ISSN 2091-2889 (Online)
ISSN 2091-2412 (Print)

Journal of Chitwan Medical College 2019;9(29):34-42
Available online at: www.jcmc.cmc.edu.np

ORIGINAL RESEARCH ARTICLE

PREVALENCE OF TEMPOROMANDIBULAR DISORDERS AMONG NEPALESE POPULATION

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Received: 30 Jan, 2019
Accepted: 1 Sept, 2019
Published: 17 Sept, 2019

Key words: Clicking; Deviation; DC/TMD criteria; RDC criteria; TMD.

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DOI:https://doi.org/10.3126/jcmc.v9i3.25780

Citation

Shivhare P, Singh V, Giri R, Singh A, Penumatcha MR, Taparia N, Sabah N. Prevalence of temporomandibular disorders among Nepalese population. Journal of Chitwan Medical College. 2019; 9(29):34-42.

Peer Reviewed

ABSTRACT

Background: Temporomandibular disorders (TMDs) comprise of a variety of clinical signs and symptoms such as joint sounds, muscle tenderness, joint tenderness, deviation, deflection, pain on mouth opening, protrusive, lateral movement and limited mouth opening which can be the result of trauma, stress, gum chewing, hard food biting habits, bruxism, long dental appointment. This study was aimed to determine the prevalence of temporomandibular disorders in Nepalese population in Eastern Nepal.

Methods: The study was performed from May 2018 to Oct 2018. All the patients who came to the Department of Oral Medicine and Radiology, Nobel Medical College and Teaching Hospital (NMCTH) and health camps in Eastern part of Nepal were included. The self-administered questions were asked to the subjects about demographic data, different signs and symptoms of TMDs and etiological factors responsible for it.

Results: More than two thirds of the study sample (83.96%) in the present study had one or more clinical signs and symptoms of TMDs. Deviation of mandible on mouth opening and clicking sound made up the highest percentage. Females were reported to have significantly higher prevalence of TMDs signs and symptoms than male. Disc displacement was the most prevalent disorder followed by myofascial pain and degenerative joint disorder.

Conclusions: The results of this study show that a significant percentage of the population has signs and symptoms of TMDs. Measures should be taken to prevent and treat TMDs in this part of the world.

INTRODUCTION

Temporomandibular joint (TMJ) is one of the most intricate joints, composed of glenoid fossa of the temporal bone and the head of mandibular condyle, articulating disk associated with muscles and ligament. Mandibular movement occurs as a complex series of interrelated three dimensional rotational and translational activities. It is determined by the combined and simultaneous activities of both TMJ. [1-2] Temporomandibular disorders comprises of a variety of clinical signs and symptoms confined to the TMJ and/ or related structures (masticatory musculature, bone and facial structures) which include clicking, crepitus, muscle tenderness, joint tenderness, deviation, deflection, pain on mouth opening, protrusive, lateral movement and limited mouth opening (less than 40 mm), jaw locking, and dislocation, referred pain /headache and morning joint / muscle stiffness etc. TMDs can be the result of trauma, stress, gum chewing, hard food biting habits, bruxism, and long dental appointment. It has been

reported that prevalence of TMDs ranged from 19% to 92.1%, the most affected age group varied between 20 years to 50 years with a female predilection. [1-3]The clinical diagnostic criteria developed by several researches have been used to diagnose the TMDs, these include Helkimo index (HI), RDC/TMD criteria, craniomandibular index (CMI) and Fonseca's anamnesis index (FAI).[4] Recently new refined and modified version of RDC/TMD is produced known as diagnostic criteria for temporomandibular disorders (DC/TMD).[5] The present study aimed to estimate the prevalence rate of TMDs among Nepalese population in Eastern part of Nepal, through individual examination.

