

Temporomandibular Joint Disorders and Class III Malocclusion before and After Its Treatment: What Kind of Relationship?

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Abstract: Relationship between Temporomandibular Joint Disorders (TMD), malocclusion and craniofacial deformity is an extremely critical issue in dentistry field and still controversial. To investigate the prevalence of Temporomandibular Joint Disorders (TMD) and its relationship with different types of Class III malocclusion, this study was undergone through a pre-established clinical form among 30 patients (19,9±4,459) with class III malocclusion. The findings of the study has shown that the prevalence of TMD was around 66,7%. It was 52,6% among patients having achieving their treatment. The relationship between TMD and class III malocclusion was not statistically significant (P= 0,297) before treatment and it was at the limit of significance after treatment (P= 0, 057). Concerning harmful factors for TMD, gender and occlusal disorders were investigated in this study but did not play a significant part in the establishment of this disorder. To establish a cause-effect relationship, prospective longitudinal studies with large and representative samples are needed, integrating an approach concerning psychosocial and physical factors in the screening and management of TMD especially among Class III orthognathic surgery patients.

Keywords: Malocclusion, Angle Class III - Temoromandibular Joint Disorders.

INTRODUCTION

Relationship between Temporomandibular Joint Disorders (TMJ Disorders), malocclusion and craniofacial deformity is an extremely critical issue in dentistry field and still controversial. Therefor two questions must be requested: which of sagittal and / or vertical malocclusion is likely to be in association with Temporomandibular Joint Disorders?

Which one of these two parameters has been established first then has led to the second: Temporomandibular Joint Disorders or malocclusions / dentofacial deformities?

In order to respond to these questions, many studies have been conducted to investigate this relationship. In literature, till now, the etiological factor(s) of TMJ disorders still unwell known otherwise difficult to explain and to understand; its relationship with dento-facial deformities, skeletal discrepancies and / or dental malocclusions still unclear.

For this reason, our study had been conducted in order to investigate the prevalence of TMJ Disorders among a specific orthodontic population: patients with class III malocclusion. Thus, to have an idea if an association can be established between TMJ Disorders and this type of dento-facial deformity.

In another hand, the current study exhibits some of the harmful factors for TMJ Disorders which is commonly considered as a multi-factorial dysfunction.

MATERIALS AND METHODS

30 patients (60 ATM) of mean age 19.9 ± 4.45 [14-24] years were randomly selected from the ODF department at the Monastir-Tunisia Dental Clinic.

All have complete clinical records with panoramic and TRP radiographs before and after orthodontic or orthodontic-surgical treatment.

Transversal study with an analytical component on a sample of the Tunisian orthodontic population using a clinical sheet has been established to meet the objectives of the work.

In order to study the different associations, χ^2 test or Fisher's exact test were used. It is a cross-sectional study with an analytical side whose aim is to

study the relationship between Temporomandibular Joint Disorders and Class III malocclusion before and after its treatment among 30 patients (60 TMJ), with class III malocclusion (Angle Class III or skeletal class III deformity), they are all of Tunisian origin and who had consulted in the Dentofacial Orthopedics department in the clinic of medicine and oral surgery of Monastir.

RESULTS

Description of study population

In the present study, two-thirds of patients are composed of women (66,7 %). The main age of study population is 19,9 years old with a standard deviation ($\pm 4,459$) and the majority of patients are young with an age between 14 and 24 years old (86,7 %).

The half of the study population presents a mixed Class III malocclusion that is skeletal and dentoalveolar at the same time. A third represents those

