain, exposure to stressful life events and long-term outcomes in temporomandibular disorder patients. J Oral Maxillofac Surg 2001;59:628–633.
33. Turk DC, Rudy TE, Kubinski JA, Zaki HS, Greco CM. Dysfunctional patients with temporomandibular disorders: Evaluating the efficacy of a tailored treatment protocol. J Consult Clin Psychol 1996;64:136–146.
34. Dworkin SF. Behavioral and educational modalities. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1997;83: 128-133.
35. Dworkin SF, Turner JA, Wilson L, et al. Brief group cognitive-behavioral intervention in chronic temporomandibular disorder pain. Pain 1994;59:175-187.
36. Dworkin SF, Huggins KH, Wilson L, et al. A randomized clinical trial using Research Diagnostic Criteria for Temporomanibular Disorders Axis II to target clinical cases for a tailored self-care treatment program. J Orofac Pain (In press).
37. Sanders SH, Brena SF, Spier CJ, Beltrutti D, McConnell H, Quintero O. Chronic low back pain patients around the world: Cross-cultural similarities and differences. Clin J Pain 1992;8:317-323.