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RESEARCH ARTICLE

A NEW APPROACH FOR PAIN IN TEMPOROMANDIBULAR DISORDERS ADDRESSING THE INTERACTION OF DIET, EATING HABITS AND MEDICATIONS

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ABSTRACT

Background: Temporo-mandibular disorders (TMDs) is an umbrella term to describe a condition with a multifactorial etiology characterized by various symptoms including:limitations on opening the mouth, clicking or grinding, orofacial pain, referred muscular pain or headaches.Pain has many origins, such as muscular, neuropathic, or vascular. It is the most frequent symptom, and often limits the patient's daily habits. In the presence of orofacial pain in temporomandibular disorders some functions such as eating, talking, or singing are limited and there are foods that can improve or worsen the symptoms. The patient, in the presence of pain, often has to resort to medications. Even today, this pathology, although quite widespread, does not have precise guidelines for therapy. In addition, the literature is still not clear about the most appropriate types of therapy as muscle pain and neuropathic pain are usually co-present with TMD. Therapy depends upon correctly identifying the etiology, for the treatment or the management of symptoms to be successful and to improve quality of life.
Aim: The aim of this study was to evaluate, through a survey, the correlation between lifestyle (diet, oral habits, medications, pasorthodontic treatments) and temporomandibular disorders (TMDs) and how these two variables interact, in order to counsel the patient with orofacial/TMJ pain on how to best modify their diet/eating habits to reduce the symptoms and modify, if needed, any pharmacological intervention.
Materials and Methods*:*Two hundred and nine (209) patients completed an online survey including questions about their TMD symptoms, their diet, frequency of meals, previous and current orthodontic treatments and most used medications to reduce pain. The questionaries, available in two languages (Italian and English) and composed mostly of yes/no questions, were shared among patients affected by TMDs who were being treated and or had been treated for temporo-mandibular disorders.
Results: Our study confirms what we found in the literature, which is an association between frequency of eating and TMJ/orofacial pain. The consistency or texture of frequently consumed foods was also relevant in the severity of pain as patients reported an association between the consumption of hard foods and pain. Among the respondents, NSAIDs and myorelaxants were significantly more effective than supplements and corticosteroids. No statistical correlation was found between orthodontic therapy and a decrease in mouth opening.
Conclusions: Food and eating habits seem to have the capacity to affect TMJ/orofacial pain. The role of daily eating habits, should be further investigated. In fact they could represent a new frontier in the management of joint pain as they can be managed directly by the patients, and complement other pain therapy options such as medications and oral devices.

Keywords: Temporomandibular disorders, eating, pain, daily habits, medications

INTRODUCTION

Temporomandibular disorders (TMDs) are pathological conditions including intra-articular abnormalities of the position and/or of the structure of the disc, known as intra capsular disorders, as well as muscles dysfunctions that are known as extra capsular disorders[1] or more commonly referred to as orofacial pain disorders (OPD), when encompassing both types of disorders and functional disability.

TMJ/orofacial pain disorders are quite common in people, even more now than in the past as they are currently much more understood and studied determining a higher possibility to get the right diagnosis.[2]

The main reason for which people inquire about therapy is the pain experienced, which is primarily of muscular origin and this is the reason why, currently in the US, the standard of care is to refer to these problems not as TMD but as orofacial pain disorders with or without TMJ involvement. TMJ/OPDs affect females more than males, because of various biological aspects and, in particular, likely due to hormonal influence[3]In general, TMJ/OPDs have an annual incidence of 4% and peak in individuals between 20 and 40 years of age[4]The patients with juvenile idiopathic arthritis they may be at risk.[5,6,7]

Regarding diagnosis, the standard system introduced by Dworkin is the most used. It is based on diagnostic criteria for TMD and it has been accepted by the scientific community all over the world [9]

Instrumental examination can help in the diagnosis. The best instrumental examination to visualize and analyze the position of the disk is magnetic resonance imaging (MRI), but to evaluate hard tissues of the joint, such as the mandibular condyles and the temporal fossae, a CT scan is very useful, in particular the cone beam computerized tomography (CBCT), which is an imaging technique with a very low dose of radiation.[8,9]

