Distribution of diagnoses in a population of patients with temporomandibular disorders

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Objectives. The objective of this study was to describe the frequency of TMD diagnoses in a patient population for comparison with the available literature.
Methods. Five hundred twenty consecutive patients seeking TMD treatment underwent a Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) assessment. The prevalence and age distribution of the different RDC/TMD axis I and II diagnoses were described.
Results. Muscle disorders, disk displacements, and other joint disorders were diagnosed respectively in 56.4%, 42.0%, and 57.5% of patients. Sixty percent of patients had depression symptoms, 76.6% had somatization, and 21.8% presented high levels of pain-related impairment. Disk displacements were more frequently diagnosed in the younger-aged, other joint disorders in the older-aged, and muscle disorders in the middle-aged subjects (ANOVA for mean age comparison, $F = 3.355$; $P = .002$).
Conclusions. These distribution frequencies of TMD diagnoses provide insight into the epidemiology of this disease. (Oral Surg Oral Med Oral Pathol Oral Radiol 2012;114:e35-e41)

The term temporomandibular disorder (TMD) refers to a heterogeneous group of pathologies affecting the stomatognathic system, characterized by pain and functional limitation within the temporomandibular joint (TMJ) area, the muscles of mastication, and the related structures.[1] TMDs are considered the most common cause of orofacial pain of nondental origin and are currently included within the musculoskeletal disorders.[2,3] The prevalence of TMD signs and symptoms in the general population is high and ranges from 16% to 88%,[4] even if treatment is needed only by a minority of subjects.[5] This observation supports the claim that TMDs are generally self-limiting and the progression toward chronic and disabling forms is uncommon.

Also, there is a strong need to define treatment-seeking populations in terms of percentage of patients receiving the different TMD diagnoses, so as to gather as many data as possible on TMD epidemiology. To this aim, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were proposed as guidelines for cross-center comparison of findings[6] and, despite their wide diffusion with multilanguage translation[7-9] and ongoing validation of revised diagnostic algorithms,[10] a recent meta-analysis of the literature pointed out that only a few research groups actually described findings in their clinics' TMD patient populations by relying on the RDC/TMD.[11] From those studies, it emerged that myofascial pain was the commonest diagnosis,[12-15] that combined muscle and joint disorders affect about half of the patients,[16] and that different age peaks characterize subjects with disk displacement disorders with respect to those with inflammatory degenerative disorders.[17] Also, it emerged that most TMD patients have symptoms belonging to the psychosocial sphere, as identified by the RDC/TMD axis II evaluating depression, somatization, and chronic pain–related impairment.[18] Notwithstanding that, gathering more data on TMD patient populations is a compelling need to get deeper into the knowledge of disease epidemiology and to increase the external validity of findings described so far, especially in the light of recent observations that a very low number of articles reported on both axis I and axis II findings.[19]

With these premises, the aim of this article was to describe the frequency of physical and psychosocial diagnoses in a sample of patients attending a TMD clinic and to compare them with the available literature.

MATERIAL AND METHODS

Data were collected from 520 consecutive patients seeking treatment for TMD at the TMD Clinic, School of Dental Medicine, University of Pavia, during the period from January 1, 2006, to June 31, 2010. History taking and clinical examination were performed according to the RDC/TMD guidelines,[6] by the adoption of the standard, internationally accepted Italian version of the RDC/TMD instrument available since 2002 on

