Tinnitus in Temporomandibular Disorders: Axis I and Axis II Findings According to the Diagnostic Criteria for Temporomandibular Disorders

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Aims: To examine the associations of self-reported presence of tinnitus with subtypes of temporomandibular disorders (TMD) as assessed by Axis I of the Diagnostic Criteria for TMD (DC/TMD) and with psychologic characteristics as assessed by Axis II. **Methods:** This retrospective controlled study included 108 consecutive TMD patients referred to the Tel Aviv University Orofacial Pain Clinic. Each patient received full Axis I and Axis II diagnoses according to the DC/TMD. The patients were asked about currently experiencing tinnitus. Pearson chi-square test and Fisher exact test were used to test the associations between categorical variables. Mann-Whitney test was used to assess differences in continuous variables between categories. A P value < .05 was considered statistically significant. **Results:** Thirty-three (30.6%) TMD patients reported experiencing tinnitus. There was a significantly higher prevalence of myofascial pain with referral (P = .008) and nonspecific physical symptoms (P = .014) among the TMD patients who reported tinnitus. In addition, those patients reported significantly longer pain duration compared to TMD patients without tinnitus (P = .039). **Conclusion:** This study emphasizes the necessity of assessing both Axes I and II according to the DC/TMD in future studies and supports creating a standardized tinnitus screener tailored to TMD patients for future studies on tinnitus in TMD patients. *J Oral Facial Pain Headache 2020;34:265–272. doi: 10.11607/ofph.2611*

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Tinnitus, defined as the "conscious perception and reaction to a sound in the absence of a matching external acoustic stimulus," is considered a symptom rather than a disease.[1] Tinnitus is categorized as primary or secondary. Common secondary causes for tinnitus include external, middle, and inner ear pathologies, ototoxic medications, and nonauditory causes, such as myoclonus, vascular anomalies, and tumors.[2] Tinnitus is considered primary and "somatic" when it is evoked or modulated by somatosensory, somatomotor, or visuomotor inputs[3–8] and influenced by contractions of muscles of the head and neck,[4,5,9] orofacial and eye movements,[10,11] or myofascial trigger points.[12] There is no standardized diagnostic criteria for somatic tinnitus.[13–16] Recently, an attempt was made to create a set of criteria that strongly support the diagnosis of somatic tinnitus.[17] According to these criteria, the presence of the following symptoms strongly suggests a somatosensory influence of tinnitus: tinnitus accompanied by frequent cervical, head, and shoulder pain; the presence of myofascial trigger points; increased muscle tension of the suboccipital and extensor muscles of the cervical spine; accompanying temporomandibular disorders (TMD); and/or clenching, bruxism, and dental disease. In addition, modulation of tinnitus by voluntary movements of the head, jaw, neck, or eyes and by pressure on myofascial trigger points strongly suggests a somatosensory influence of tinnitus according to these diagnostic criteria.[17]

The most common musculoskeletal condition associated with somatic tinnitus is TMD, followed by cervical spine disorders.[13] TMD is defined as a heterogenous group of musculoskeletal conditions involving the temporomandibular joint (TMJ), the masticatory muscles, and related structures.[18] The most common diagnostic criteria used for research on TMD is the Diagnostic Criteria for TMD (DC/TMD),[19] based on the older version, the Research Diagnostic Criteria for TMD (RDC/TMD),[20] and was developed in order to improve the reliability and validity of TMD diagnoses and to enable its use for both clinical and research purposes. The dual-axis diagnoses included in this protocol provide information on both physical findings (Axis I) and psychosocial findings (Axis II) in TMD patients. Compared to the general population,[21,22] numerous studies consistently report a significantly higher prevalence of tinnitus among TMD patients.[23,24] Psychologic comorbidities, such as anxiety disorders, depression, and somatization disorders, are also widely reported to be associated with tinnitus.[25–29] All of these comorbidities can be assessed by the Axis I and Axis II instruments of the RDC/TMD or the DC/TMD, but were either not explored at all or were only partially explored in some studies that have used these tools for the diagnosis of TMD.[23,24]

To the best of the authors' knowledge, only one study has examined the prevalence of tinnitus in TMD patients by means of the DC/TMD,[30] but that analysis used both the RDC/TMD and the DC/TMD to diagnose TMD, and Axis II was not assessed. Given the diversity in the prevalence of tinnitus reported among TMD patients and the lack of in-depth studies on associations between different subtypes of TMD diagnoses (as assessed by Axis I of the DC/TMD) and tinnitus, as well as between psychologic characteristics (as assessed by Axis II of the DC/TMD) and tinnitus, the aim of this study was to use the DC/TMD to examine these parameters in patients diagnosed with TMD.