Due to occlusal factors, which are considered as a possible etiology of some symptoms of TMDs, oral splints are used for symptomatic treatment. These oral devices can reduce muscle spasms and stiffness thus relaxing the orofacial muscles. Moreover, the oral devices can even alleviate the joints symptoms by changing the position of the jaw, the condyle and the disk. In some patients, after an initial successful oral splint therapy, the result might need to be stabilized through orthodontic therapy.[7]

Depending on the etiology of the orofacial pain (intra-capsular disorders, muscle pain, neuralgia, trauma or malocclusion), clinicians may decide accordingly to treat occlusion or muscle pain or TMJ disorders, or to refer the patient to a neurologist, or to a chronic pain specialist, or to a physiotherapist for treatment of the overall postural problems affecting the orofacial muscles. In fact, laboratory research and clinical experience have led to the observation of the connections between postural adaptations, anatomical conditions and TMJ/OPD.[3] The posture of the jaw is determined by a complex feedback-feedforward system in which the central nervous system integrates the input signals from various receptors localized in the oral and peri oral musculature, tongue, periodontal ligament and many other tissues, integrating them and processing a signal that determines the postural tonic system.[10]

Another important aspect in the management of TMJ/OPD, is the pharmacological therapy which can be very helpful in the acute phase of the disorder. Since this disorder can have an inflammatory aspect, like every skeletal-muscle condition, the use of nonsteroidal anti-inflammatory drugs (NSAIDs), can be helpful. Furthermore, although corticosteroids have an anti-inflammatory effect, the clinicians should prescribe them judiciously due to the various systemic side effects[11].

In addition, in the extracapsular forms, muscle relaxants are often used because they can reduce muscular pain, soreness and spasm, in particular in patients affected by bruxism and clenching. However, without addressing the cause or etiology of bruxism and clenching, the effect of the muscle relaxant is going to be temporary. TMJ/OPDs are quite common in patients affected by clenching or bracing, and these parafunctions can be linked to psychological stress for which psychotherapy can be effective Moreover, current literature shows a correlation between orofacial and TMJ pain and sleep disorders, in particular sleep bruxism that is usually caused by poor nocturnal breathing and especially obstructive sleep apnea. Several studies demonstrated that bruxism can be an etiological factor in articular pain and functional limitations.[12,13]

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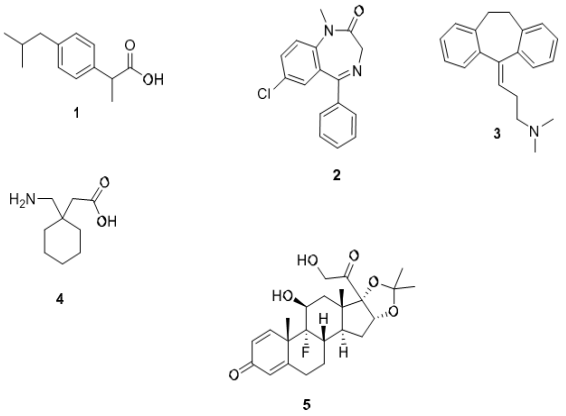

Figure 1. Chemical structure of ibuprofen (**1**), diazepam (**2**), amitriptyline (**3**), gabapentin (**4**) and triamcinolone acetonide (**5**).

Certainly, bruxism subjects the TMJ and the orofacial musculature to considerable stress that can cause pain.TMJ/OPD can affect the capability to chew and eat. The kind of food and its consistency can affect the activity of the TMJ and in particular the function of the oral-facial muscles, as it is reported in the literature and in clinical experience that patients with orofacial pain try to avoid hard foods that trigger or increase that pain. Nowadays people are used to eating more frequently than in the past and that could be a factor that exacerbate the jaw's muscle activity and spasms, especially if it is hard-to-chew foods or gum.[13,15,16]

A correlation between chewing and TMJ/OPDs was found by Tabrizi et al. as they observed that the prevalence of pain disorders increases in patients who routinely chewed gum.[15]

