Original Article

The epidemiological profile of temporomandibular joint disorders in the Tunisian population: A cross-sectional study

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ABSTRACT

Objective: This study aimed to explore the prevalence, signs, and symptoms of different types of TMD (Temporomandibular joint disorders) disorders in Tunisian patients.
Methods: A retrospective cross-sectional study was conducted using the clinical records of patients from the Department of Functional Exploration, Pain, and Orofacial Dysfunction of the Dental Clinic of Monastir.
Results: TMD is associated with a female predominance, with a peak prevalence among those aged between 20 and 40 years. Pain and a limited range of motion were significantly more prevalent in women (p = 0.019 and p = 0.012, respectively). Clicking sounds were the most frequent joint noises (38.2 %). Crepitus was more prevalent among older adults (33 %). Of the different types of TMD, disk displacement with reduction was the most prevalent (n = 216, 39 %). Sleep bruxism was more prevalent than awake bruxism (20.7 % VS 9.5 %). Due to the heterogeneous TMD signs and symptoms, patients tend to seek medical attention from various specialties (e.g. neurology and otolaryngology).
Conclusion: The prevalence of different types of TMD, and the different signs and symptoms varied depending on sociodemographic characteristics, such as sex, age and lifestyle. Diagnosis is challenging and TMD may be confused with other orofacial pain conditions.

1. Introduction

Temporomandibular joint disorders (TMD) are a group of musculo-skeletal pathologies that involve the temporomandibular joints (TMJ), masticatory muscles, and associated tissues (Fernandes et al., 2014). The most frequently described symptoms are pain, joint sounds, and limited ranges of motion (Manfredini et al., 2011; Suvinen et al., 2005). The prevalence varies widely among populations, depending on lifestyle, quality of life, stress exposure, race, as well as sociodemographic and economic profiles (Kmeid et al., 2020). In the general population, the prevalence ranges from 6 % to 12 %, with a clear predominance for women and those aged between 20 and 40 years (Bueno et al., 2018; Fernandes et al., 2014; Leresche and Drangsholt, 2008; Manfredini et al.,2011; Poveda-Roda et al., 2007; Qvintus et al., 2020).

Several epidemiological studies in different populations have been conducted (Alkisti et al., 2012; Bengt et al., 2014; Bagis et al., 2012; Cooper and Kleinberg, 2007; Ferreira et al., 2016; Kmeid et al., 2020; Karibe et al., 2012; Manfredini et al., 2006; Qvintus et al., 2020). To date, no studies have yet evaluated the characteristics of TMD in the Tunisian population.

This retrospective cross-sectional study aimed to explore the prevalence of different types of TMD and their signs and symptoms in the Tunisian population.

2. Materials and Methods

2.1. Study design

This retrospective cross-sectional study analysed the clinical records of patients with TMD from the Department of Functional Exploration, Pain, and Orofacial Dysfunction of the Dental Clinic of Monastir from 2007 to 2015.

Only TMD diagnoses based on the Axis I Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were explored, and neuropathic pain was excluded. Each patient may be diagnosed with one or more conditions.

2.2. Data collection

Clinical records were selected using an elementary draw from a pool of 1852. The data collected were as follows: (i) sociodemographic characteristics of the patients, including age at first consultation, sex, and occupation; (ii) psychological state of the patient during psychiatric follow-up and treatment; (iii) signs and symptoms, such as pain location, joint sounds, range of motion, and functional difficulties; (iii) diagnosis.

2.3. Statistical analysis

Data were analysed using Statistical Package for Social Sciences (SPSS), version 18.0. Descriptive results are summarised as frequencies for qualitative variables and means and standard deviations for quantitative variables. The Chi-square index was performed to compare the frequencies. A p-value of 0.05 was considered statistically significant.

3. Results

3.1. Patient characteristics

Five hundred and fifty clinical records were obtained. Four hundred and nineteen (76.2 %) were female and 131 (23.8 %) were male (female to male sex ratio = 3.2). Their ages ranged from 11 to 88 years (mean age ± SD = 30.37 ± 13.26 years). The age distribution analysis showed a predominance for young adults (61.3 %). Students comprised 40.5 % of the study population (Table 1).