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the RDC/TMD consortium Web site.[20] Criteria for exclusion were age younger than 18 (because of the characteristics of the RDC/TMD, the reliability of which has been tested on adult populations), diagnosis of other orofacial pain disorders, and presence of polyarthritis and/or other rheumatic disease. This study focused on data of both RDC/TMD axis I and II diagnoses. All patients were simultaneously assessed by the same 2 examiners (N.A., M.S.), who collected all RDC/TMD data and assigned axis I diagnoses by consensus. Patients were given 1 or more of the following axis I group diagnoses: muscle disorders (group I); disk displacement (group II); and arthralgia, osteoarthritis, and osteoarthrosis (group III). As for axis II assessment, levels of depression and somatization were evaluated by the use of dedicated Symptoms Checklist-90 (SCL-90) items, whereas the Graded Chronic Pain Scale (GCPS) was used to rate pain-related impairment. Details on the diagnostic and scoring criteria were described in the original 1992 RDC/TMD publication.[6] The investigation was based on routine clinical assessments and diagnostic activities of the TMD clinic, with waiver from the local ethics committee. All patients gave their written informed consent to the clinical diagnostic procedures undertaken during the investigation and to the use of the so-gathered data for statistical purposes.

The prevalence of the different RDC/TMD axis I diagnoses as well as the axis II psychosocial scores were described. Findings were then stratified per age, to compare the age distribution of axis I and II diagnoses. Analysis of variance (ANOVA) was performed to test for the existence of differences in the mean age of diagnostic groups, with significance level set at P less than .05. All statistical procedures were calculated with the software SPSS 19.0 for Windows (SPSS Inc., Chicago, IL).

RESULTS

Fifty-eight patients were excluded from data analysis for the following reasons: 34 subjects received diagnoses of other orofacial pain disorders (i.e., atypical odontalgia), 21 subjects had a concurrent diagnosis of fibromyalgia or other rheumatic disorders, and 3 were younger than 18.

A total of 462 (n = 462; females 79.5% [female: male ratio 3.8]; mean age 39.2 years [range 18-81]) patients satisfied inclusion criteria. Group I disorders (muscle disorders) were diagnosed in 261 (56.4%), group II disorders (disk displacements) in 195 (42%), and group III disorders (arthralgia, osteoarthritis, and osteoarthrosis) in 266 (57.5%) of the 462 patients. Table I shows specific RDC/TMD diagnoses.

Table I. Frequency of the different RDC/TMD axis I diagnoses in the study population

RDC/TMD group	*Patients, n*	*% frequency*
I a	169	36.5
I b	92	19.9
II a		
R or L	102	22.0
R and L	39	8.4
II b		
R or L	31	6.7
R and L	7	1.5
II c		
R or L	9	1.9
R and L	7	1.5
III a		
R or L	123	26.6
R and L	40	8.6
III b or III c		
R or L	72	15.6
R and L	31	6.7

RDC/TMD, Research Diagnostic Criteria for Temporomandibular Disorders; R, right joint; L, left joint; Ia, myofascial pain; Ib, myofascial pain with limited opening; IIa, disk displacement with reduction; IIb, disk displacement without reduction with limited opening; IIc, disk displacement without reduction without limited opening; IIIa, arthralgia; IIIb, osteoarthritis; IIIc, osteoarthrosis.

Muscle disorders alone were diagnosed in 92 patients (19.9%) with a mean age of 38.6 ±12.9 years, disk displacement disorders alone in 65 patients (14.0%) with a mean age of 34.7 ± 15.2 years, and a group III diagnosis alone in 80 patients (17.3%) with a mean age of 43.6 ± 16.4 years, thus indicating that about half of patients (48.7%) received RDC/TMD diagnoses of more than 1 group. The mean age of the patients receiving the different combinations of single and combined TMD diagnoses was significantly different (F = 3.355; P = .002) (Table II).