TMJ disorders seemed to have increased in recent years, probably due to some heavily processed foods which, according to many studies, favor inflammatory diseases that contribute to chronic pain. It can be surmised that changing daily eating habits, eating frequency and the types of food consumed can be important tools to reduce the level of pain caused by TMJ/OPDs. Furthermore, there is a relationship between diet and respiratory problems which can favor oral respiration. In particular it is known that some foods can trigger nasal congestion, like those containing tyramine, which facilitates the production of histamine. The subsequent oral breathing ~~can~~ changes the rest position of the mandible and the function of the oral muscles, thus creating or supporting TMJ dysfunctions. Since the stomatognathic system is influenced by diet and by eating modalities and timing, from a medical perspective, many studies suggest that intermittent fasting can help decrease the activity and severity of a few diseases and conditions, in particular those characterized by inflammation which could also directly affect the TMJ. Adawi et al., in a multi-center study, reported that intermittent fasting, like during Ramadan, could reduce the inflammation index and the disease's activity in many types of arthritis [16,17] and, when appropriate, patients with TMJ/OPDs should be referred to their regular physician to assess the need for nutritional counseling. Some clinicians recommend natural supplements, such as Glucosamine and Vitamin C, to help patients with this chronic condition, but there is not enough literature to support this kind of therapy.[18,19]

The concept of fasting as a component of health was already known at the time of Buddha who fasted regularly. We now live in a society in which calorically rich foods are so widespread and readily available that people eat them even when they are not hungry, out of boredom or to soothe themselves (*comfort food*). In the past, having rich meals was a symbol of wealth and wellness, but today there is a need for a more balanced diet to achieve and maintain proper health, while avoiding obesity, diabetes and other inflammatory diseases. Medical literature indicates that a balanced diet can help in preventing many diseases, and in particular inflammatory conditions. [20,21]

Finally, great importance is now given to microbiota, which is influenced by diet. Microbiota is linked to many aspects of health, in particular to brain function and to the integrity of the immune system. It is well documented that an altered microbiota can produce cytokines which can create low grade. inflammation affecting all the joints, including the TMJ, and promoting chronic fatigue syndrome, which sometimes is a co-morbidity of people suffering from chronic orofacial pain. Furthermore, an altered microbiota cannot only be just the consequence of psychological disfunction, but also, by changing the equilibrium of serotonin, microbiota may promote the chronicity of this dysfunction.[22] It is remarkable that a dysfunctional microbiota seems to be implicated in the development of depression as well, which is a condition that can increase the risk of TMJ/OPDs and their chronicity, therefore depression is considered a co-morbidity.[23]

Recent studies have also highlighted that an unhealthy diet can indeed alter the microbiota, which can affect changes in neurotransmitters linked to

cognitive impairments, and in return, and according to the biopsychosocial theory, cognitive impairment itself creates social problems that can exacerbate or promote chronicity of TMJ/OPD.[24]

This study aims to analyze the correlation between diet (specifically types of food and eating practices) and TMJ/orofacial pain disorders, by way of a questionnaire, and to see if these disorders can be connected to the frequency of eating and the type of diet. This study wants to investigate if there are kinds of foods that can exacerbate painful symptoms and if limited times of fasting, or increasing the time between meals, can reduce the level of pain. It tries to find out if there are other medical and behavioral approaches that can be helpful in mitigating orofacial pain. Furthermore, it tries to understand the relationship between gender, level of stress, frequencies of eating and the level of pain. At the same time, it studies which pharmacological tool seems to be more effective in managing TMJ/orofacial pain considering the use of natural supplements as well. This study aims at analyzing the level of pain and the patients' request for therapies and instrumental examinations, and finally, it explores the connection of pain, the level of mouth opening in patients and whether they underwent orthodontic or splint therapy.

MATERIALS AND METHODS

We enrolled in our research 209 patients, with an age range between 20 and 60 and with a slight majority of subjects being between 40 and 60 years of age. The exclusion criteria were people without temporo-mandibular disorders and patients who did not accept to answer the questionnaire. The only inclusion criteria was for patients to be suffering from TMD and willing to participate in the questionnaire. All subjects gave their informed consent for inclusion before they participated in the study .The study was conducted in accordance with the Declaration of Helsinky. The questionarrie was anonymous. All participants provided an informed consent and accepted the privacy policy for the protection of personal data before compiling the survey.