3.2. TMD signs and symptoms

Pain was the most prevalent chief complaint (70.7 %). Pain was also significantly more frequent in women (73.7 % vs. 62.6 %; p = 0.019). Overall, the most prevalent TMD sign, as determined by clinical examination, was muscular pain (56.73 %). In contrast, joint pain was significantly more common in women than in men (35.32 % vs. 21.37 %, p = 0.003). Joint sounds were the second most reported chief complaint

in men and women (both 47.3 %) (Table 2). Clicking was the most prevalent joint sound in men and women (both 38 %) (Table 3). The distribution of joint sounds by age showed that clicking was significantly more prevalent among children and adolescents (p < 0.001), and tended to decrease with age. Conversely, crepitus was more common among older adults (p < 0.001) (Table 5). Furthermore, a limited range of motion was significantly more frequent among women (p = 0.012) (Table 3).

3.3. TMD diagnoses

Among the different types of TMD diagnosed, disc displacement was the most common. Moreover, disc displacement with reduction (DDWR) was the most prevalent type of disc displacement diagnosed (Table 4). DDWR was more prevalent in children and adolescents than in adults. In contrast, osteoarthrosis was predominantly detected in older adults. Additionally, bruxism was significantly more common in adults than in children (Table 5). Furthermore, disc displacement without reduction (DDWoR) was statistically more prevalent in women (p = 0.006) (Table 4).

4. Discussion

This is the first study to assess the prevalence of TMD and the associated signs and symptoms in the Tunisian population.

4.1. Epidemiological profile

4.1.1. Sex
The results of this study showed that TMD was most prevalent in women (sex ratio = 3.2:1). This finding is consistent with those of similar studies (reported female-to-male sex ratios = 2.6:1 to 5:1) (Bueno et al., 2018; Leresche and Drangsholt, 2008; Manfredini et al., 2011). Poveda-Roda et al., 2007; Qvintus et al., 2020). The female predisposition to TMD can be explained by psychosocial and neurobiological factors, especially hormonal considerations (for example, oestrogen's role in phosphocalcic metabolism, bone remodelling, inflammatory responses, and endogenous opioid neurotransmission) (Rebecca 2007). Women also tend to seek treatment more frequently (Bueno et al., 2018; Poveda-Roda et al., 2007). The predominance of TMD among women was confirmed in this study, and several physiological and behavioural aetiologies may be implicated.

4.1.2. Age
Of the participants, 61.3 % were aged between 19 and 40 years old. This concurred with the high incidence of TMD in young adults reported

Table 1
Socio-demographic data of Tunisian TMD patients.

	Study Population n (550)		Male n (131)		Female n (419)	
	n	%	n	%	n	%
Age mean	30.37 ± 13.26	–	30.73 ± 13.6	–	30.26 ± 13.16	–
Age range						
Child and adolescents (<18)	94	17.1	29	22.1	65	15.5
Young adults [19–40]	337	61.3	71	54.2	266	63.5
Adults [41–64]	110	20	30	22.90	80	19.1
Elderly (>65)	9	1.6	1	0.8	8	1.9
Occupation						
Student	223	40.5	59	45	164	39.1
housewife	122	22.2	–	–	122	29.1
Teacher	26	4.7	4	3.1	22	5.3
Worker (factory, dressmaker..)	39	7.1	8	6.1	31	7.4
Others conditions	140	25.5	60	45.8	80	19.1
Refering doctor*						
Dentist	122	55.5	30	24.6	92	75.4
Orthodontist	36	16.4	6	16.7	30	83.3
MFS	52	23.6	20	38.5	32	61.5
ORL, GP,Neuro	10	4.5	4	40	6	60
Psychiatric problems	47	8.5	6	12.8	41	87.2

* Data collected only for 220 patients; MFS: Maxillofacial surgeon; ORL: Otolarynghologist; GP: generalist practitioner, Neuro: neurologist.

Table 2
Prevalence and distribution of Tunisian TMD patients' chief complaints and referring doctor by gender.

Chief complaint	Study Population (n = 550)		Women (n = 419)		Men (n = 131)		p- value
	n	%	n	%	n	%	
Pain	389	70.7	307	73.3	82	62.6	0.019
Joint sounds	260	47.3	198	47.3	62	47.3	0.988
Functional difficulties	139	25.3	104	24.8	35	26.7	0.663
Limited range of motion	84	15.3	73	17.4	11	8.4	0.012
Refering doctor*							
Dentist	122	55.5	92	57.5	30	50	
Orthodontist	36	16.4	30	18.75	6	10	
MFS	52	23.6	32	20	20	33.3	
ORL, GP,Neuro	10	4.5	6	3.7	4	6.7	

* Data collected only for 220 patients; MFS: Maxillofacial surgeon; ORL: Otolarynghologist; GP: generalist practitioner, Neuro: neurologist. p-value: probability in the χ2 test. p > 0.05 not significant.