Materials and Methods

Study Population

This retrospective study included 253 consecutive patients who were referred to the Maurice and Gabriela Goldschleger Tel Aviv University Orofacial Pain Clinic and were first seen during 2015 to 2017. In order to assess the current presence of tinnitus, a short modification of the tinnitus screener was added to the DC/TMD questionnaire.[31] The screener included a short description of tinnitus as ringing, humming, or other noises in your ears or head. In addition, the description "when your mouth is at rest" was added to the initial description of the screener in order to differentiate between joint noises and tinnitus. It was further explained that sounds related to mandibular movements, chewing, or yawning (such as clicking or crepitation) were not included in the definition of tinnitus. After these explanations, the patients were asked if they were currently experiencing bilateral or unilateral tinnitus. TMD diagnosis was established according to the DC/TMD using the official Hebrew version.[32] All of the study patients were examined by senior staff members of the Orofacial Pain Clinic who were all certified in the DC/TMD Training and Calibration Course at the Department of Orofacial Pain and Jaw Function, Faculty of Odontology, Malmö University, Sweden (E.W., A.P.E., P.F.R., and S.R.). Excluded from the study were subjects who were younger than 18 years (n = 27), who did not meet the criteria to receive an Axis I diagnosis of TMD according to the DC/TMD specifications[19] (n = 22), and who were diagnosed as having other orofacial pain conditions, such as neuropathic pain (n = 9), rheumatoid arthritis (n = 1), fibromyalgia (n = 9), persistent idiopathic facial pain (n = 6), occlusal dysesthesia (n = 9), odontogenic pain (n = 4), burning mouth syndrome (n = 13), referred otalgia from a cervical source (n = 1), obstructive sleep apnea without a TMD diagnosis (n = 2), oromandibular dystonia (n = 1), coronoid hyperplasia (n = 2), or sinusitis (n = 1). Subjects who did not fill in the questionnaire according to the DC/TMD specifications (n = 16) were not included in the final analysis. The 5 TMD patients who did not fill in the tinnitus questionnaire were excluded from the study. Since only 17 patients were diagnosed with sleep and/or awake bruxism with no TMD diagnosis, they were also excluded from the final analysis.

The final study population was comprised of 108 TMD patients. Each patient received full DC/TMD Axis I and Axis II diagnoses. The following was diagnosed for Axis I: intra-articular TMD (disc displacement with reduction; disc displacement with reduction with intermittent locking; disc displacement without reduction with limited opening; disc displacement without reduction without limited opening); local myalgia; myofascial pain with referral; headache attributed to TMD; arthralgia; degenerative joint disease; and subluxation. The following was evaluated for Axis II: depression level (Patient Health Questionnaire [PHQ]-9), anxiety level (Generalized Anxiety Disorder [GAD]-7), and nonspecific physical symptom levels (PHQ-15 questionnaire). Characteristic pain intensity (CPI), pain persistence (PP) classification, and Graded Chronic Pain Scale (GCPS) version 2.0 were calculated for each patient according to the specifications of the DC/TMD. Further information regarding Axes I and II diagnoses are available at: http://rdc-tmdinternational.org

Ethical Considerations

Approval from the university institutional ethical committee was obtained prior to data collection (#20160419_12230106). Informed consent for the study group was waived since the data were retrieved retrospectively. However, each patient who is referred to the "Orofacial and TMD Clinic" routinely signs a form in which they agree that their data can be anonymously used for research purposes. The study was self-funded by the authors.

Statistical Analysis

Continuous variables were evaluated for normal distribution by means of a histogram and quantile-quantile (Q-Q) plots. Since the continuous variables were not distributed normally, they were reported as median and interquartile range (IQR) or SD and analyzed using nonparametric tests. Categorical variables were described as frequency and percentage. Pearson chi-square test and Fisher exact test were used to test the associations between categorical variables. Mann-Whitney test was used to assess differences in continuous variables between categories. All tests were two-tailed. SPSS Statistics for Windows, version 25.0 (IBM) was used for all statistical analyses. A P value < .05 was considered statistically significant.