The questionnaire contained 16 questions, some in a yes/no format and others in a multiple choice or on a scale format, disseminated through an online ~~form~~ service (Google Form service, Google LLC, Mountain View, California, U.S.). The questionaries were administered to all patients bilingual form (Italian- English). No personal information that identifies the individuals was collected and the data was analyzed only in aggregate form. All responses were collected and anonymized using the Google Form service. A pre-pilot quantitative questionnaire was distributed to some patients of the authors and to identify any errors that it may have contained, which were subsequently corrected. The authors to this regard found no need to per- form a pilot study.

The questions asked to patients are the following:

1. Gender
2. Age
3. Level of education
4. Did you ever have an orthodontic therapy? Yes/No
5. Did you ever use an oral appliance (bite)? Yea/No
6. Did you ever have an instrumental examination for the diagnosis? If yes, which one?
7. Do you have limitations in opening your mouth? Yes/No
8. Do you notice that when you are under stress, you eat more and your TMJ pain increases? If yes, how much? (1-10)
9. Did you ever fast for few hours/days? If yes, how much did it reduce your TMJ pain? (1-10)
10. Do you feel the more times you eat during the day the more TMJ pain increase?
11. Did you ever notice that a particular food influence your TMJ pain causing worsening? If yes, which one?
12. Do anti inflammatory drugs (NSAIDs) reduce your TMJ pain? (1-10)
13. Do muscle relaxants reduce TMJ pain? If yes, how much? (1-10)
14. Did you ever take corticosteroids? If yes, how much did they help? (1-10)
15. Did you ever take any supplement with the anti-inflammatory features? If yes, how much did it help? (1-10)
16. Did you ever have an orthodontic therapy? Do you have limitations in opening your mouth? Yes/No

Statistical Analysis

The descriptive statistics were reported as a mean and standard deviation or median and interquartile range. The frequencies were summarized as percentages.

The pain score represents our primary outcome, and it consists of a continuous variable. Painkillers were the most used response to pain. This variable was divided into four categories: NSAIDs, corticosteroids, muscle relaxants and supplements. Since the variable pain score did not follow a normal distribution (Shapiro-Wilk W test, P = 0.01), we ran the Kruskal-Wallis test and, after that, the Wilcoxon rank-sum for the pairwise comparisons. At first the α-level was fixed at 0.05 and then reduced to 0.008, when we performed pairwise comparisons, taking into account 6 tests.

All data was analyzed with the statistical software IBM SPSS Statistics v25. This is a study carried out on subjects who, in freedom and autonomy, filled out a survey questionnaire, it was not possible to calculate the sample size in advance through power analysis. A calculation of the margin of error was therefore carried out on the basis of the respondents actually obtained. The collected sample was of 209 subjects. Considering that the reference population has approximately 5.4 million patients and considering a confidence level of 95%, an estimated margin of error is obtained for the parameters of interest equal to at 7%. The formula used for the calculation is the following:

Table 1. The sample analyzed consists of 209 individuals and 199 are women.

RESULTS

Descriptive univariate statistics of analyzed variables are firstly presented. Frequency tables are shown for qualitative variables while centrality and variability indexes are presented for quantitative variables.

Table 1. The sample analyzed consists of 209 individuals and 199 are women.

Gender

		Frequency	Percent	Valid Percent
Valid	Female	199	95.2	95.7
	Male	9	4.3	4.3
	Total	208	99.5	100.0
Missing		1	.5	
Total		209	100.0	

$$\text{Margin of error} = z \times \frac{\sigma}{\sqrt{n}}$$

Table 2. The majority of the sample is between 30 and 60 years old with a slight majority between 40 and 60 years.

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10-20	9	4.3	4.3	4.3
	20-30	52	24.9	25.0	29.3
	30-40	65	31.1	31.3	60.6
	40-60	69	33.0	33.2	93.8
	other	13	6.2	6.3	100.0
	Total	208	99.5	100.0	
Missing		1	.5		
Total		209	100.0		

Table 3. The level of education most observed is college with the 65.7% of the units.