Table 3
Prevalence and distribution of different TMD diagnosis and parafunctions by gender in a group of Tunisian TMD patients.

Diagnosis	Study population (n = 550)		Men (n = 131)		Women (n = 419)		p-value
	n	%	N	%	n	%	
Diagnosis							
DDWR	216	39.3	51	38.9	165	39.4	0.927
DDWOR	78	14.2	9	6.9	69	16.5	0.006
Hypermobility	152	27.6	39	29.8	113	27	0.531
Arthrosis	17	3	2	1.5	15	3.6	0.431
arthritis	2	0.4	0	0	2	0.5	1
arthralgia	7	1.3	2		5		0.637
Myofascial pain	80	14.5	19	14.5	61	14.6	0.988
Myofascial pain with LMO	12	2.2	4	3.1	8	1.9	0.434
Parafunctions							
Awake Bruxism	52	9.5	9	6.9	43	10.3	0.247
Sleep Bruxism	114	20.7	35	26.7	79	18.9	0.053

p-value: probability in the χ2 test. p > 0.05 not significant. DDWR: disc displacement with reduction; DDWoR: disc displacement without reduction; LMO: limited mouth opening.

Table 4
Prevalence and distribution of TMD signs by gender in a group of Tunisian TMD patients.

Signs	Study population (n = 550)		Men (n = 131)		Women (n = 419)		p
	n	%	n	%	n	%	
Muscular pain	312	56.73	65	49.6	247	58.95	0.06
TMJ pain	176	32	28	21.37	148	35.32	0.003
Headache	14	2.5	4	3.05	10	2.39	0.75
Clicking	210	38.2	50	38.2	160	38.2	0.997
Cracking noise	9	1.6	2	1.7	7	1.5	1
Crepitation	16	2.9	1	3.6	15	0.8	0.135
Limited range of motion(mm)	81	14.73	11	8.4	70	16.7	0.012
- 20	8	1.45	0	0	8	1.9	
[20 – 30]	43	7.81	7	5.3	36	8.6	0.091
[30—35]	30	5.45	4	3.1	26	6.2	
Laxity							0.66
[40–50]	26	4.7	6	4.6	20	4.8	
>50	121	22	33	25.2	88	21	

p-value: probability in the χ2 test. p > 0.05 not significant.

in other studies (Manfredini et al., 2011; Ferreira et al., 2016). It is important to note that TMD was diagnosed in all ages. However, the nature of musculoskeletal disorders varies with age. For example, hypermobility disorders were more common in younger patients, while osteoarthrosis was much more common in those 50 years and older, especially postmenopausal women (Manfredini et al., 2010). Notably, TMD is generally more prevalent among young adults but there are exceptions in specific subgroups.

4.1.3. Occupation and psychological profiles

In this study, students represented the majority (40.5 %). High-stress exposure among students may be the common predisposing factor for TMD. Furthermore, students are at greater risk for psychological problems; therefore, they are often included as a target population in studies that investigate the influence of psychological factors on the prevalence and development of TMD signs and symptoms (Stallman, 2010). Moreover, the association between psychological factors and chronic pain conditions, such as TMD, is well-documented. Psychological problems, such as depression, anxiety, and stress, seem to be more common in those with chronic TMD pain than in healthy controls. Furthermore, psychological functioning measures have been effective in predicting

the onset of TMD (Fillingim et al., 2013). The findings confirmed that 8.5 % of patients experienced psychological problems. Thus, it is plausible that the prevalence may have been underestimated in this study. As a retrospective study, only patients undergoing psychiatric treatment and follow-up were considered. Our results support that psychological factors may influence the development of TMD. Importantly, a causal relationship between these pathological entities may exist.

4.2. Signs and symptoms

4.2.1. Pain

Pain was the most common symptom (70.7 %). It should be noted that pain is a subjective symptom and difficult to quantify. The most prevalent pain conditions were myalgia and arthralgia. These types of TMD often presented simultaneously, and muscular pain was the most common symptom. Joint pain was more prevalent among women, which suggests a possible link between the pathogenesis of TMD and female hormones, such as oestrogen. Oestrogen is known to influence the inflammatory process. Our results are consistent with findings reported in the literature (Manfredini et al., 2006).