METHODS

An observational descriptive study was carried out between May 2018 and October 2018.Out of all the patients who attended the Department of Oral Medicine and Radiology, Nobel Medical College and Teaching Hospital (NMCTH) and patients who attended various camps in Eastern part of Nepal organized by (NMCTH) during this period were screened for sign and symptoms for TMDs based on DC/TMD criteria. Those patients who had at least one symptom of TMDs were included in this study. Subjects having permanent dentition, age above 18 years, Nepalese nationality and cooperative subjects were included in this study. Subjects with previous history of orthodontic treatment, craniofacial anomalies, systemic, musculoskeletal or neurological disorders and those who did not sign the consent form were excluded from this study.The patients from camp with positive findings for TMDs were asked to come to our hospital for radiographic evaluation and evaluation of craniofacial anomalies, systemic, musculoskeletal or and neurological disorders. The provision of investigation was made free by NMCTH. Those patients who did not come for evaluation were also excluded from the study. Finally, 1584 subjects were included in this study. The subjects were divided into three groups depending on their age as follows: Group I- <30 years, Group II- 31-50 years, and Group III- more than 50 years.

An approval for this study was obtained from the Institutional Review Committee (NMCTH).The subjects were required to sign an informed consent before their participation in the study. After obtaining demographic data, self-administered questions were asked to the subjects to obtain symptom (history) and sign (examination) based on the DC/TMDcriteria.[5] Different symptoms/history related to TMDs such as joint pain, muscle pain, referred pain /headache, joint sound and morning joint /muscle stiffness were asked. The patients were also asked about the causative factors responsible for TMDs such as history of trauma, stress, gum chewing, hard food biting habits, bruxism. and long dental appointment.

The subjects were examined by two investigators (to decrease bias) for different signs of TMDs such as clicking, crepitus, muscle tenderness, joint tenderness, deviation, deflection, pain on mouth opening, protrusive, lateral movement and limited mouth opening(less than 40mm). The subjects were also examined for malocclusion as a causative factor. Panoramic radiograph were taken to rule out degenerative joint disorders, subluxation and ankylosis.Data was analyzed using SPSS version 24. Test done are descriptive, Chi square test.

RESULTS

The demographic details have been summarized in Table 1.

Table 1: Distribution of study subjects according to age and gender

Age group in year	Gender				Total	
	Male		Female			
	Number	%	Number	%	Number	%
≤30	205	28.51	254	29.36	459	28.98
31-50	380	52.85	410	47.4	790	49.87
>50	134	18.64	201	23.24	335	21.15
Total	719	100	865	100	1584	100

Among 1584 study subjects, 1330 (83.96%) subjects had TMD which was found to be highly significant (p<0.001) (Table 2). Regarding gender-wise distribution, 532 (73.99%) males and 798 (92.25%) females had TMD (Table 3).

Table 2: Distribution of study subjects according to presence /absence of TMD based on age

TMD	Age group in year						Total		p-value
	≤30		31-50		>50				
	Number	%	Number	%	Number	%	Number	%	
Present	417	90.85	727	92.03	186	55.52	1330	83.96	<0.001**
Absent	42	9.15	63	7.97	149	44.48	254	16.04	
Total	459	100	790	100	335	100	1584	100	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

Table 3: Distribution of study subjects according to presence /absence of TMD based on gender

TMD	Gender				Total		p- value
	Male		Female				
	Number	%	Number	%	Number	%	
Present	532	73.99	798	92.25	1330	83.96	<0.001**
Absent	187	26.01	67	7.75	254	16.04	
Total	719	100	865	100	1584	100	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

Table 4: Distribution of study subjects according to presence of sign and symptoms based on gender

Sign and symptoms		Gender				Total		p-value (level of significance)
		Male		Female				
		Number	%	Number	%	Number	%	
Clicking	Present	508	70.65	645	74.57	1153	72.79	0.081 NS
	Absent	211	29.35	220	25.43	431	27.21	
Cripetus	Present	25	3.48	14	1.62	39	2.46	0.014*
	Absent	694	96.52	851	98.38	1545	97.54	
Muscle tenderness	Present	318	44.23	354	40.92	672	42.42	0.185 NS
	Absent	401	55.77	511	59.08	912	57.58	
Joint tenderness	Present	206	28.65	184	21.27	390	24.62	<0.001**
	Absent	513	71.35	681	78.73	1194	75.38	
Referred pain	Present	213	29.62	241	27.86	454	28.66	0.439 NS
	Absent	506	70.38	624	72.14	1130	71.34	
Deviation	Present	463	64.39	576	66.59	1039	65.59	0.837 NS
	Absent	256	35.61	289	33.41	545	34.41	
Deflection	Present	102	14.19	85	9.83	187	11.81	0.007*
	Absent	617	85.81	780	90.17	1397	88.19	
Pain on opening mouth	Present	225	31.29	295	34.1	520	32.83	0.235 NS
	Absent	494	68.71	570	65.9	1064	67.17	
Limited mouth opening	Present	105	14.6	96	11.1	201	12.69	0.036*
	Absent	614	85.4	769	88.9	1383	87.31	
Stiffness of joint	Present	98	13.63	64	7.4	162	10.23	<0.001**
	Absent	621	86.37	801	92.6	1422	89.77	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