Level of education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Middle school	2	1.0	1.0	1.0
	High school	45	21.5	22.1	23.0
	College	134	64.1	65.7	88.7
	PhD	23	11.0	11.3	100.0
	Total	204	97.6	100.0	
Missing		5	2.4		
Total		209	100.0		

Table 4. About 57% of the interviewees have received an orthodontic therapy.

Did you ever have an orthodontic therapy?

		Frequency	Percent	Valid Percent
Valid	No	88	42.1	42.5
	Yes	119	56.9	57.5
	Total	207	99.0	100.0
Missing		2	1.0	
Total		209	100.0	

Table 5. 58.7% of the respondents have used an oral appliance.

		Frequency	Percent	Valid Percent
Valid	No	86	41.1	41.3
	Yes	122	58.4	58.7
	Total	208	99.5	100.0
Missing		1	.5	
Total		209	100.0	

Table 6. The majority of those who ~~did~~ had instrumental examination for the diagnosis had MRI and CT, while 54.1% of the interviewees have never done imaging.

Did you ever have an instrumental examination for the diagnosis? if yes. which one?

Frequency			Percent	Valid Percent
Valid	Both	39	18.7	18.8
	CT	31	14.8	15.0
	MRI	25	12.0	12.1
	none	112	53.6	54.1
	Total	207	99.0	100.0
Missing		2	1.0	
Total		209	100.0	

Table 7. The majority (61.5%) has a limitation in opening their mouth.

Did you ever notice that a particular food influence your TMJ pain causing worsening? If yes, which one?

		Frequency	Percent	Valid Percent
Valid	None	38	18.2	18.2
	Hard food	106	50.7	50.7
	Chewing food	7	3.3	3.3
	Solid food	27	12.9	12.9
	Sticky food	23	11.0	11.0
	Irritating F&B	8	3.8	3.8
	Total	209	100.0	100.0

Table 8. On a scale from 1 to 10 the mean value, given to "Do you notice that when you are under stress you eat more and your TMJ pain increases?", is 5.68

Statistics

		Do you notice that when you are under stress, you eat more and your TMJ pain increases? if yes, how much? (1 is minimum; 10 is maximum)	Do you feel the more times you eat during the day the more TMJ pain increase? (1 is minimum; 10 is maximum)-	Did you ever fast for few hours/days? if yes, how much did it reduce your TMJ pain? Please answer just if you ever fasted (1 is minimum; 10 is maximum)
N	Valid	197	198	142
	Missing	12	11	67
Mean		5.68	5.62	4.55
Median		6.00	6.00	5.00
Std. Deviation		2.908	3.006	2.800
Percentiles	25	3.00	3.00	2.00
	50	6.00	6.00	5.00
	75	8.00	8.00	6.25

142 people have ever fasted for a few hours/days. On a scale from 1 to 10 the average value given to reducing of the TMJ pain, thanks to the fasting, is 4.55.We also got 5.62 as the average value for "Do you feel the more times you eat during the day the more TMJ pain increase?"

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Table 9. Of all the respondents,-81.8% have experienced increasing of the TMJ pain after eating some food. In particular, 50.7% say that the pain was mostly caused by hard food.

Do you have limitations in opening your mouth?

		Frequency	Percent	Valid Percent
Valid	no	80	38.3	38.5
	yes	128	61.2	61.5
	Total	208	99.5	100.0
Missing		1	.5	
Total		209	100.0	

Table 10. On a scale from 1 to 10, the pharmaceutical treatment for ~~the~~ TMJ pain with the highest average point given by the interviewees is for muscle relaxants (4.98) and the one with the lowest is corticosteroids (3.45).