Results

The sources of referral of the patients in the study group are presented in Table 1. Of the included patients, 64.8% were referred by dental professions (dentists/specialists in dentistry/dental hygienists), while only one patient was referred by an ear, nose, and throat (ENT) specialist for the purpose of evaluation of tinnitus as the chief complaint. None of the other patients included tinnitus among their chief complaints.

The demographic and socioeconomic data of the study population are shown in Table 2. The male: female ratio was 1:2.6, the mean ± SD age was 36.5 ± 13.98 years, and the age range was 18 to 76 years. The mean reported pain duration was 64.1 ± 89.46 months.

Axis I Diagnoses in the Study Group

Of the study group (n = 108), 50 (46.3%) patients were diagnosed as having local myalgia, 39 (36.1%) as having myofascial pain with referral, 25 (23.1%) as having arthralgia, 26 (24.1%) as having headache attributed to TMD, 44 (40.7%) as having intra-articular disc disorders, 18 (16.7%) as having degenerative joint disease, and 14 (13.0%) as having subluxation.

Table 1 Sources of Referral in the Study Population (n = 108)

Source of referral	No. (%)
General dentist	57 (52.8)
Self-referral	27 (25)
Oral medicine/oral surgery specialist	9 (8.3)
Friend (nonphysician)	6 (5.6)
Family physician	4 (3.7)
Orthodontist	3 (2.8)
Ear, nose, and throat specialist	1 (0.9)
Dental hygienist	1 (0.9)

Axis II Characteristics in the Study Population

- Depression level (according to PHQ-9): 60 (55.6%) scored normal, 33 (30.6%) scored mild, 5 (4.6%) scored moderate, and 10 (9.3%) scored moderately severe-severe.
- Generalized anxiety (according to GAD-7): 81 (75.0%) scored normal (score of 0 to 4), 13 (12.0%) scored mild, 7 (6.5%) scored moderate, and 7 (6.5%) scored severe.
- Nonspecific physical symptoms (according to PHQ-15): 55 (50.9%) scored normal, 38 (35.2%) scored mild, 11 (10.2%) scored moderate, and 4 (3.7%) scored severe.
- CPI (0 to 100): The mean CPI was 54.6 ± 24.54, and the median CPI was 56.60 (34.12 to 73.30).
- GCPS version 2.0: 5 (4.6%) scored level 0, 32 (29.6%) scored level 1, 50 (46.3%) scored level 2, 11 (10.2%) scored level 3, and 10 (9.3%) scored level 4.
- PP: 65 (68.4%) reported < 90 days of pain in the last 6 months, and 30 (31.6%) reported ≥ 90 days of pain in the last 6 months.

Comparison Between TMD Patients With and Without Tinnitus

Thirty-three TMD patients (30.6%) reported tinnitus and were compared to the 75 TMD patients (69.4%) who did not report tinnitus. No demographic or socioeconomic differences were found between the two groups (Table 2).

Regarding Axis I diagnoses (Table 3), significant differences were found only for a diagnosis of myofascial pain with referral (P = .008). Axis II evaluation (Table 4) found significant differences only for nonspecific physical symptoms (PHQ-15 scores) (P = .014), including total score (P = .036). In addition, the duration of pain was longer in the tinnitus group (P = .039) (Table 3).

Table 2 Comparison of Demographic and Socioeconomic Data Between TMD Patients With and Without Tinnitus

Demographic and socioeconomic data	TMD without tinnitus (n = 75)	TMD with tinnitus (n = 33)	Study group (n = 108)	*P*
Sex				
Male	20 (26.7)	10 (30.3)	30 (27.8)	.698
Female	55 (73.3)	23 (69.7)	78 (72.2)	
Age, y				
Mean (SD)	36.47 (14.48)	36.67 (13.004)	36.5 (13.98)	.696
Median (IQR)	32.00 (25.00 to 46.00)	33.00 (26.50 to 41.00)	33.00 (26.00 to 45.00)	
Education				.175
Elementary/high school	23 (31.1)	7 (21.2)	30 (28.0)	
Some college/college graduate	38 (51.4)	15 (45.5)	53 (49.5)	
Professional or postgraduate level	13 (17.6)	11 (33.3)	24 (22.4)	
Income				.581
Very low, low	12 (16.7)	3 (9.1)	15 (14.3)	
Average	41 (56.9)	20 (60.6)	61 (58.1)	
High, very high	19 (26.4)	10 (30.3)	29 (27.6)	
Marital status				.898
Never married	33 (44.6)	13 (39.4)	46 (43.0)	
Married/living as married	35 (47.3)	18 (54.5)	53 (49.5)	
Divorced/separated	4 (5.4)	2 (6.1)	6 (5.6)	
Widowed	2 (2.7)	0 (0)	2 (1.9)	

Data are reported as n (%) unless otherwise indicated. IQR = interquartile range.