4.2.2. Joint sounds

Joint sounds were found in 42.7 % of patients. Clicking was the most prevalent (38.2 %) joint sound, and more common among adolescents (54.3 %) and young adults (41.5 %). An increased ligament laxity in children, adolescents and young adults may be a possible reason. Laxed ligaments attaching the disc to the poles of the condyles may lead to clicking sounds.

Joint crepitus was found in 2.9 % of patients. The peak prevalence was detected in older adults (33.3 %). A high prevalence of degenerative disorders with age may be a key reason.

The prevalence of clicking was the same in both sexes (38.2 %). Crepitus was observed more frequently in female patients. A female predisposition to degenerative diseases, leading to crepitations may be a possible explanation. However, no significant differences were observed between the groups. Importantly, although joint sounds are among the most prevalent clinical signs, they should not be considered a therapeutic objective.

4.3. Referring healthcare professional

Owing to missing data, the number of referring healthcare professionals was determined for only 220 patients. The results showed that 55.5 % of the patients were referred by general dental practitioners. This reflects the specificity of these disorders, requiring specialised care. Another 16.4 % of patients were referred by orthodontists, which may infer a possible relationship between TMD and malocclusion. Up to 23 % of patients were referred by oral maxillofacial surgeons. A proportion of patients were referred by general medical practitioners or otolaryngologists. Our observations suggest that TMD may be the most common orofacial pain condition of non-odontogenic origin. TMD is associated with an ambiguous clinical semiology, with frequent concurrent presence of other symptoms, such as otologic symptoms, headaches, and tooth pain. As a result, TMD may be confused with other disorders involving the cephalic extremities, and patients may seek treatment from different specialists (other than dentists), such as neurologists, otolaryngologists, or maxillofacial surgeons. Although our data was incomplete, this is the first study to report on where patients with TMD seeking treatment. These findings highlight the challenges faced by patients and clinicians, confirming that TMD is difficult to diagnose.

4.4. Diagnoses

4.4.1. Disc displacement

Disc displacement (with or without reduction) was the most common type of TMD (53.5 %). Our findings are consistent with those reported in

Table 5

Distribution of TMD signs and symptoms, parafunctions and TMD diagnosis by age range in a group of Tunisian TMD patients.

	[0–18] (n = 94)		[19–40] (n = 337)		[41–65] (n = 110)		>65 (n = 9)		P-value
	n	%	n	%	n	%	n	%	
Symptoms / Signs									
Muscles pain	45	47.9	191	56.7	71	64.5	4	44.4	0.098
Pain in TMJ	30	31.9	107	31.7	33	30	5	55.5	0.475
headache	1	1.1	11	3.3	2	1.8	0	0	0.569
TMJ sounds									
Clicking	51	54.3	139	41.2	19	17.3	0	0	<0.001
Cracking noise	1	1.1	4	1.2	4	3.6	0	0	0.323
Crepitus	2	2.1	3	0.9	8	7.3	3	33.3	<0.001
Limited range of motion	14	14.9	55	16.3	12	10.9	2	22.2	0.482
Parafunctions									
Awake Bruxism	4	4.25	30	8.9	18	16.4	0	0	0.017
Sleep Bruxism	7	7.4	61	18.1	45	40.9	1	11.1	<0.001
diagnosis									
DDWR	52	54.7	143	42.6	20	18.2	1	11.1	<0.001
DDWoR	14	14.9	53	15.8	8	7.3	3	33.3	0.102
Hypermobility	25	26.6	103	30.6	21	19.1	3	33.3	0.125
osteoarthrosis	0	0	5	1.5	10	9.1	2	22.2	0.000
osteoarthritis	0	0	1	0.3	1	0.9	0	0	0.725
arthralgia	0	0	6	1.8	1	0.9	0	0	0.543
Myofascial pain	11	11.7	42	12.5	27	24.5	0	0	0.007
Myofascial pain with LMO	2	2.1	8	2.4	2	1.8	0	0	0.954

p-value: probability in the χ2 test. p > 0.05 not significant. DDWR: disc displacement with reduction; DDWoR: disc displacement without reduction; LMO: limited mouth opening.

the literature (Manfredini et al., 2011). Overall, DDWR was the most prevalent. It is also more common in women, and most cases occur during adolescence and childhood. The prevalence of DDWR tends to decrease with age. Clicking is the most common clinical sign associated with DDWR. The high prevalence of clicking among children and adolescents correlates with a high prevalence of DDWR. Despite its high prevalence, DDWR only requires treatment if pain or functional difficulties are present.