Statistics

		Do anti inflammatory drugs (NSAIDs) reduce your TMJ pain? (1 is minimum; 10 is maximum)	Do muscle relaxants reduce your TMJ pain? if yes, how much? (1 is minimum; 10 is maximum)	Did you ever take corticosteroids? if yes, how much did they help?(1 is minimum; 10 is maximum)	Did you ever take any supplement with anti inflammatory features? if yes, how much did it help? (1 is minimum; 10 is maximum)
N	Valid	178	140	96	128
	Missing	31	69	113	81
Mean		4.72	4.98	3.45	3.99
Median		5.00	5.00	2.00	4.00
Std. Deviation		2.651	2.932	2.894	2.841
Percentiles	25	2.00	2.00	1.00	1.00
	50	5.00	5.00	2.00	4.00
	75	7.00	7.00	5.75	6.00

To evaluate if pain under stress, meals frequency and benefit of fasting are significantly different in subgroups determined by the food that generates the most discomfort, an ANOVA test was used, comparing the average score attributed to the three scales according to the group.

Table 11. First of all, it emerges that the average scores are different and ~~how~~ the patients who do not have particular hassles associated with food and drink are also those who benefit less from the diet or less annoyance from the high frequency of meals.

Descriptives by group

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
Do you notice that when you are under stress, you eat more and your TMJ pain increases?	None	36	4.69	3.097	.516	3.65	5.74
	Hard food	100	6.16	2.681	.268	5.63	6.69
	Chewing food	7	5.14	3.078	1.164	2.30	7.99
	Solid food	24	6.08	3.243	.662	4.71	7.45
	Sticky food	22	4.36	2.718	.579	3.16	5.57
	Irritating F&B	8	6.88	2.475	.875	4.81	8.94
	Total	197	5.68	2.908	.207	5.27	6.08
Do you feel the more times you eat during the day the more TMJ pain increase?	None	36	3.78	2.789	.465	2.83	4.72
	Hard food	103	6.30	2.879	.284	5.74	6.86
	Chewing food	7	6.43	3.207	1.212	3.46	9.39
	Solid food	26	5.38	3.213	.630	4.09	6.68
	Sticky food	18	5.11	2.610	.615	3.81	6.41
	Irritating F&B	8	6.38	2.446	.865	4.33	8.42
	Total	198	5.62	3.006	.214	5.20	6.04
Did you ever fast for few hours/days? if yes, how much did it reduce your TMJ pain?	None	24	2.29	1.574	.321	1.63	2.96
	Hard food	70	5.21	2.637	.315	4.59	5.84
	Chewing food	5	4.40	2.608	1.166	1.16	7.64
	Solid food	20	4.65	2.870	.642	3.31	5.99
	Sticky food	16	4.56	3.366	.841	2.77	6.36
	Irritating F&B	7	5.43	3.047	1.152	2.61	8.25
	Total	142	4.55	2.800	.235	4.08	5.01

Table 12. For all three variables, the ANOVA test allows us to reject the null hypothesis of equality of the mean scores in the subgroups (p<.05), allowing us to state that the differences in pain under stress, pain linked to meal frequency and the benefit of fasting are significantly different depending on the food.