To ascertain the age-related pattern of axis I diagnoses distribution, the sample was divided into 4 groups on the basis of percentile-derived intervals within the variable "age" (25th percentile was 27 years, 50th was 39 years, and 75th was 50 years). There were 118 (74.4% females) patients aged 27 years or younger. The most common diagnoses were those of RDC/TMD group II (disk displacement) (54.5%), whereas 50.8% and 46.7% of patients were given RDC/TMD group I and III diagnoses respectively. There were 121 (73.8% females) patients aged between 28 and 39 years. RDC/TMD group I diagnoses were made in 64.5% of patients, group II in 38.1%, and group III in 52.9% of patients. There were 116 (88.4% females) patients aged between 40 and 50 years. RDC/TMD criteria for group I diagnoses were satisfied in 61.8%, group II in 40.9%, and group III in 60.1% of patients. There were 108 (77.7% females) patients older than 50 years. RDC/TMD group I

Table II. Frequency and mean age of single and combined RDC/TMD axis I diagnoses in the study population

RDC/TMD axis I group diagnoses	*% frequency*	*Mean age, y*
I	19.9	38.6 ± 12.9
II	14.0	34.7 ± 15.2
III	17.3	43.6 ± 16.4
I + II	8.6	33.2 ± 10.6
I + III	20.1	41.4 ± 13.5
II + III	10.8	40.1 ± 15.8
I + II + III	7.8	38.6 ± 14.6

RDC/TMD, Research Diagnostic Criteria for Temporomandibular Disorders.

diagnoses were made in 47.2%, group II in 30.6%, and group III in 65% of patients (Figure 1).

Axis II assessment showed that 60.1% of patients had moderate or severe depression levels, 76.6% had somatization, and 21.8% presented high levels of pain-related impairment (i.e., GCPS grade III or IV) (Table III). Significant differences emerged as for the mean age of patients showing different somatization ($F = 8.435$; $P < .001$) and depression levels ($F = 4.263$; $P = .015$).

Age-related distribution pattern of axis II diagnoses showed that younger subjects had the lowest frequency of high pain-related impairment (11.8%), whereas the highest percentage was found in the group aged 28 to 39 years (29%) (Figure 2). Younger subjects also had the lowest frequency of moderate/severe depression (44%) and somatization (62.8%) levels, whereas the percentage of moderate/severe levels of depression and somatization was similar across the other age groups (Figures 3 and 4).

DISCUSSION

A major concern affecting the literature on TMD epidemiology is the poor diagnostic homogeneity, which often prevented comparison of findings from different studies. The introduction of the RDC/TMD dated back to 2 decades ago[6] and was intended to be a step toward standardizing the diagnostic assessment of patients with TMD from a clinical as well as a psychosocial viewpoint. Several points of criticism emerged over the years, and debates led to the ongoing proposal of revised diagnostic algorithms.[10,21] Notwithstanding that, a recent systematic review of the literature pointed out that only 15 articles on TMD patient populations and 6 on community samples were performed to collect clinical diagnostic data on consecutive patients by the use of the RDC/TMD.[11] Even fewer data are available on the combined clinical and psychosocial diagnoses. Therefore, there is still a need to gather standardized

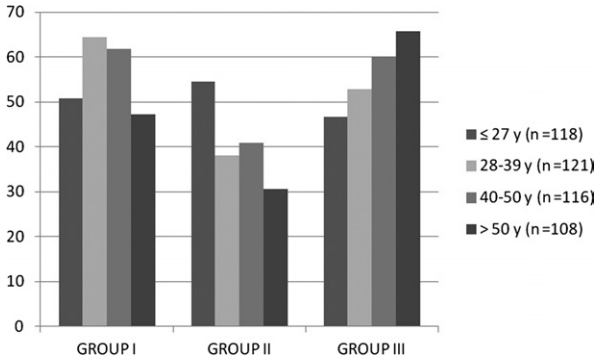

Fig 1. Frequency (%) of the different axis I group diagnoses in the various age groups, as identified by percentiles in the variable age. Group I, muscle disorders; group II, disk displacements; group III, arthralgia, osteoarthritis, osteoarthrosis.