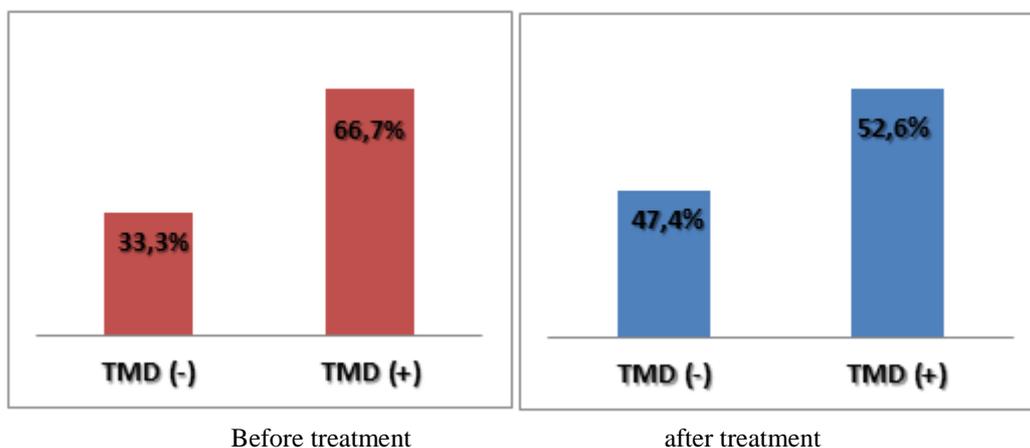
with only skeletal Class III deformity and the rest include patients with Angle Class III malocclusion.

60 % of patients underwent an orthodontic treatment to correct their Angle Class III malocclusion; those whose skeletal deformity was corrected by both orthodontic appliance and Orthognathic surgery are about 40 %.

The majority of patients had accomplished their treatment (63,3 %), 26,7 % were studied before any treatment and only 10 % are studied while ongoing their treatment..

Prevalence of TMD

Temporomandibular Joint Disorders (TMD) was diagnosed if one of clinic and / or radiographic signs was detected. It was highlighted among two-thirds (66,7 %) of study population, however, only 33,3 % are unharmed from TMD.

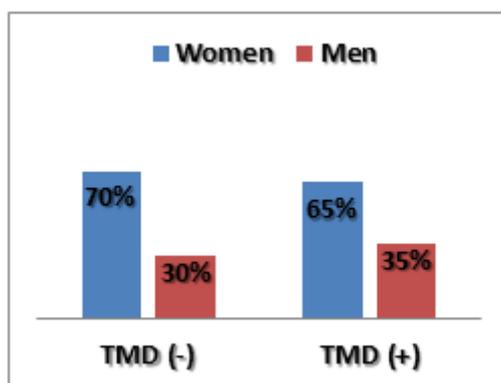


Among the 19 patients, we have a little more than a half has shown persistent signs of TMD even after correction of Class III malocclusion. The rest study population didn't report any sign of TMD.

Among 19 patients after treatment, as much women as men reported and / or showed signs of TMD. No significant relationship was found between gender and TMD before/after treatment.

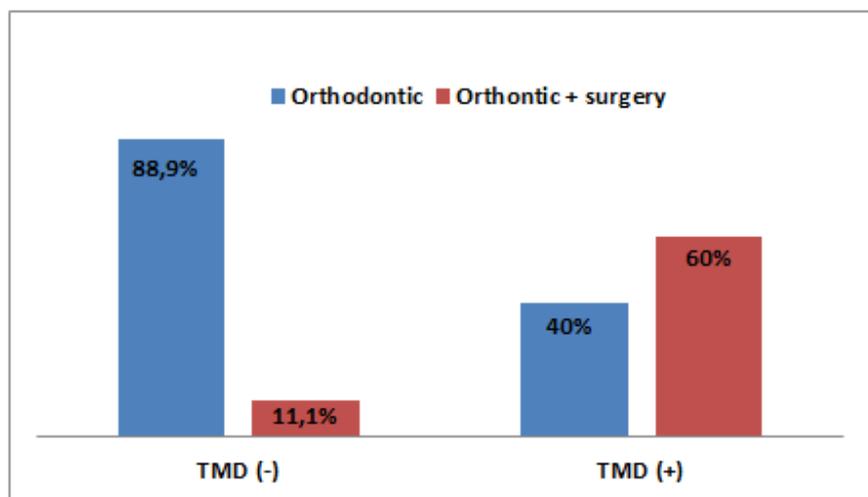
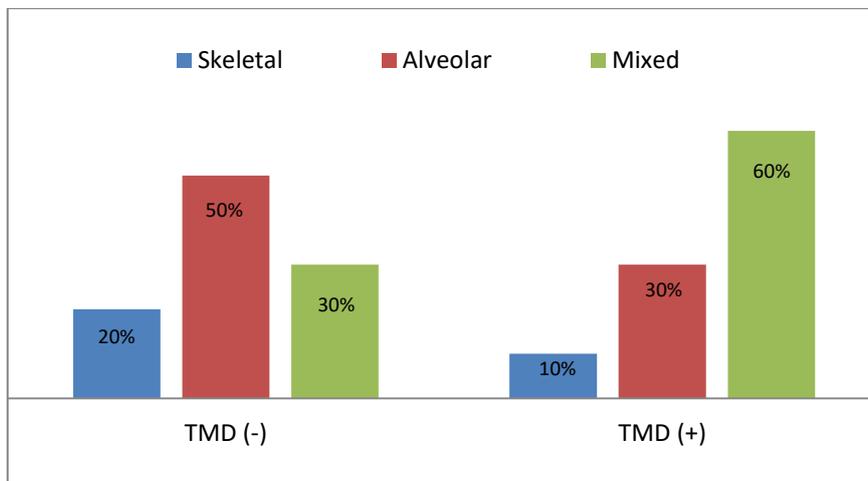
Relationship Analysis