Table 3 Comparison of Axis I Diagnoses, Characteristic Pain Intensity (CPI), and Pain Duration Between TMD Patients With and Without Tinnitus

Axis I diagnoses	TMD without tinnitus (n = 75)	TMD with tinnitus (n = 33)	*P*
Myalgia	39 (52.0)	11 (33.3%)	.073
Myofascial pain with referral	**21 (28.0)**	**18 (54.5%)**	**.008**
Arthralgia	19 (25.3)	6 (18.2%)	.417
Headache attributed to TMD	19 (25.3)	7 (21.2%)	.644
Intra-articular TMD[a]	32 (42.7)	12 (36.4%)	.539
Degenerative joint disease	13 (17.3)	5 (15.2%)	.779
Subluxation	12 (16.0)	2 (6.1%)	.219
Report of headache	39 (53.4)	23 (69.7%)	.115
Mean (SD) pain duration, mo	**52.17 (68.45)**	**90.56 (121.28)**	**.039**
Median (IQR) pain duration, mo	**24.00 (8.00 to 72.00)**	**42.00 (19.50 to 120.00)**	
Mean (SD) headache duration, mo	42.42 (67.24)	51.19 (50.06)	.115
Median (IQR) headache duration, mo	9.00 (2.00 to 60.00)	36.00 (7.50 to 96.00)	
Mean (SD) CPI	54.37 (25.99)	55.23 (21.25)	.989
Median (IQR) CPI	56.60 (33.30 to 76.60)	53.30 (43.30 to 70.00)	

Data are reported as n (%) unless otherwise indicated. Statistically significant values ($P < .05$) are in bold.
IQR = interquartile range.
[a]Disc displacement with reduction; disc displacement with reduction with intermittent locking; disc displacement without reduction; disc displacement without reduction without limited opening

Discussion

In the current study, 33 of 108 (30.6%) TMD patients reported perceiving tinnitus. This finding is higher than the reported prevalence of tinnitus in the general population[21,22] (8% to 25.3%) and supports previous studies that consistently show a higher prevalence of tinnitus among TMD patients. In two systematic reviews and meta-analyses,[24,33] the prevalence of tinnitus in TMD patients ranged from 3.7% to 70%. The authors did not limit the inclusion criteria to RDC/TMD– or DC/TMD–based studies. This may raise some uncertainty about the consistency of the diagnosis of TMD and may, therefore, be one of the reasons for the wide variation in the reported prevalence of tinnitus in these two systematic reviews. Indeed, Mottaghi et al[23] were able to narrow the variation of reported prevalence of tinnitus among TMD patients (35.8% to 60.7%) by selecting only RDC/TMD– or DC/TMD–based studies. Differences in clinical settings or in diagnostic and selection criteria may create a different composition of TMD patients. As mentioned in a recent commentary by Manfredini,[34] considering "TMD" as an umbrella term is problematic when attempting to investigate and analyze the associations between different diagnoses included under this term and tinnitus, and, for that matter, any other associations. For example, Calderon et al[35] selected

Table 4 Comparison of Axis II Evaluations Between TMD Patients With and Without Tinnitus