Table III. Frequency and mean age of RDC/TMD axis II diagnoses in the study population

RDC/TMD axis II diagnoses	*% frequency*	*Mean age, y*
Pain-related impairment (GCPS)		
0	16.4	39.5 ± 15.1
I	28.5	38.7 ± 14.6
II	33.3	38.2 ± 14.7
III	15.1	40.8 ± 14.1
IV	6.7	42.6 ± 13.9
Depression (SCL-DEP)		
Normal	39.9	37.1 ± 15.4
Moderate	11.5	38.1 ± 13.7
Severe	48.6	41.3 ± 13.9
Somatization (SCL-SOM)		
Normal	23.4	36.2 ± 16.7
Moderate	25.6	36.7 ± 13.8
Severe	51	41.9 ± 13.5

RDC/TMD, Research Diagnostic Criteria for Temporomandibular Disorders; GCPS, Graded Chronic Pain Scale: grade 0, no disability; I, low disability, low intensity; II, low disability, high intensity; III, high disability, moderately limiting; IV, high disability, severely limiting; SCL, Symptoms Checklist.

data on TMD populations to increase knowledge on TMD epidemiology.

The data presented in this study were previously unpublished, and came from a tertiary university-based TMD clinic in northern Italy. Demographic features of the study sample (3.8 female:male ratio; mean age of 39.2 years, with a range of 18-81 years) were in line with literature findings of a 2.6 to 7.3 sex ratio and a mean age of about 40 years.[12,15,16,22-24] As for the frequency of the different axis I diagnoses, findings from this investigation have interesting similarities and some peculiar differences with respect to literature studies with the same design. In particular, it is notable that group I muscle disorders and group III inflammatory-degenerative joint disorders, alone or combined

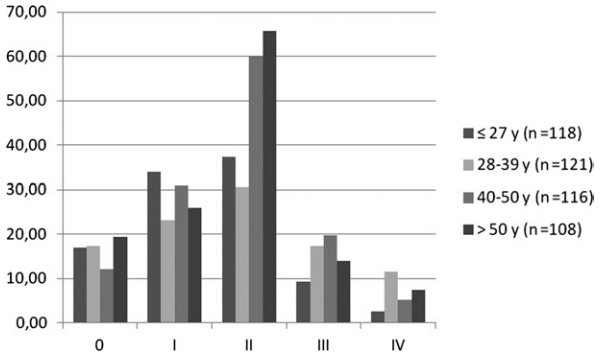

Fig 2. Frequency (%) of the different GCPS ratings in the various age groups, as identified by percentiles in the variable age. GCPS grade 0, no disability; I, low disability, low intensity; II, low disability, high intensity; III, high disability, moderately limiting; IV, high disability, severely limiting.

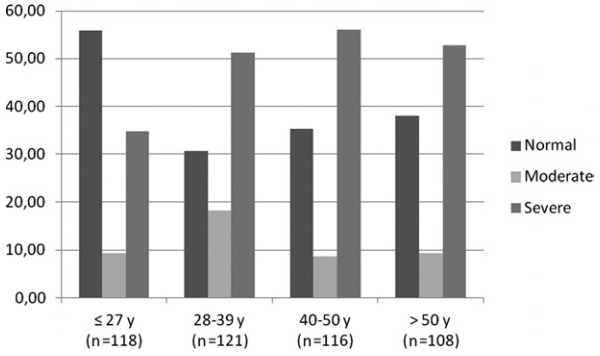

Fig 3. Frequency (%) of the different depression levels in the various age groups, as identified by percentiles in the variable age.

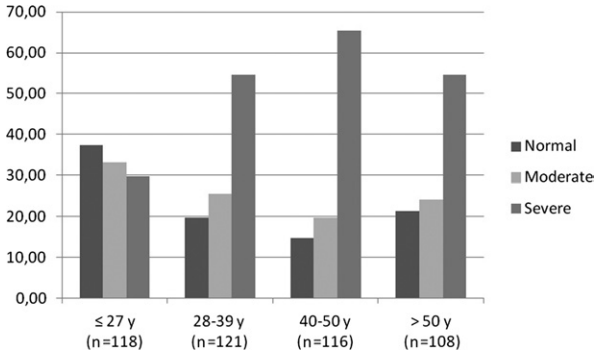

Fig 4. Frequency (%) of the different somatization levels in the various age groups, as identified by percentiles in the variable age.

with other diagnoses, were diagnosed in more than half of the study sample.