On evaluation of clinical sign and symptoms based on gender (Table 4),joint tenderness and stiffness of joint was found to be highly significant (p <0.001) while crepitus, limited mouth opening was significant (p<0.01).Similarly, clicking, crepitus, muscle tenderness, deviation, limited mouth opening, stiffness of joint was found to be highly significant (p<0.001) based on age (Table 5).

Table 5- Distribution of study subjects according to presence of sign and symptoms based on age

Sign and symptoms		Age group in year						Total			p-value
		≤30		31-50		>50					
		Number	%	Number	%	Number	%	Number	%	% among TMD population (n=1330)	
Clicking	Present	373	81.26	650	82.28	130	38.81	1153	72.79	86.69	<0.001**
	Absent	86	18.74	140	17.72	205	61.19	431	27.21	13.31	
Cripetus	Present	2	0.44	13	1.65	24	7.16	39	2.46	2.93	<0.001**
	Absent	457	99.56	777	98.35	311	92.84	1545	97.54	97.07	
Muscle tenderness	Present	136	29.63	412	52.15	124	37.01	672	42.42	50.53	<0.001**
	Absent	323	70.37	378	47.85	211	62.99	912	57.58	49.47	
Joint tenderness	Present	105	22.87	187	23.67	98	29.25	390	24.62	29.32	.081 NS
	Absent	354	77.13	603	76.33	237	70.75	1194	75.38	70.68	
Referred pain	Present	96	20.92	256	32.41	102	30.45	454	28.66	34.14	.121 NS
	Absent	363	79.08	534	67.59	233	69.55	1130	71.34	65.86	
Deviation	Present	338	73.64	593	75.06	108	32.24	1039	65.59	78.12	<0.001**
	Absent	121	26.36	197	24.97	227	67.76	545	34.41	21.88	
Deflection	Present	57	12.42	62	7.85	68	20.3	187	11.81	14.06	<0.001**
	Absent	402	87.58	728	92.15	267	79.7	1397	88.19	85.94	
Pain on opening mouth	Present	127	27.67	288	36.46	105	31.34	520	32.83	39.1	<0.001**
	Absent	332	72.33	502	63.54	230	68.66	1064	67.17	60.9	
Limited mouth opening	Present	45	9.8	85	10.76	71	21.19	201	12.69	15.11	<0.001**
	Absent	414	90.2	705	89.24	264	78.81	1383	87.31	84.89	
Stiffness of joint	Present	26	5.66	97	12.28	39	11.64	162	10.23	12.18	<0.001**
	Absent	433	94.34	693	87.72	296	88.36	1422	89.77	87.82	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

The presence of causative agents from history based on age (Table 6) was found to be highly significant with regards to bruxism, malocclusion, stress, gum chewing, hard food biting habits (p<0.001). Similarly, stress and hard food biting habit was highly significant (p<0.001) and malocclusion and trauma were significant (p<0.01) with regards to gender (Table 7).

Table 6- Distribution of study subjects according presence of causative factors based on age

