The relationship between TMJ symptoms and orthodontic treatments: a survey on 236 orthodontic patients

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The study analyzes how and if temporomandibular joint symptoms are influenced by different types of orthodontic therapy. Two-hundred-and-thirty-six adult orthodontic patients treated by different clinicians, were asked to complete a survey in which factors as the age, the gender and the type of device were considered. The questions were about the typical symptoms of temporomandibular disorders, in particular headache, bruxism, clenching, pain while opening the mouth and joint's noise. It was highlighted if these symptoms changed during the therapy and if they increased or decreased. The answers to our questionnaire revealed that the only statistically significative difference was related to bruxism, because we found a higher rate in patients treated with aligners than patients treated with metal braces, so we can suggest the fixed technique in the orthodontic patient who suffers of bruxism, even if further studies are required.

Malocclusion is an improper position of the teeth associated, in some cases, with an abnormal relationship between the jaws that don't respect some parameters. In particular there can be problems which were divided according to Angle classes; these are defined considering the relationship between the lower and upper first molars and the upper canine with the lower teeth; furthermore, there are other kinds of malocclusions which consist in transversal discrepancy, sagittal problems, cross bites and overbites. In the recent literature the types of malocclusions which are more related to symptoms, commonly known as temporal mandibular disorders, TMDs, are the ones with an evident overbite and a unilateral crossbite, but it is still controversial.

The malocclusions are quite common nowadays as human lifestyle changed, if we consider the past; now people are used to having a soft diet which is considered one of the reasons of malocclusion.

Another important factor that causes malocclusion to spread between people is the presence of habits during adolescence, which influence the development of the jaws and the teeth. It is undeniable that in the last years the TMDs are more common between people, comparing to the past, which brought the scientific community to look for the reason and the treatments that can help in solving the issue.

For all these reasons, there are many types of orthodontic treatments, as the need for them increased; the orthodontists really believe that each case has its own type of treatment and device. The clinicians refuse the idea that each device can be used in any case, but the choice should be made according to the problems and symptoms that the patient has.

According to the recent studies the malocclusion and TMD are more prevalent in females than males and related also to the adolescents, even if there are few studies that consider them. (1-12)

Key words: TMJ symptoms; braces; aligners; orthodontics; survey

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Liu et al. in 2013 showed how TMD concerns more than 5% of the population and that there is a peak between the ages of 20 to 40, although it can affect all ages, while Lipton et al. highlighted that about 6% to 12% of the people experienced clinical symptoms of TMD (13-16).

There are few theories which support that some hormones and systemic aspects can influence this kind of issue. We also know that there is also a connection between TMD and rheumatological disease, like juvenile arthritis, as rheumatoid arthritis (RA), seronegative spondylopathies, such as ankylosing spondylitis, psoriatic arthritis, gout, and infectious arthritis.

The main symptoms thought to be related to the malocclusion were bruxism, headache, articular noise, orofacial muscle pain and ear pain. TMD can be divided in articular or muscular issues and in a few cases, they can both be present.

These disorders are synonymous with intracapsular and extracapsular conditions, respectively. most non-articular disorders present as myofascial pain focused on the muscles of mastication. In fact, more than 50% of TMD is myofascial pain. Other non-articular disorders include chronic conditions, such as fibromyalgia, muscle strain, and myopathies. Myofascial pain and dysfunction are theorized to be caused also from clenching, bruxism, or other parafunctional habits. The result is masticatory musculature strain, spasm, pain and functional limitation.

For this reason, in the last 30 years there was the idea to treat these symptoms improving the dental occlusion, giving a stable one, an orthopedic stability. It was a common belief in the 90s that the dental occlusion was the main reason of the temporal mandibular disorders, TMD, that can develop in different ways. Since 1950 it was thought that a dental pre contact could exacerbate or cause bruxism and clenching. Till now there is the idea that bruxism and clenching can increase the other symptoms which we said before, in particular the muscle soreness and pain. For that reason at the beginning, it was given great importance the muscle balance which was thought to be reached when there was a stable and proper occlusion.