Among the patients with signs of TMD before treatment, 65% are females. The rest are male (35%).



Among the patients reporting TMD before treatment, the majority is aged between 14 and 24 years old. After treatment, around 80% of patients with

TMD's signs had the age compromised between 14 and 24 years old. No significant relationship was found between age and TMD before/after treatment.



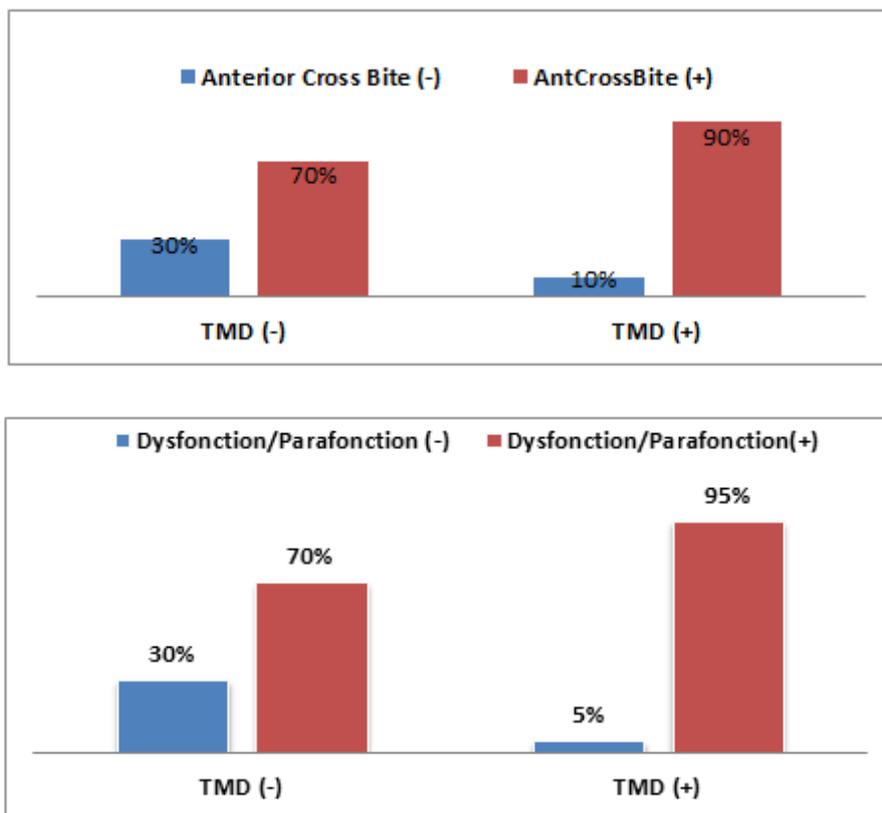
The majority of patients had a malocclusion of class III which is skeletal and dento-alveolar at the same time (60%). But no significant correlation between Class III malocclusion and TMD was found. After treatment, 60% of patients showed TMD's signs. The (p) value is at the limit of significance (P= 0, 057).

Occlusal disorders

85% of patients with TMD present to describe an abnormal Overjet and almost totally of patients with

TMD showed an abnormal Overbite (90%). The majority of patients with TMD (80%) present dentomaxillary disharmony.

90% of patients present an anterior cross bite given that the study population presents the malocclusion of Class III with TMD.