Causative agents		Age group in year						Total		P value (level of significance)
		≤30		31-50		>50				
		Number	%	Number	%	Number	%	Number	%	
Bruxism	Present	33	7.19	154	19.49	39	11.64	226	14.27	<0.001**
	Absent	426	92.81	636	80.51	296	88.36	1358	85.73	
Malocclusion	Present	65	14.16	103	13.04	14	4.18	182	11.49	<0.001**
	Absent	394	85.84	687	86.96	321	95.82	1402	88.51	
Trauma	Present	11	2.4	22	2.79	14	4.18	47	2.97	0.313 NS
	Absent	448	97.6	768	97.21	321	95.82	1537	97.03	
Stress	Present	12	2.61	57	7.22	38	11.34	107	6.76	<0.001**
	Absent	447	97.39	733	92.78	297	88.66	1477	93.24	
Gum chewing	Present	86	18.74	156	19.75	5	1.49	247	15.59	<0.001**
	Absent	373	81.26	634	80.25	330	98.51	1337	84.41	
Hard food biting habits	Present	451	98.26	783	99.11	278	82.99	1512	95.45	<0.001**
	Absent	8	1.74	7	0.89	57	17.01	72	4.55	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

Table 7- Distribution of study subjects according to presence of causative factors based on gender

Causative agents		Gender				Total		p- value
		Male		Female				
		Number	%	Number	%	Number	%	
Bruxism	Present	103	14.33	123	14.22	226	14.27	0.952 NS
	Absent	616	85.67	742	85.78	1358	85.73	
Malocclusion	Present	105	14.6	77	8.9	182	11.49	0.003*
	Absent	614	85.4	788	91.1	1402	88.51	
Trauma	Present	31	4.31	16	1.85	47	2.97	0.004*
	Absent	688	95.69	849	98.15	1537	97.03	
Stress	Present	83	11.54	24	2.77	107	6.76	<0.001**
	Absent	636	88.46	841	97.23	1477	93.24	
Gum chewing	Present	120	16.69	127	14.68	247	15.59	0.921 NS
	Absent	599	83.31	738	85.32	1337	84.41	
Hard food biting habits	Present	701	97.5	811	93.76	1512	95.45	<0.001**
	Absent	18	2.5	54	6.24	72	4.55	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

Table 8- Distribution of study subjects according to DC / TMD based on age

TMD		Age group in year						Total			p- value (level of significance)
		≤30		31-50		>50					
		Number	%	Number	%	Number	%	Number	% in total population	% out of tmd population	
Myofascial pain	Present	106	23.09	220	27.85	53	15.82	379	23.93	28.5	<0.001**
	Absent	353	76.91	570	72.15	282	84.18	1205	76.07	71.5	
Disc displacement	Present	298	64.92	483	61.13	70	20.9	851	53.72	63.98	<0.001**
	Absent	161	35.08	307	38.86	265	79.1	733	46.28	36.02	
Degenerative joint disorder	Present	2	0.44	6	0.76	48	14.33	56	3.54	4.21	<0.001**
	Absent	457	99.56	784	99.24	287	85.67	1528	96.46	95.79	
Others	Present	11	2. 40	18	2.28	15	4.48	44	2.78	3.31	0.102 NS
	Absent	448	97.6	772	97.72	320	95.52	1540	97.22	96.69	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

Table 9- Distribution of study subjects according to DC / TMD based on gender

TMD		Gender				Total			p-value
		MALE		FEMALE					
		Number	%	Number	%	Number	% in total population	% out of TMD population	
Myofascial pain	Present	158	21.98	221	25.55	379	23.93	28.5	<0.001**
	Absent	561	78.02	644	74.45	1205	76.07	71.5	
Disc displacement	Present	311	43.25	540	62.43	851	53.72	63.98	<0.001**
	Absent	408	56.75	325	37.57	733	46.28	36.02	
Degenerative joint disorder	Present	30	4.17	26	3.01	56	3.54	4.21	0.210 NS
	Absent	689	95.83	839	96.99	1528	96.46	95.79	
Others	Present	33	4.59	11	1.27	44	2.78	3.31	<0.001**
	Absent	686	95.41	854	98.73	1540	97.22	96.69	

**-Significant (p<0.05), **-Highly significant (p<0.001), NS- Not significant (p>0.05)*

The distribution of study subjects according to the DC/TMD based on age groups and gender (Table 8,9) showed that myofascial pain (with or without referral), disc displacement and degenerative joint disorder to be highly significant (p<0.001).