Nowadays the role of the dental occlusion is not more centric in the treatment of the TMD, because many clinicians noticed that the benefits of the change of the mandible position were not so much lasting in the time. In some way the change of the position of the mandible, in many patients gives an initial benefit to their symptoms, but these benefits were not always continuous. Anyway these aspects are controversial, because there are clinicians still today who think that occlusion has still an important role in this problem even if it is not the only one. The most common and equilibrated idea is that the TMD is a multifactorial disease; in the last years they found an important relationship between the OSAS (Obstructive Sleep Apnea Syndrome), TMD and bruxism and it seems that the OSAS can increase this unwanted movement of the teeth during the night; it was also remarkable in few studies a reduction of the bruxism when OSAS was solved. Moreover, it was also discussed if the devices used to treat the OSAS, like MADs, can influence TMJ and TMD. It is good, as said before, while deciding to start an orthodontic treatment in a patient with TMDs, to consider many aspects, also systemic problems which seem, apparently, far from the alignment of the teeth. As well emotional stress can contribute to increase bruxism and clenching.

This study/survey was done to analyze the connection between the orthodontic treatment and the disorders related to the temporal mandibular joint (TMJ) and how the technique and the devices used can influence the most common symptoms (17-22).

We tried to see how the TMJ's symptoms in patients, who needed an orthodontic treatment because of their malocclusion, can change in according to their age and sex, the type of orthodontic device used.

MATERIALS AND METHODS

We enrolled 236 consecutive patients (217 females and 19 males) admitted to a private dental clinic suffering from teeth misalignment. All patients underwent a complete dental evaluation comprehensive of x-rays and dental impressions. After evaluation braces were prepared personalized based on previously taken impressions and cephalometric measures to correct the misalignment.

After 3 months from treatment, questionnaires were administered to all patients from 05/3/2020 to 05/30/2020 by an online form service (Google Form service, Google LLC, 1600 Amphitheatre Parkway, Mountain View, California, U.S.) and the sample was randomly selected. Demographic data are plotted in table I.

The form, presented in bilingual Italian English, was composed of nine multiple choice question (23-33):

- Are you female or male? - Sei femmina o maschio? (male; female)
- How old are you? - Quanti anni hai?
- What type of braces do you wear? - Quale tipo di apparecchio porti? (Ceramic, lingual, traditional trasparent aligners)
- When did your orthodontic treatment begin? - Quando è iniziato il tuo trattamento ortodontico?
- Do or did you suffer from headache? - Hai sofferto o soffri di mal di testa?
- Do or did you suffer from articular noise? - Hai sofferto o soffri di rumore articolare?
- Do or did you suffer from pain during the opening and/or the closure of the mouth? - Hai sofferto o soffri di dolore durante l'apertura e/o la chiusura della bocca?
- Do or did you suffer from bruxism? - Hai sofferto o soffri di bruxismo?
- Do or did you suffer from teeth clenching? - Hai sofferto o soffri di serramento dei denti?

For the above item the answers were:

1. Before and during with the same intensity - Prima e dopo con la stessa intensità
2. Before and during, but less before - Prima e durante, ma meno prima
3. Before and during, but more before - Prima e durante, ma più prima
4. Before the orthodontic treatment - Prima del trattamento ortodontico
5. During the orthodontic treatment - Durante il trattamento ortodontico
6. Never - Mai

All data were taken in anonymized plot and identified by time signature. Patients wearing ceramic and lingual braces were excluded from the analysis as too scarce to be representative, 208 patients were included in statistical analysis. Distribution homogeneity age group for the two brace types and distribution of answers were evaluated by Kruskal-Wallis test. Homogeneity for sex was assessed using chi square test. All data were analyzed using Statistical Package for the Social Sciences (SPSS 25.0, SPSS Inc., Chicago, USA")

Table I. *Demographic data*

Demographic data	
Age Group	
18-29	106 (44.9%)
30-49	110 (46.6%)
50 and older	20 (8.5%)
Sex F/M	217/19
Bracket type	
Ceramic Braces	27 (11.4%)
Lingual Braces	1 (0,4%)
Metal braces	75 (31,8%)
Aligners	133 (56.4%)

RESULTS

All 236 patients responded to the online questionnaire, and we included 208 patients that used transparent or traditional braces. The only significant difference between the two groups was Bruxism.

DISCUSSION

We evaluated different symptoms usually related to malocclusion to see if there are changes according to the type of the device used for the treatment.

We considered many factors, the age, the gender, the habits like bruxism and clenching which are two of the most debated aspects that are related to headaches and muscles soreness; moreover, we considered the articular noise, which, according to Ribeiro et al. (6), involves a part as well of the patients who are TMD's symptoms free and 86% of the TMD's patients (23-30).