DDWoR was also more prevalent among women. This finding aligns with the predominance of mandibular movement restrictions in women. Moreover, most patients with DDWoR seek treatment in the acute stage, which is mainly characterised by pain and a limited range of motion.

4.4.2. Joint hypermobility

The second most common articular disorder was temporomandibular joint hypermobility (TMJH; 27.6 %). TMJH is predominant in women. A cross-sectional descriptive study involving 69 patients with TMJH reported that 74.2 % of patients were female (Nosouhian et al., 2015). Our result concurs with the findings of that study. Our results showed that, of the 152 patients diagnosed with TMJH, 113 (74.3 %) were women. This female predominance could be explained by biological factors (hormones), and anatomical and histological factors (muscle and ligament laxity) (Poveda-Roda et al., 2007). In the future, comparative studies evaluating anatomical and histological differences between the sexes are warranted.

4.4.3. Group III TMD diagnosis (arthralgia, arthritis and osteoarthrosis)

Regarding the group III axis 1 TMD diagnoses, namely, arthralgia, osteoarthrosis, and arthritis, arthralgia was diagnosed in 1 % of patients. The prevalence in our study population was far lower than that reported in the literature. For example, Manfreddini et al., in their *meta*-analysis, reported a prevalence of 34.2 % for arthralgia (Manfredini et al., 2011). Of note, only isolated arthralgia was considered in this study. This differed from other studies, which considered joint pain as a symptom of other TMDs as well as arthralgia. Notably, joint pain was reported by 32 % of patients included in this study. As arthralgia generally involves an inflammatory process in the joint structures, it should be considered a

clinical symptom but not a diagnosis. Therefore, the RDC for axis 1 TMD and taxonomy should be reviewed.

Osteoarthrosis was detected in 3 % of patients, with a clear predominance in women and a peak prevalence among older adults. These findings are consistent with the results in the literature. Osteoarthrosis may be caused by a reduced adaptive capacity of the joint due to advanced age or mechanical overload, which may be conditioned by parafunctions or malocclusion (Guarda-Nardini et al., 2012; Tanaka et al., 2008). Although osteoarthrosis is attributed to advanced age, no age group can be spared from this pathological entity.

Temporomandibular arthritis rarely occurs in isolation. It is usually associated with systemic diseases, such as rheumatoid arthritis (RA), systemic sclerosis (SS), psoriatic arthritis, lupus erythematosus, and ankylosing spondylitis. This was observed in three patients in the present study, two of whom had RA and one had SS.

4.4.4. Bruxism

Bruxism was detected in 30.2 % of patients. The prevalence in men and women was similar. In particular, sleep bruxism was more prevalent (20.7 %). Previous epidemiological studies demonstrated that the prevalence of bruxism tends to decrease with age, and the highest prevalence is observed among children (Manfredini et al., 2013). However, in this study, bruxism, especially sleep bruxism, was predominant among adults. This may be explained by the small number of children in this population study. Therefore, the results cannot be extrapolated and applied to the general population. A positive association between bruxism and TMD, particularly myofascial pain, has previously been reported (Manfredini et al., 2003). The high prevalence of bruxism among patients with TMD suggests a possible causal relationship between TMD and bruxism. Further investigations to validate this finding is important.

5. Conclusion

TMD is more common in women and young adults. The high prevalence of TMD among students suggests that stress and quality of life influence the development of TMD. The most frequent symptoms were

pain, joint sounds, and a limited range of motion. Pain is the most common symptom and the primary reason patients seek treatment. TMD pain is considered a diagnostic and therapeutic challenge because referred pain may be confused with other pathological entities, such as otologic and neurological disorders. This study found that the most common types of TMD are DDWR, joint hypermobility, and myofascial pain. As this study focused on axis 1 RDC/TMD diagnoses, future clinical trials that assess psychological factors associated with TMD using psychometric measurements are needed. Additionally, epidemiologic studies that examine TMD prevalence in the general population are also warranted.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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