Group I disorders affected 56.4% of patients (19.9% with limited mouth opening), in comparison with more extreme frequency values described for myofascial pain in Asian (31%)[22] and Swedish and U.S. patients (76%),[15] and for myofascial pain with limited opening in other Italian (7.5%)[17] and in Swedish, US, and Israeli patients (about 30%).[13,15] Myofascial pain alone (in the absence of other diagnoses) was diagnosed in almost 20% of patients and, despite its frequency, values were well within the literature range; it is likely the RDC/TMD version 1.0 adopted so far tended to overestimate the prevalence of muscle disorders. The adoption of more rigorous diagnostic criteria and the elimination of unreliable muscle palpation sites (e.g., intraoral and submandibular regions) is likely to help reappraising the prevalence of treatment-needing patients with TMD. Also, there is a need to define clinical criteria discriminating among muscle tenderness, fatigue, and pain, as the potential mislabeling of postexercise tenderness and fatigue as myofascial pain has to be considered a major bias influencing the diagnosis and treatment of muscle disorders in the clinical setting.

As for joint disorders, the frequency of group II diagnoses of disk displacements (42%) was in line with the literature average in patient populations (41.1%),[11] with disk displacement with reduction being the commonest diagnosis (30.4%; 22% monolateral). Group III inflammatory-degenerative joint disorders were diagnosed much more frequently than average (57.5% vs 30.1%),[11] with arthralgia being the commonest diagnosis (35.2%; 26.6% bilateral); both diagnostic groups were assigned in the absence of other diagnoses in about one-third of cases. Literature data on disk displacements showed a high variability of findings, with studies on Italian, Swedish, US, and Israeli populations describing disk displacement with reduction in about one-third of the sample[12,15,16] and lower frequency in Asian populations.[25] Disk displacement without reduction was less frequent and affected 11.6% of patients (8.6% monolateral), also in line with literature suggestions that nonreducing disk displacements are the less frequent group II diagnoses.[11] The percentage of group III diagnoses was higher than that reported in the literature, but it should be kept in mind that a large variability of findings also affected reports on those diagnoses. Interestingly, both group II and III joint disorders affected the TMJs bilaterally in only a minority of patients (i.e., less than one-third of patients receiving the diagnosis).

Multiple diagnoses were found in 47.3% of the study sample. Such information was seldom reported in previous studies, and data are available only on other Italian[16,26] and Asian populations.[25] In general, it can be suggested that about half of patients with TMD are affected by combined muscle and/or disk and/or other joint disorders; from a clinical viewpoint, such observation supports the need for a thorough clinical assess-

ment because of the complex clinical picture characterizing TMDs.