Almost totally of patients present at least a dysfunction and / or parafonction among the group with TMD (95%). Most of patients with TMD (90%) present deviation of media. However, no significant relationship between DAM and any of centring, guiding or timing function was observed. Concerning harmful factors studied in the present study, none of them has shown a significant relationship with TMD ($p>0,05$).

DISCUSSION

Dento-facial deformities and malocclusion have been thought for long time the major cause even the principle etiology of developing dysfunction in the temporomandibular joint (TMJ) and masticatory muscles, commonly known as temporomandibular disorders (TMD) [1]. In the same way, skeletal discrepancy and related occlusal instability have been also considered as the basis for the development of this disorder [2]. Thus, many studies since then have been conducted in order to investigate accurately this relationship.

Generally, the prevalence of TMD among individuals with class III skeletal deformities was reported in 41–88% of the subjects according to some studies [3, 4-7].

In our study, the prevalence of TMD was evaluated at 66.7% before treatment and 52.6% after treatment without significant difference in relation to gender, age, and Class III types. This would seem to be far from the pourcentage reported by Mladenović I *et*

al. (45.5%) for example [8]. Concluding that the prevalence of TMD found among groups of patients with Class III is similar but differs in clinical appearance. However, in others studies *Wisth, Athanasiou* and *Yücel-Eroğlu, Onizawa et al. Ueki et al. Farella et al.* this trouble seemed to be common among patients with skeletal class III malocclusions, going up to 88%. In another study, this can be associated with an open gonial angle and/or increased SN to Mandibular Angle, or with retroposition of the mandible [9].

This wide disparity in the results might be explained by the differences in sample sizes, age, methods of evaluation, ethnic origin. Concerning, gender and age, TMD was reported by almost two-thirds of patients without significant difference between women and men or different age groups. In another hand, types of class III dento-facial deformity do not influence features concerning the distribution of TMD among different groups of patients. These findings are not in line with previous report demonstrating that age category of young adults showed high incidence of disk displacement and absence of inflammatory-degenerative joint disorders [10].

Class III dento-facial deformities have been associated with various osseous changes in TMJ. This may result from adaptive response to functional loading or a sign of dysfunctional modeling [11]. For *Irena et al.* the predominant type of TMD among orthognathic surgery group according to the results of their study, was myofacial pain, observed in 90.5% of the cases

[12]. According to a Japanese study conducted by Koichiro Ueki *et al.* about 88 joints of 44 Class III dento-facial deformity patients, TMJ disk morphology in Class III subjects is associated with stress on the condyle and skeletal pattern [13].

Contrary to the old concept supporting the idea that malocclusions cause TMD, occlusal modifications suddenly observed may be resulted from joint or muscle disorders due to connection between these structures and the dental occlusion. For example: anterior open bite is commonly described among patients with TMJ degenerative diseases (Temporomandibular Joint osteoarthritis); which is called “acquired open bite associated with TMJ “osteoarthritis” [14] and unilateral posterior open bite associated with unilateral condylar resorption [15] or associated with unilateral joint effusion (intracapsular inflammatory disorders: retrodiscitis) [16]; the results of the investigation of José M^a Barrera-Mora *et al.* about the association between TMD, malocclusion patterns, benign joint hypermobility syndrome and the initial condylar position, among one hundred sixty-two subjects, had classified anterior cross-bite, pathognomonic sign of Class III malocclusion pattern, as a risk factor for TMJ Disorders. The examination of painful sites in the right joint revealed significant values when associated with malocclusion in the sagittal plane ($p=0.034$) [17].

This difference between results can be attached to different tools of exploration and diagnosis of signs of TMD. Concerning therapeutic options, they are different according to the origin of class III malocclusion. It may be totally corrected by orthodontic treatment or with association to orthognathic surgery (severe class III deformity) and are associated with risk factors, such as an anterior cross-bite in adults is often accompanied by temporomandibular joint and muscle disorders (TMD) [18].

Earlier, skeletal class III patients can be treated with facemask therapy for maxillary protraction. Hyunju Lee *et al.* in their study about 18 children, they found after comparison of three-dimensional cone-beam computed tomography images before (T1) and after (T2) orthopedic treatment, that the mandibular condyles were displaced outside, upward, and backward; Also it resulted in bone apposition (to the anterior wall) and bone resorption (of the posterior wall) in the glenoid fossa [19]. These changes may result in improvement of TMJ disorders by replacing the mandibular condyles posteriorly and outside. But our study population did not include children who had undergone an orthopedic treatment (facemask therapy for maxillary protraction), so we can investigate its influence on TMJ other than its beneficial impact on the correction of sagittal discrepancy. Therefore our results concern only adolescents and adults who had undergone an orthodontic and or orthognathic surgery.