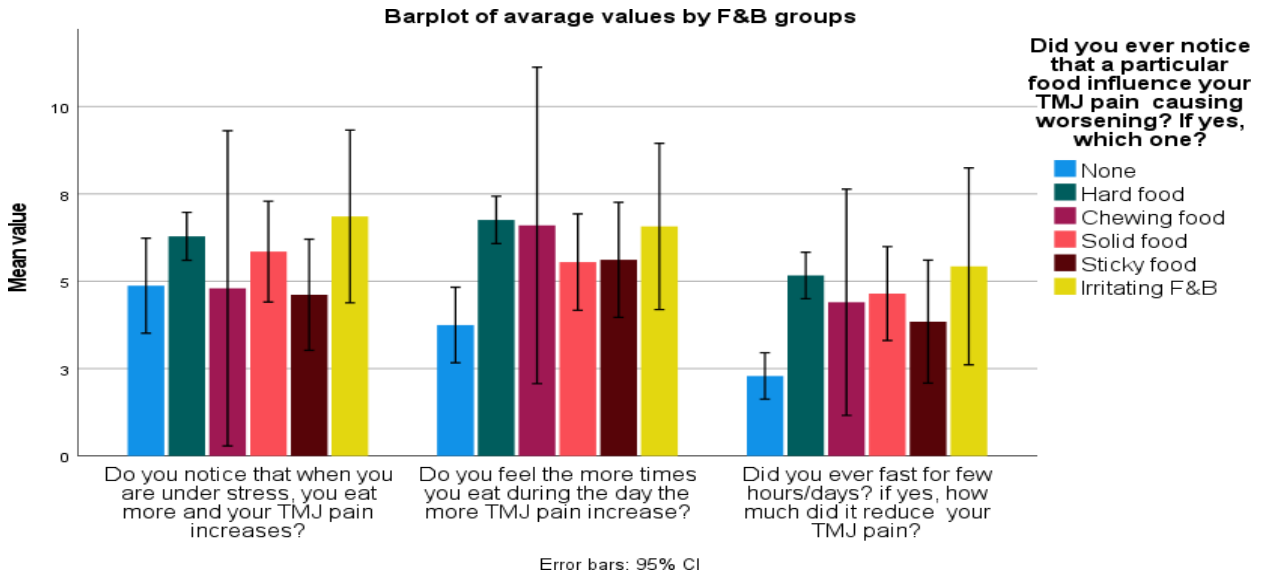
ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Do you notice that when you are under stress, you eat more and your TMJ pain increases?	Between Groups	113.473	5	22.695	2.808	.018
	Within Groups	1543.735	191	8.082		
	Total	1657.208	196			
Do you feel the more times you eat during the day the more TMJ pain increase?	Between Groups	185.178	5	37.036	4.457	<.001
	Within Groups	1595.413	192	8.309		
	Total	1780.591	197			
Did you ever fast for few hours/days? if yes, how much did it reduce your TMJ pain?	Between Groups	159.009	5	31.802	4.571	<.001
	Within Groups	946.146	136	6.957		
	Total	1105.155	141			

In particular, for “Do you notice that when you are under stress, you eat more and your TMJ pain increases?”, the group suffering ~~for~~ with hard food presents significantly higher scores, at level 0.10, of both None group (p=.090) and Sticky food group (p=.083). Instead, for “Do you feel the more times you eat during the day the

more TMJ pain increases?", the group suffering ~~for~~ with hard food has significantly higher scores, at level 0.001, than the None group (p<.001).
Finally, for "Did you ever fast for few hours/days? if yes, how much did it reduce your TMJ pain?", the group that has no particular ~~annoyances~~ problems with food and drinks, has significantly lower scores than almost all other groups, particularly lower than Hard Food (p<.001), than Solid Food (p<.042), than Sticky Food (p=.089) and than Irritating F&B (p=.069), the latter two comparisons having ~~with~~ a level of significance at 0.10.

Table 13. To process data we divided 6 food groups: none, hard foot, chewing food, solid food, sticky food and irritating F&B.



DISCUSSION

Temporo-mandibular disorders (TMDs) are conditions capable of compromising the quality of life of the affected patients. In fact, their typical clinical signs are muscle pain, TMJ clicking and grinding noises, deflection and deviation of the jaw in opening and restriction in mouth opening. These signs can make it difficult to perform everyday activities such as chewing and speaking, contributing to frustration, sleep disturbances and anxiety.[25]

TMD/orofacial symptoms are very common, especially among women and they are considered the most common orofacial pain conditions of nondental origin [5]. Our study confirmed this aspect, as 95.2% of the sample, who chose to answer the questionnaire, were women.

61.5% of the patients reported a limited mouth opening, one of the typical signs of TMDs. A decreased range of mouth opening was found to be very common,. A limited mouth opening could be caused by disc displacement or muscle contraction therefore a correct diagnosis is essential for a correct treatment. The results of this study did not find a statistical correlation between the decreased mouth opening and orthodontic therapy. In fact, in addition to oral health, a correct orthodontic therapy aims to preserve or restore the proper functioning of the joint and muscles. When properly conducted, orthodontic therapy allows the joint to work in the most physiological way.

Regarding the diagnosis of TMDs, the largest portion of the sample (54.1%) never had any instrumental examination. Reportedly, a MRI was used to diagnose the disorder in 12% of the sample, a CT in 15% of the sample and both imaging techniques in 18.8%. So, both a MRI and a CT, although with different potentials, seemed effective in diagnosing temporo-mandibular disorders.