Axis II evaluation		TMD without tinnitus (n = 75)	TMD with tinnitus (n = 33)	*P*
GCPS = 0		4 (5.3)	1 (3.0)	.721
GCPS = 1		23 (30.7)	9 (27.3)	
GCPS = 2		33 (44)	17 (51.5)	
GCPS = 3		8 (10.7)	3 (9.1)	
GCPS = 4		7 (9.3)	3 (9.1)	
Low disability (GCPS 0, 1, 2)		60 (80.0)	27 (81.8)	.826
High disability (GCPS 3, 4)		15 (20.0)	6 (18.2)	
Depression (PHQ-9)				
Normal	≤ 4	43 (57.3)	17 (51.5)	.902
Mild	5–9	20 (26.7)	13 (39.4)	
Moderate	10–14	3 (4.0)	2 (6.1)	
Moderately severe-severe	15+	9 (12.0)	1 (3.0)	
Total score				.838
Mean (SD)		5.67 (6.38)	4.94 (4.23)	
Median (IQR)		3.00 (1.00–8.00)	4.00 (2.00–7.50)	
Anxiety (GAD-7)				
Normal	≤ 4	55 (73.3)	26 (78.8)	.432
Mild	5–9	8 (10.7)	5 (15.2)	
Moderate	10–14	6 (8.0)	1 (3.0)	
Severe	15+	6 (8.0)	1 (3.0)	
Total score				.454
Mean (SD)		4.24 (5.47)	2.94 (3.59)	
Median (IQR)		2.00 (0–5.00)	2.00 (0–4.00)	
Nonspecific physical symptoms (PHQ-15)				
Normal	**≤ 4**	**44 (58.7)**	**11 (33.3)**	**.014**
Mild	**5–9**	**23 (30.7)**	**15 (45.5)**	
Moderate	**10–14**	**6 (8.0)**	**5 (15.2)**	
Severe	**15+**	**2 (2.7)**	**2 (6.1)**	
Total score				**.036**
Mean (SD)		**4.73 (4.11)**	**6.24 (3.97)**	
Median (IQR)		**4.00 (2.00–7.00)**	**5.00 (4.00–8.00)**	
PP score ≤ 89 d		42 (64.6)	16 (53.3)	.295
PP score < 90 d		23 (35.4)	14 (46.7)	

Data are reported as n (%) unless otherwise indicated. Statistically significant ($P < .05$) values are in bold. IQR = interquartile range; GCPS = Graded Chronic Pain Scale (version 2.0); GAD = Generalized Anxiety Disorder; PHQ = Patient Health Questionnaire; PP = pain persistence.

only female chronic TMD patients who had a history of TMD for more than 6 months. The reported prevalence of tinnitus in this study was 54.24%, with no difference in pain duration between patients who reported tinnitus and those who did not report tinnitus. This is in contrast to the current study, which showed a significantly longer pain duration in TMD patients who reported tinnitus ($P = .039$). A similarly high prevalence (60%) was reported in another study that was performed in a hospital-based tertiary clinic.[36]

In the current study, examination of the Axes I and II results revealed that TMD patients who reported tinnitus exhibited differences in biologic and psychologic components of the biopsychosocial model. For Axis I diagnoses, the only group difference found in the current study was a significantly higher prevalence of myofascial pain with referral in the tinnitus TMD group compared to TMD patients who did not report tinnitus ($P = .008$). To the best of the authors' knowledge, the current study is the first to examine the association of the two distinct myogenic group entities (as defined in the DC/TMD Axis I) with tinnitus: specifically, local myalgia and myofascial pain with referral. These results support the recent diagnostic criteria suggested for somatic tinnitus,[17] which include both the existence of myofascial trigger points and modulation of tinnitus by pressure on these trigger points. While several studies support the association between myofascial trigger points and tinnitus,[12,37,38] Mottaghi et al,[23] who reviewed five RDC/TMD–based studies, concluded that there is no scientific evidence in the literature on which subclass of Axis I diagnosis according to the RDC/TMD or DC/TMD is more prevalent in TMD patients who report tinnitus due to the fact that only one study[39]—which showed significant associations with myofascial pain with limited opening, disc displacement with reduction, and arthralgia—adhered to the Axis I diagnoses and subclassified the patients in detail. Therefore, more research with strict adherence to Axis I of the DC/TMD is warranted.