The TMJ noise affects, according Naieje et al. (7), between the 18% and the 35% of the general population. In this study there was no evidence of difference of articular noise in the patients treated with different devices, in particular braces and aligners. We know that orthodontics is not very effective on articular noise. In the same article, we can see that the splint therapy is more indicated for this kind of problem (34-42).

We also analyzed the pain while opening the mouth, as it is common in patients with malocclusion and eventual TMD, temporal mandibular disorders, to have a limited opening and pain during that time. We considered the study of A.M. Heredia-RIizo et al., in which it was proved that in the orthodontic patients the maximal opening of the mouth was major than the non-orthodontic patients, even if the pain is affected by many factors and the same pain influences the maximal opening.

In our survey, we also considered the general headache, which, we know is not a very objective symptom, as it is influenced, and it is caused by many aspects. In literature we can find different opinions, but there is the general idea, according to a lot of studies, that an improved and balanced occlusion can determine an improvement of pain and headache (43-50).

Table II. *Results*

Results			
	Bracket type		
	Metal braces	**Aligners**	**Significance**
Females/ Males	69/6	122/11	N.S
Age Group			
18-29 Y.O	49	47	N.S.
30-49 Y.O.	25	69	
50 and older	1	17	
Do or did you suffer from headache?			N.S
Before and during with the same intensity	14	28	
Before and during, but less before	5	11	
Before and during, but more before	7	15	
Before the orthodontic treatment	11	9	
During the orthodontic treatment	10	19	
Never	28	51	
Do or did you suffer from articular noise?			
Before and during with the same intensity	8	14	N.S
Before and during, but less before	1	5	
Before and during, but more before	3	6	
Before the orthodontic treatment	6	9	
During the orthodontic treatment	2	8	
Never	54	91	
Do or did you suffer from pain during the opening and/or the closure of the mouth?			N.S
Before and during with the same intensity	5	7	
Before and during, but less before	4	4	
Before and during, but more before	3	6	
Before the orthodontic treatment	4	11	
During the orthodontic treatment	6	15	
Never	53	90	
Do or did you suffer from bruxism?			P<0.05
Before and during with the same intensity	5	9	
Before and during, but less before	2	6	
Before and during, but more before	4	9	
Before the orthodontic treatment	2	14	
During the orthodontic treatment	2	13	
Never	60	81	
Do or did you suffer from teeth clenching?			N.S
Before and during with the same intensity	13	14	
Before and during, but less before	9	6	
Before and during, but more before	7	17	
Before the orthodontic treatment	3	10	
During the orthodontic treatment	20	35	
Never	22	50	

In this study we found a significant difference in the patients affected by bruxism, when treated with different devices. The bruxism, according to Eduardo E. Castrillon et al. (9), is an oral behavior that may lead to repetitive jaw-muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible with 2 distinct circadian manifestations: sleep bruxism or awake bruxism (51-57). They share common risk factors and lead to similar consequences for the masticatory system but may have different etiology and pathophysiology. This oral behavior has been associated with tooth wear, masticatory muscle tenderness, headaches, and painful temporomandibular disorders. Available scientific evidence does not support the view that bruxism is a direct cause of pain, which should be taken into account when treating/managing patients.

In this survey we noticed that the fixed braces induced a reduction of this habit, which, at same time, is connected to TMJ pain (8-12), more than the aligners. That confirmed a general opinion which developed in the past years that at least during the orthodontic treatment, the patients suffer bruxism less than before or less than the ones untreated. The newest thing that this study revealed was that the fixed braces seem to determine this improvement more than the aligners.

Until today there were many studies about bruxism, but they still did not find a clear etiology and a definitive cure for this problem. Interesting it was the study conducted by R. Needham et al. (9), that through a grindcare, an oral device that gives impulses, they were able to reduce the bruxism in a great part of the patients.

However, it is clear that bruxism is a multifactorial problem which has many features, of course a balanced and stable occlusion would help. Our study is confirming the conclusion which was reached by T. that aligners do not help or influence this habit (58-61).

According to our study, we can suggest fixed oral braces, not to treat the bruxism itself, but we can advise fixed braces in patients who need orthodontic treatment. In the meantime, they suffer from bruxism, because there is less invasive procedure to treat bruxism in patients, with no need of orthodontic treatment, and that in a way or another helped patients who just suffer of bruxism and not have malocclusion. Therefore, in the light of the data obtained from this study we can say that in the presence of bruxism we should not treat the symptom but investigate the diagnosis.

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