A MRI has the advantage to visualize soft tissues clearly, and MRI findings are useful for the visualization of disc position and configuration, condylar morphology and joint effusion. A CT is useful to visualize only hard tissues, such as condylar and temporal morphology. Matsubara et al. showed that a MRI examination could be the principal instrumental examination in patient with

TMD symptoms, as a CT and a CBCT, which mainly reveal hard tissues, may not be as useful for evaluating the anatomical and physiological complexity of TMJs.[27]

In this study, a high correlation was found between daily eating habits and the severity of symptoms and as both the frequency and the type of food subject the joints to different levels of effort and pain. 142 people in this study had tried various degrees of fasting and it was reported as being quite effective in reducing TMJ, since chewing is not performed and the joint is not subjected to stress.[28]

Conversely, the patients reported that increasing the number of meals or eating certain foods also increased joint pain. Regarding the type of food consumed, a correlation was found between TMJ pain (reported by 85.2 % of the patients) and hard food, which seems to increase joint pain. During chewing of particularly hard foods, the muscle force exerted by the stomatognathic system is considerable and it's usually asymmetric (according to chewing dominance, preferring right or left side) and this can cause damaging stress to the temporo-mandibular joint.[29]

These findings should be investigated with further studies. to evaluate a targeted therapeutic protocol involving a specific diet and chewing strategies; to evaluate possible associations between foods and parafunctions such as bruxing, muscle bracing, clenching and biting, which were not addressed in this study; to compare the effectiveness of addressing parafunctions such as muscle bracing, excessive muscle recruitment, pencil biting, or leaning on a hand ~~etc~~. to reduce the orofacial/TMJ pain; or to evaluate the possibility to prevent orofacial/TMJ pain by reducing predisposing factors such as a soft diet since infancy (which is not promoting proper muscle function) or poor nasal breathing (which sets up a cascade of physiological changes). [30]Unfortunately there are some variables that cannot be controlled easily, such as the hormonal impact of being females, which directly affects the TMJ function and therefore affects the development of pain.[31]

Regarding pharmacological treatment, muscle relaxants were found to be the most effective in reducing TMJ pain, probably because the largest percentage of the patients were affected by orofacial muscular symptoms. However, unexpectedly, the interviewees found corticosteroids not very effective despite inflammation being one of the main mechanisms underlying TMDs symptoms.

Limitations of the study are the fact that it is an anonymous questionnaire and many questions may not be well understood , and that the sample could be larger .Future studies should investigate these correlations on larger samples.[32]

CONCLUSION

The study supports the findings in literature suggesting that daily eating habits affect the severity of TMDs symptoms. These findings could help in the management of joint pain by suggesting the patient follow a specific diet, among other strategies. In fact, it would seem that consuming softer foods and reducing the number of meals, also reduces pain being that of muscular or joint origin, thus improving the patients' quality of life, although long term consumption of softer foods has other epigenetic impacts on the stability of occlusion and the orofacial skeletal complex. Furthermore, it would be interesting to investigate if different types of food can also be a trigger in the development of temporo- mandibular disorders.

In addition, the patients reported that the most common drugs they used to manage pain consisted in FANS, myorelaxant and supplements.

Our study confirmed that a limited mouth opening is a very common sign of TMDs, in fact it is present in the majority (60%) of the sample, and the results of the study show that there is no statistical correlation between orthodontic therapy and a limited mouth opening.

However, further studies need to be conducted to confirm a more specific role of food and eating practices in TMD/orofacial pain, its interaction with other contributing factors (sleep disorders, orthotics, early traumas or medications) and to evaluate new therapeutic approaches for patients affected by orofacial pain.

DECLARATIONS

Conflicts of interest and financial disclosures

The authors declare no conflict of interest

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Ethical Approval

Institutional Review Board Statement: The study was conducted at one clinical center in conformity with the Good Clinical Practice Guidelines, following the recommendations of the World

Medical Association Declaration of Helsinki ethical principles for medical research involving human subjects, as revised in Fortaleza (2013). The patient included in this work was treated in a private dental practice with written consensus.

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