For Axis II diagnoses, all DC/TMD Axis II components were included in the current study. In addition, PP, pain duration, and CPI were calculated for

each patient. Significant differences were found only for nonspecific physical symptoms and pain duration. Patients suffering from tinnitus were shown to exhibit a high prevalence of psychiatric disorders,[25–29] and a correlation between presence of a psychiatric disorder and tinnitus-related severity and intereference was shown.[40] Unfortunately, the majority of studies that used the RDC/TMD or DC/TMD either only partially assessed Axis II components[36,39,41,42] or omitted them altogether.[30,35,43–50] While the current study did not find significantly higher levels of depression in the tinnitus group compared to other studies,[38,40,41] it should be noted that comparing Axis II results by means of the RDC/TMD to Axis II results by means of the DC/TMD is problematic due to the use of different questionnaires and probably skewed cutoff points.[51] None of the studies that used the RDC/TMD examined the association between tinnitus and levels of nonspecific physical symptoms or anxiety. The only study that assessed tinnitus in TMD by means of the DC/TMD did not assess Axis II.[30] The lack of Axis II assessment is especially problematic since psychologic treatment, particularly cognitive behavioral therapy, was shown to be effective for subjective tinnitus.[52–54] This problematic issue of not considering Axis II components of the RDC/TMD and the DC/TMD was pointed out by Palla.[55]

TMD patients who reported tinnitus showed a significantly longer duration of TMD compared to TMD patients who did not report tinnitus ($P = .039$). When combining this information with the Axis I and II findings reported above, the concurrent significantly higher prevalence of myofascial pain with referral, nonspecific physical symptoms, and longer pain duration in TMD patients who report tinnitus point to a resemblance of this subgroup of TMD patients to fibromyalgia patients. Indeed, studies consistently show a high prevalence of tinnitus in fibromyalgia patients.[56,57] While the current study excluded patients who were diagnosed with fibromyalgia (n = 9) and this association was not examined, this resemblance is noteworthy and adds to previous resemblance reports.[58,59]

This study has several limitations: First, a modification of a tinnitus screener was used to assess the prevalence of tinnitus among TMD patients. Thus, no additional information was obtained as to the characteristics of the tinnitus, such as frequency, severity, duration, intensity, and psychologic impact. Keeping in mind the extensive and lengthy DC/TMD questionnaire and trying not to increase subject burden and decrease reliability due to subject fatigue,[60] the question is whether a detailed tinnitus questionnaire should be used initially or whether tinnitus screening should be used first, followed by a more detailed questionnaire once the patient has reported tinnitus. Another important issue is creating a tinnitus screener tailored for TMD patients. This screener will include information that will aid in the differentiation between joint noises and tinnitus, as this distinction may confuse TMD patients who may experience joint noises in addition to tinnitus. Therefore, this special modification was added to the tinnitus screener used.

Second, in the current study, the concurrent report of tinnitus and TMD signs and symptoms suggested somatic tinnitus as the correct diagnosis. However, these patients did not receive a full ear, nose, and throat examination prior to inclusion in the study. It should be noted that only one patient was referred by an ENT specialist after a complete examination that ruled out other etiologies for tinnitus, and 24 of the other 32 patients reported bilateral tinnitus. No patients reported pulsatile tinnitus, any other suspected otologic symptoms, the use of suspected ototoxic medications, or any abnormal cranial nerve findings. In addition, it would be helpful to keep Cochrane's aphorism in mind when discussing the need for a full ENT evaluation, which asks whether the results of an ENT examination will change the behavior of a treating dentist. In most cases, the answer will probably be "no," but the cost to the patient and to society will be considerable.

And finally, in the current study, the decision was made to include all subtypes of Axes I and II of the DC/TMD, in contrast to the majority of previous studies. This of course increased the number of comparisons to 27 at the .05 significance level and may have increased the probability of a false positive. It should be remembered that a strict requirement for adjusting for all comparisons may encourage researchers to decrease the number of comparisons presented. While multiple-comparisons corrections are strongly considered for confirmatory analyses, when it comes to exploratory studies of existing data, a strict adjustment for multiple comparisons is less critical. It is therefore recommended for follow-up studies to confirm the results reported herein.

Conclusions

This study shows the importance of adhering to a biopsychosocial model and including assessment of all the different diagnoses according to the Axis I criteria of the RDC/TMD and DC/TMD, as well as a full Axis II assessment of TMD patients. Future comparisons between studies with large data will not be possible without adhering to the precise DC/TMD protocol, not only for tinnitus but for any other study on TMD. Creating a specialized and standardized tinnitus screener for TMD patients will enable the identification of TMD patients who suffer from tinni-

tus, as it appears that unless asked specifically, the TMD patient will most likely not report tinnitus, as was shown in the current study and has been reported by others.[50]

After identifying a TMD patient who suffers tinnitus, a further detailed questionnaire, examination, and referral for a full ENT evaluation is warranted.

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