From a methodological viewpoint, some concerns affect the cross-study comparison of findings on the frequency of inflammatory-degenerative disorders, which is highly variable and ranges between 9% and 80%.[13,15,16] It is likely that the variability of findings is because of ethnic and sociocultural reasons, as well as because of the different adoption of imaging techniques. In general, despite that the original RDC/TMD guidelines allowed the use of radiological techniques to get deeper into the assessment of TMJ disorders, only a few RDC/TMD studies reported combined clinical/imaging diagnoses. Consequently, studies adopting a clinical diagnosis alone found a lower prevalence of degenerative joint disorders (i.e., group III diagnoses of osteoarthritis/osteoarthrosis), in line with a recent suggestion that about 90% of subjects with radiological signs of arthrosis (i.e., bone flattening, resorption, osteophytes, remodeling) do not show any clinical signs.[27] On the other hand, the panoramic radiographs used in that study to detect radiological signs related to changes in hard tissues are not the most indicative imaging technique to diagnose TMJ osteoarthrosis. In the present investigation, as already described in previous publications on Italian patients,[16,17,26] in most cases, radiological deepening with orthopantomography and/or plain tomography (i.e., the 2 techniques allowed for assessment of TMJ disorders in the 1992 RDC/TMD publication[6]) was already performed at the time of the first appointment in our clinic. This was explained with the peculiar nature of the national health care system, which lacks any control against the abuse of imaging and laboratory exam prescription, and with the peculiar typology of dental professionals referring patients to tertiary TMD clinics, that is, most of them were general dentists lacking any specific education in the TMD field and thus sending their patients to specialized TMD clinics after prescribing several radiological exams without any particular rationale supporting their prescription. It could also be hypothesized that the frequency of group III joint disorders in this study's sample was lower than that described in another Italian population owing to the differences in the patients' referral pattern between the 2 clinics. Notwithstanding that, the problem of the use of imaging criteria is a much more delicate issue, because an accurate weight of the risk of overestimating joint disorders by the routine use of imaging techniques for diagnostic purposes versus the risk of underestimating them by relying on clinical diagnosis alone should be made.

As for axis II psychosocial findings, depression and somatization symptoms were shown by 60.1% and 76.6% of patients respectively. Such values were higher than those reported in the largest multicenter studies on axis II data performed so far,[28] but they were also within the range described in the literature. Indeed, the prevalence of depression in the available literature studies ranged from about 39% to 44%[29,30] to about 50% to 65%,[31,32] whereas the prevalence of somatization ranged between 45%[29] and 66%,[30] with peaks of 85% in a biracial population of young women.[33] High pain-related impairment, as diagnosed with the GCPS, was recorded in 21.8% of the study population. Again, such findings were in line with literature suggestions reporting a 13% to 24% prevalence of GCPS grade III or IV ratings.[28,34,35] So, it can be concluded that fewer than one-fourth of patients with TMD reported a high pain-related impairment, and that only a very small portion (6.7% in the present investigation) developed such a disabling pain and felt severely limited.

The present study also assessed the age distribution of TMD diagnoses. The main reason to perform such an age-stratified analysis was in the attempt to compare findings with those from a previous study suggesting that 2 distinct age peaks could be identified: one at about the age of 30 to 35 years for subjects mainly complaining of disk displacements with or without pain and one at about the age of 50 to 55 years for subjects with degenerative joint disorders.[17] Such observation may appear obvious at first glance, but it was never described before; a mean age of about 40 years was usually described for TMD populations as a whole.[36] Actually, the term "temporomandibular disorders" groups together some different pathologies featuring common clusters of symptoms; so, getting deeper into the epidemiology of the different TMD diagnostic groups is fundamental for an improvement of knowledge in this field.

In the present investigation, the mean age of patients with pure diagnoses (i.e., without any other diagnoses) of group II disk displacements, group I muscle disorders, and group III inflammatory-degenerative joint disorders was significantly different (34.7 vs 38.6 vs 43.6 years respectively). Interestingly, the distribution of diagnostic groups in relation to age showed that the frequency of group III diagnoses significantly increased with age, ranging from about 46% in subjects younger than 28 years to up to about 66% in those older than 50; by contrast, group II diagnoses of disk displacement decreased with age, from 54.5% in the youngest to about 30% in the oldest age groups. The frequency of group I muscle disorders had a different age-related pattern, with peaks in the middle age groups.

To gather as much data as possible, age-related distribution of diagnoses was assessed also with regard to axis II findings. The mean age of patients reporting severe depression and somatization was significantly higher than subjects with normal or moderate symp-

toms. Notwithstanding that, it is likely that the detected significances were not relevant from a clinical viewpoint, as all mean ages are within a 5-year range. Moreover, the mean age of patients receiving the different GCPS ratings were not different.