DISCUSSION

One paramount cause for orofacial pain is TMDs. The term TMD has been described as a cluster of disorders characterized by a group of many sign and symptoms such as anomalous sound like clicking and crepitus, deviation, deflection, pain in joint, pain in muscles of mastication, pain during mandibular motion, limited mandibular motion etc. Various etiologies have been proposed such as bruxism, trauma, stress, developmental disorders, infections etc.[1, 4]

This study showed the prevalence rate of 83.96%. The prevalence rate from different studies were found to be 19%-92.1% containing at least one TMD symptoms.[1,2] The prevalence of TMD symptoms and signs in non-patient populations is highly variable,

mostly due to the different criteria and populations studied as well as a different way of daily habits.[1,2]

In various studies female predominance were clearly noted[1,6, 8,9] while one study had shown no genders difference.[10] This study in accordance with many other studies has shown significantly higher female predominance. The higher prevalence of TMD among females might be cognate to gender physiological differences, such as hormonal variations, lower muscle structure and pain threshold, psychosocial differences and environmental factors but still, need to explore.[11] Sexual hormones especially estrogen perform a paramount role in the painful sensation in the muscles of mastication, TMD pathogenesis, the pain threshold and its tolerance varies according to the menstrual cycle phase.[12- 14]

As estrogen is a peril factor for TMDs and other craniofacial pain conditions, studies with animals and humans have shown that it can have a peripheral and central action in pain modulation. It is also seen that sexual hormones and estrogen receptors regulate the sensitivity of the trigeminal neurons or somehow influence on the pain trigeminal pathways (or in the spinal trigeminal nucleus).[15-16]

The tendency for the signs and symptoms of TMDs to decrease with age was established in the present study, which is in accordance with many other studies.[17,18] One study had shown that the disc displacement and muscle pain is more common in younger age group while degenerative joint disorder is common in older age group, to which our study confirms. Another study has shown that propensity for the signs and symptoms of TMDs to increase depends on age but this result was due to increased prevalence of degenerative joint disorder in this specific study.[17]

The clicking sound was the most prevalent sign in most studies.[1,3,6,9] Alhussini et al concluded headache to be a major symptom[7], while Karthik et al showed masticatory muscle pain and difficulty in mouth opening to be more common.[8] But in most of studies clicking is one of the most common symptoms followed by deviation and muscle pain.[7,8,19] While one study showed that limitation and deviation of the temporomandibular joint (TMJ) were the least prevalent. [6]In our study clicking (72.8%) was the most common sign followed by deviation (65.60%) and muscle pain (42.42%).

The distribution of study subjects between age groups and gender showed that disc displacement (54.16%) was the most prevalent disorder. This was in accordance with many other studies.[19-21] While myofascial pain was the most common subgroup of TMD in non-patient populations.[22, 23]

TMDs have many possible etiological factors such as trauma, stress, bruxism, malocclusion, orthodontic treatment, gum chewing, hard food biting habits, parafunctional habits.[24] Many researches have been done to investigate the relation of these etiologic factors in cognation to TMDs. Our study showed a very paramount cognation of TMDs with hard aliment biting. In Nepal, hard aliment biting habits are traditional and very prevalent. Hard Nepalese pabulum includes Chura, Pustakari, Chhurpi, Sukuti, Sekuwa, dry/half cooked beans, peas, legumes. Biting on hard food has a significant effect on muscles and TMJ. Studies have suggested that anterior disc derangement can be associated with chewing hard food.[25]

This study has confirmed a significant association of stress/anxiety to TMDs in accordance to other studies.[6, 26] Emotional stress has an influence on muscular activity and occlusion. When the individual is submitted to an emotional overload, clenching of teeth may be initiated which in turn produces circulatory changes in the muscles of mastication or compression on the pain receptors as a consequence of which the fluid increase in the muscle compartment.[27]

There are studies which showed different predisposing factors which are most responsible for TMDs like occlusal discrepancies with loss of posterior teeth, trauma, clenching, premature contact in protrusive movement and bruxism, malocclusions such as posterior crossbite, anterior open bite, Angle Class II and III malocclusions, and maxillary overjet.[7, 8,28, 29]

A study was conducted on subjects with normal dental occlusion and function to evaluate the effect of bolus hardness on the jaw-elevator muscle activity and kinematics of mastication. The results showed that EMG peak amplitude of both the masseter and

anterior temporalis muscles was higher for the side of the bolus but the contralateral side increased its activity significantly more than the ipsilateral side when the hardness of the bolus increased. This proves the effect of hard bolus on muscles.[30]

Masticatory muscle pain can be elicited experimentally by excessive jaw functions like intense and prolonged clenching and chewing. Intense and prolonged clenching and chewing lead to a reduction of blood flow in the masticatory muscles resulting in localized hypoxia which leads to immediate, ischemia followed by accumulation of metabolites. These metabolites results in muscle pain.[31] This study showed significant relation of hard food biting with prevalence of TMDs.