Later, orthognathic surgery, as it is commonly known, resolves severe skeletal discrepancies through surgical corrections of maxillomandibular complex but in the same way may affect both hard and soft tissues in the maxillofacial region and thus may have a causative role in the onset of TMD [20]. At the same way, it can change condylar position. Many clinical investigations had been conducted and showed various degrees of evolution: Improvement [21-23], deterioration [24] or no change [25-27] in TMD symptoms after orthognathic surgery. For example, in a study about 40 patients with mandibular prognathism who underwent combined orthodontic-surgical treatment (orthognathic surgery group) and 42 patients with untreated mandibular prognathism served as a control group, the results showed the prevalence of TMD was not significantly different between the groups. However the myofacial pain was significantly higher, arthralgia, arthritis was significantly lower in the orthognathic group ($p < 0.05$) [12]. Through other studies, orthognathic surgeries of dento-facial deformities can improve TMJ's symptoms such as pain and dysfunction [29,30]. In another way, Henrikson *et al.* [31] suggested that short-term decrease of the painful tenderness can be explained by the altered activity of the muscles, also Onizawa *et al.* [32] speculated that alteration of TMJ sounds after orthognathic surgery were associated with postoperative reduction of mandibular mobility. However, those improvements of the TMJ symptoms may be due to the betterment of occlusal, skeletal and neuromuscular balance after orthognathic surgery. In the same context, according to Ueki *et al.* [33], the incidence of TMJ symptoms decreased after Sagittal Split Ramus Osteotomy (SSRO) meeting the findings of Togashi *et al.* [34], decrease of TMD's signs and symptoms from 29.5% before orthognathic surgery to 12.1% one year after surgery. The results in this study showed that even if TMJ symptoms were not treated before the surgery, 2-jaw surgery could have therapeutic effects for TMJ symptoms while also provide good stability of condyles [35]. In a systematic review performed by, Z. Catherine, P. Breton, *et al.* about condylar resorption after orthognathic surgery (CROS), the condylar remodeling seems to be secondary to an imbalance between mechanical stress applied to TMJ and the host adaptive capacities and presents a progressive alteration of shape and volume; according to them, some of the risk factor for TMJ Disorders were: class II malocclusion, mandibular advancement superior to 10 mm and counterclockwise rotation of the mandible, [36] those conditions do not meet the class III malocclusion pattern.

After treatment, almost half of 19 patients who had undergone combined treatment orthodontic and surgery showed TMD's signs even after correction of class III malocclusion. No significant relationship between gender and age with TMD was found. However, type of treatment can affect in some ways

TMD by increasing its relating signs and symptoms. Actually, almost significant association between DAM and combined orthodontic-surgical treatment could be deduced from our study ($P = 0.057$). Indeed, more than half of patients reported DAM disorders even after this kind of treatment. This is in agreement with some works but in contradiction with others [37-40] where they report an improvement of certain symptoms of DAM such as pain by the reduction of muscular activity and mandibular mobility. On the other hand, the improvement of occlusal, skeletal and post-surgical neuromuscular balance contributes greatly to this reduction of DAM. This can be explained by the different criteria used for the diagnosis of DAM, various occlusal parameters included various surgical techniques and the heterogeneity among patients of this study.

For example, in the study of Panula *et al.* [41] and Dervis and Tuncer [42], improvement in joint pain on palpation after orthognathic surgery was found and myofacial pain was significantly higher in the orthognathic surgery group. Having in mind that muscle tenderness caused by orofacial trauma last up to 3 months after injury [43], higher prevalence of myofacial pain in orthognathic group could be related to the certain psychological mechanisms which may influence patient's pain experience [44, 45] as well as to high prevalence of females among post-operative TMD cases [46]. These findings do not meet those of Aghabeigi *et al.* [40] who have suggested that female patients are at higher risk of persistent TMD pain after orthognathic surgery. In fact, this sensitivity to TMD pain was previously explained by sex-linked behavior, influence of female hormones [47, 48] and central nociceptive processing up-regulation [49]. In addition, females with abnormal psychological profile were even more prone to have persistent post-operative TMD pain [50].