So, the most important age-related findings concern information gained on age-related distribution of axis I TMD diagnoses, because it can be suggested that the 3 main diagnostic categories are characterized by significant age distributions. This observation supported the need for an accurate study of the epidemiology of the various TMD-related diagnoses. Also, it is recommended that past statements on the age of onset of TMD symptoms, which were usually based on the mean age of TMD populations in general, should be abandoned in favor of more specific statements differentiating between the TMD diagnoses.

An important methodological aspect to be considered when appraising the external validity of this investigation's findings relates to the 4-year time span of the data gathering and concerns about diagnostic homogeneity. All patients were assessed by the same 2 examiners (i.e., the individual responsible for the TMD clinic, who is also in charge of residency programs for continued in-house TMD training and education, and a resident postgraduate student). The 2 examiners assessed all patients together, so that, despite that data on their calibration were not recorded for this investigation, it is not likely that interexaminers' reliability influenced the diagnostic assessment. Also, the 4-year range between the first and last patient's assessment cannot be underestimated as a potential bias for diagnostic homogeneity. Notwithstanding that, all patients were assessed according to guidelines that were published in 1992,[6] and that had been used for several years at this same tertiary clinic before this investigation was performed. Moreover, the potentially long time span for data gathering is likely to be a common denominator for large sample-sized observational and epidemiologic studies on patients with TMD owing to the need for recruiting many patients. In any case, a better definition of the examiners' calibration, possibly performed also at different points in time to minimize bias related to the time span between the first and last patient's assessment, is recommended in future studies to increase the external validity of the findings.

As a basis for suggesting recommendations for the future, the present investigation found comparable results with respect to literature data on the frequency of both RDC/TMD axis I and axis II diagnoses in patients with TMD, thus suggesting that the RDC/TMD guidelines were useful in depicting a worldwide pattern of TMD prevalence and to show cross-cultural differences likely owing to ethnic and sociocultural reasons. Notwithstanding that, it is hoped that the revised diagnostic algorithms will contribute much to increase homogeneity of findings between the different studies and to assign the right weight to the various criteria for muscle and joint disorders. The upcoming introduction of the revised diagnostic criteria for TMD will provide the need for reappraising the literature data gathered with the 1992 version. In particular, the exclusion of less reproducible muscle palpation sites may lead to a decreased prevalence of muscle disorders with respect to studies adopting the 1992 criteria, which demanded only 3 positive sites of 20 for diagnosing myofascial pain. As for joint disorders, a clearer definition of those cases for which the diagnoses must be imaging based and those for which a clinical diagnosis is enough is strongly needed to avoid different interpretations of the guidelines and to further ease cross-study comparison of findings. In consideration of that, it should be interesting to perform retrospective studies assessing the frequency of TMDs, as diagnosed with the updated diagnostic criteria, to verify how the adoption of new criteria could influence the distribution pattern of TMD diagnoses. Also, a possible approach to verify the validity of the diagnostic criteria is measuring their accuracy to discriminate between treatment-needing patients and subjects not needing an active treatment. On the other hand, the very low number of articles focusing on combined physical and psychosocial diagnoses contrasts with the emerging importance of axis II findings in the treatment-planning phases. So, increasing attention on the epidemiology of all aspects related to TMD diagnoses has to be strongly recommended for future studies.

CONCLUSIONS

In summary, axis I group III joint disorders and group I muscle disorders were diagnosed more frequently than disk displacements, and significant differences emerged as for the age-related distribution of diagnoses. Such findings confirmed suggestions from previous studies, and provided support to the need for weighting the risk of over- and underestimation of joint and muscle disorders by the adoption of validated diagnostic algorithms. Axis II levels of depression, somatization, and pain-related impairment were within the literature range, and confirmed that only a few patients with TMD developed disabling pain. The need for more investigations on the epidemiology of combined physical and psychosocial features of patients with TMD is recommended.

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