The limitation of this study include inability to incorporate population from all over Nepal and failure to perform MRI of the affected joints to differentiate between various forms of disc displacement. Also the genetic screening was not done to rule out genetic disorders. In view of higher prevalence of TMDs in Nepalese population, all the oral clinician should do a proper evaluation of temporomandibular joint specially when there is history of hard food biting. There is a need of further research so that TMDs can be avoided by early intervention.

CONCLUSION

This study showed a paramount percentage of population affected with TMDs. The prevalence rate was much higher than some other studies with female predominance. Clicking was the most common sign and symptoms while disc displacement was the most prevalent disorder. The results of the study showed a paramount cognation of hard food biting to the TMDs.

ACKNOWLEDGEMENT

We extend our sincere gratitude to Dr. Mohan Raju and his team //www.statsmasterblog.wordpress.com/ for the support in doing statistical analysis.

REFERENCES

1. Khan M, Khan A, Hussain U. Prevalence of temporomandibular dysfunction (TMD) among university students. Pakistan Oral Dent J. 2015;35(3):382-385. [DOI]
2. Wahid A, Imran F, Razzaq A, Bokhari SAH, Kaukab T, Iftikhar A, Khan H. Prevalence and Severity of Temporomandibular Disorders (TMD) in Undergraduate Medical Students using Fonseca's Questionnaire. Pakistan Oral Dent J 2014;34(1):38-41. [PDF]
3. Al-Gadhaan S. M. , Khan P, Alqahtani S, Alsahrani B, Alqahtani B. Prevalence of tmj disorders among the general population in southern region of kingdom of saudiarabia- a survey report from dental centre of Afhsr. Med. Res. Chron. 2018;5 (1): 36-42. [PDF]
4. Al-Sanabani JS, Al-Moraissi EA, Almaweri AA. Prevalence of Temporomandibular Joint Disorders among Yemeni University students: A prospective, cross-sectional study. Int J Oral Craniofac Sci 2017;3(2): 053-059. [PDF]
5. Schiffman E, Ohrbach R, Truelove E.Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network*and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache. 2014;28(1):6–27. [DOI]
6. Ahmed LI, Abuaffan AH. Prevalence of Temporomandibular Joint Disorders among Sudanese University Students. J Oral Hyg Health 2016;4(2): 200. [DOI]
7. Alhussini DA, Mominkhan DM, AlhamedFJ,Saklau RA, Abdl-AlimHA.Prevalence and Awareness of temporomandibular joint disorders among patients in King Abdulaziz University, Dental Hospital. J Dent Health Oral Disord Ther. 2017; 8(5): 00300. [DOI]
8. Karthik R, Hafila MI, Saravanan C, Vivek N, Priyadarsini P, Ashwath B. Assessing prevalence of temporomandibular disorders among university students: A questionnaire study. J Int Soc Prevent Communit Dent 2017;7(1):S24-9. [DOI]
9. Basafa M, Shahabee M. Prevalence of TMJ disorders among students and its relation to malocclusion. Iranian journal of otorhinolaryngology. 2006;18(45):53–59. [PDF]
10. Pow EH, Leung KC, McMillan AS. Prevalence of symptoms associated with temporomandibular disorders in Hong Kong Chinese. J Orofac Pain. 2001;15(3):228-234. [LINK]
11. Vedolin GM, Lobato VV, Conti PC, Lauris PRJ. The

impact of stress and anxiety on the pressure pain threshold of myofascial pain patients. J Oral Rehabil. 2009;36(5):313-312. [DOI]

12. LeResche L, Mancl L, Sherman JJ, Gandara B, Dworkin SF. Changes in temporomandibular pain and other symptoms across the menstrual cycle. Pain. 2003;106(3):253-261. [DOI]