An explication of inconsistent findings across studies may lay in different factors, including involvement of different skeletal malocclusions in the samples investigated, use of various surgical techniques and fixation methods, the lack of separate investigation of certain TMD sub-diagnoses, application of different TMD screening instruments and the heterogeneity of patients with respect to etiology of TMD [12].

Actually, Research diagnostic criteria for TMD (RDC/TMD) suggested by Dworkin and LeResche [14] not only provided very specific diagnostic criteria for eight TMD sub-groups; it also recognized psychosocial aspect of TMD, including depressive symptomatology, the presence of non-specific physical symptoms (somatization) and psychosocial disturbance caused by their TMD problem [15, 49, 50]. According to the authors, this may partly be explained by the different criteria used for diagnosis of TMD. Namely, in the majority of investigations TMD was reported as the prevalence of various signs or symptoms. In the study

conducted by Farella *et al.* [50] in which TMD was assessed according to the RDC/TMD; TMD was found in 50% of untreated prognathic cases and in 29% of patients 1 year after surgical correction by Le Fort I osteotomy combined with BSSO.

Our study does not highlight a significant association between TMD and treatment of class III malocclusion. For the patients who underwent an orthodontic and / or orthognathic surgery, neither an improvement nor a regression have been reported by them. From another side, we studied some related factors that may be interfering or being associated with the establishment of TMD.

As it is well known, signs and symptoms of TMD are more prominent and more often observed among females in the general population [22, 52]. However, the findings in orthognathic surgery patients have been somehow contradictory in some studies. In the previously cited study of Z. Catherine *et al.* condylar resorption after orthognathic surgery (CROS) is likely happen among "14 to 50 years old women with pre-existing TMJ dysfunction [36]. Irena Mladenovi *et al.* found the prevalence of TMD after orthodontic-surgical treatment is similar to frequency of dysfunction in control group; however, it is significantly higher in females and is most commonly myogenic. In the same study, females had shown an increased level of chronic pain after surgery. Thus we can conclude that female gender is considered as a risk factor for TMJ Disorders [12]. Their findings after orthognathic surgery meet those of others authors [29, 42]. It is possible that biologic susceptibility for TMD and more common presence of psychosocial disorders in females in combination with orthognathic surgery effects could lead to a greater prevalence of TMD in women after orthognathic surgery [47, 53].

Based on the fact that there is an evident connection between TMJ, masticatory muscles, and the dental occlusion, many studies have been conducted in order to study precisely this relationship. For example, McNamara *et al.* through their study, concluded that the contribution of occlusal factors to TMJ symptoms is only 10 ~ 20% [4].

Concerning the association between TMD and parafunctions, an association between the uses of chewing gum, nail biting, oral piercing, and symptoms of TMD was found by Christina Mejersjo *et al.* among one hundred and twenty-four third level high school students [56].

In our study, results show insignificant relationship between the previous studied parameters and TMD. These findings do not meet results of others studies since methods of investigation are different. Also, no significant relationship was found between occlusal factors and TMD ($p > 5\%$).

CONCLUSION

Within its limitations related to the size of sample and methods of investigations, the present study has partly succeeded in investigating the prevalence of TMD among patients with class III malocclusion. Results meet those of general population showing no difference among the specific orthodontic population. It showed a non-significant relationship with gender or age neither before nor after treatment.

DAM known as a multifactorial disorder, involving biological, environmental, social and emotional behaviors and cognitive factors associated with the effects of orthognathic surgery, constitute individually or combined risk factors for this disorder. In our study, no positive correlation was found between AMD and age, gender, occlusal factors, parafunctions, which broadly corresponds to the results described in the literature [57,58].

To explore accurately cause-effect relationship, prospective longitudinal studies with large and representative samples are needed, integrating an approach concerning physical and psychosocial factors in the screening and management of TMD especially among Class III orthognathic surgery patients.

Therefore, further prospective studies are needed to examine this relationship and further studies should elucidate the role of some occlusal disorders in the generation of TMJ disorders and the possible interaction with other variables in TMD development in order to identify potential risk factors and to predict TMD presence and maintenance after its treatment.

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