13. Wiesenfeld-Hallin Z. Sex differences in pain perception. Gend Med. 2005;2(3):1371-45. [LINK]

14. Miyazaki R, Yamamoto T. Sex and/or gender differences in pain. Masui. 2009;58(1):34-9. [LINK]

15. Sarlani E, Garrett PH, Grace EG, Greenspan JD. Temporal summation of pain characterizes women but not men with temporomandibular disorders. J Orofac Pain. 2007;21(4):309-17. [LINK]

16. Fenzi F, Rizzzuto N. Estrogen receptors localization in the spinal trigeminal nucleus: an immunohistochemical study in humans. Eur J Pain. 2011;15(10):1002-7. [DOI]

17. Camacho JGDD et al.Signs and symptoms of Temporomandibular Disorders in the elderly. CoDAS 2014;26(1):76-80. [LINK]

18. Schmitter M, Rammelsberg P, Hassel A. The prevalence of signs and symptoms of temporomandibular disorders in very old subjects. J Oral Rehabil. 2005;32(7):467-73. [DOI]

19. Muthukrishnan A, Sekar GS. Prevalence of temporomandibular disorders in Chennai population. J Indian Acad Oral Med Radiol 2015;27(4):508-15. [DOI]

20. Poveda-Roda R, Bagán JV, Jiménez-Soriano Y, Fons-Font A. Retrospective study of a series of 850 patients with temporomandibular dysfunction (TMD). Clinical and radiological findings. Med Oral Patol Oral Cir Bucal 2009;14(12):e628-34. [DOI]

21. Poveda-Roda R, Bagan JV, Sanchis JM, Carbonell E. Temporomandibular disorders. A case-control study. Med Oral Patol Oral Cir Bucal 2012;17(5):e794-800. PMID: 22549687. [DOI]

22. De Leeuw R (ed). Orofacial pain. Guidelines for assessment, diagnosis, and management. Chicago: Quintessence Publishing Co, 2008. ISBN: 978-0-86715-610-2; 9780867156102;

23. Schiffman EL, Fricton JR, Haley DP, Shapiro BL. The prevalence and treatment needs of subjects with temporomandibular disorders. J Am Dent Assoc 1990;120(3):295–203. [DOI]

24. Acharya S, Chaulagain R, Pradhan A, Shah A. Temporomandibular Joint Disorders and its Relationship with Parafunctional Habits among Undergraduate Medical and Dental Students.JCMS. 2018;14(3):154-159. [DOI]

25. Ratnasari A, Hasegawa K, Oki K, Kawakami S, Yanagi Y, Asaumi JI, Minagi S. Manifestation of preferred chewing side for hard food on TMJ disc displacement side. J Oral Rehabil. 2011;38(1):12-7. [DOI]

26. Bezerra BP, Ribeiro AI, Farias AB, Farias AB, Fontes LD, Nascimento SR, Nascimento AS, Adriano MS. Prevalence of temporomandibular joint dysfunction and different levels of anxiety among college students. Rev Dor. São Paulo, 2012;13(3):235-42. [DOI]

27. Christensen LV. Facial pain and internal pressure of masseter muscle in experimental bruxism in man. Arch Oral Biol. 1971;16(9):1021-31.[DOI]

28. Ebrahimi M, Dashti H, Mehrabkhani M, Arghavani M, Daneshvar-Mozafari A. Temporomandibular Disorders and Related Factors in a Group of Iranian Adolescents: A Cross-sectional Survey. J Dent Res Dent Clin Dent Prospect. 2011; 5(4): 123–127. [DOI]

29. Bilgiç F, Gelgör IE. Prevalence of temporomandibular dysfunction and its association with malocclusion in children: An epidemiologic study. J Clin Pediatr Dent 2017;41(2):161-5. [DOI]

30. Piancino MG, Bracco P, Vallelonga T, Merlo A, Farina D. Effect of bolus hardness on the chewing pattern and activation of masticatory muscles in subjects with normal dental occlusion. J Electromyogr Kinesiol. 2008;18(6):931-7. [DOI]

31. Karibe H, Goddard G, Gear RW. Sex differences in masticatory muscle pain after chewing. J Dent Res 2003;82(2):112—6. [DOI]