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OCCLUSAL STABILIZATION APPLIANCE. EVALUATION OF ITS EFFICACY IN THE TREATMENT OF TEMPOROMANDIBULAR DISORDERS

PLACAS ESTABILIZADORAS.AVALIAÇÃO DE SUA EFICÁCIA NO TRATAMENTO DAS DISFUNÇÕES TEMPOROMANDIBULARES

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ABSTRACT

Occlusal stabilization appliances or splints are the most widely employed method for treatment of temporomandibular disorders (TMD). Magnetic Resonance Imaging (MRI) is the most indicated imaging modality to evaluate the components of the temporomandibular joint (TMJ). Forty patients with signs and symptoms of temporomandibular disorders were treated with splints for a mean period of 12 months, comprising regular semimonthly follow-ups. After stabilization of the clinical status, occlusal adjustments and MRI evaluation were performed. It was concluded that the success of this kind of treatment are related to the total (70%) or partial improvement (22.5%) of painful symptomatology and to the functional reestablishment of the craniomandibular complex. The MRI allowed evaluation and also the conclusion that the splints provide conditions for the organism to develop means to resist to the temporomandibular disorders by means of elimination of several etiologic factors. Moreover, after treatment the patients are able to cope with disc displacements with larger or smaller tolerance.
Uniterms: Temporomandibular disorders; Occlusal stabilization appliance; Magnetic resonance imaging.

RESUMO

A placa estabilizadora é o mais difundido método de tratamento das disfunções têmporo-mandibulares. A Ressonância Magnética (RM) é o exame mais indicado para a visualização dos componentes da Articulação têmporo-mandibular (ATM). Quarenta pacientes com sinais e sintomas de disfunções têmporo-mandibulares foram tratados com as placas estabilizadoras por um período médio de 12 meses, com controles periódicos quinzenais. Após a estabilização do quadro clínico foram realizados ajustes oclusais e a avaliação por meio da RM. Concluímos que os melhores resultados dessa modalidade de tratamento são relacionados à melhora total (70%) ou parcial (22,5%) da sintomatologia dolorosa e ao restabelecimento da função do complexo crânio-mandibular. A RM permitiu avaliar e concluir que as placas possibilitam condições para que o organismo possa criar meios resistentes às disfunções da articulação têmporo-mandibular por meio da eliminação de vários fatores etiológicos. E que após o tratamento, os pacientes podem conviver com os deslocamentos do disco, alguns com maior, outros com menor tolerância.
Unitermos: Disfunção temporomandibular; Placa estabilizadora; Ressonância magnética.

INTRODUCTION

Magnetic Resonance Imaging (MRI) is an examination that modifies the spin of the tissue protons by means of a powerful magnetic field and is able to catch the images of the structures in several directions, several thicknesses and variations in contrast. This examination is primarily indicated for observation of soft tissues or tissues containing a large proportion of water molecules, given that hydrogen nuclei are the most strongly magnetized and therefore generate the best image.

This is the most indicated exam for evaluation of the temporomandibular joint (TMJ), since it is the only non-invasive technique that allows observation of the position of the disk, which is a highly important component for mandibular movements and is also responsible for many problems affecting this joint.

The most common and widely employed treatment for temporomandibular disorders is the stabilization splint, which protects the teeth in patients with bruxism, to improve jaw muscle and TMJ function and to relieve related pain. It also acts as an etiologic treatment by avoiding the undesirable occlusal contacts and interferences.

The aim of this study was to investigate the real efficacy of these splints at the intra-articular level, by evaluation of patients treated with stabilization splints demonstrating total or partial symptom remission by MRI.

MATERIAL AND METHOD

A previous study (Tanaka[28], 1996) with utilization of transcranial radiograph and computerized tomography (CT) in 40 patients (4 men and 36 women aged 18 to 56 years) presenting with symptoms characteristic of TMD (facial pain, headache, muscle pain, loss of masticatory function, reduction in mouth opening), together with clinical examination, allowed the establishment of a proper diagnosis of patients with TMD. Both studies were approved by Londrina State University Human Subjects Review Committee.

Afterwards, stabilization splints (stiff and straight acrylic splints with anterior guidance for disocclusion in protrusion, and canine guidance for disocclusion in lateral movements) were provided to the patients, who wore them for around 12 months and were submitted to semimonthly follow-up. After total or partial symptom remission and when the occlusion points on the splint were stable for more than 3 months, the patients were submitted to occlusal adjustments by means of selective grinding.

The temporomandibular joints (TMJs) were examined by means of Magnetic Resonance Imaging in a Phillips Giroscan machine (0.5 Tesla and E1 surface bobbins). Ten to twelve 3-mm slices were performed in coronal direction (T1) with the mouth closed. Sagittal slices with the mouth open and closed (T1 and T2) and with progressive opening and closure were also obtained with 5-mm intervals of opening in order to allow achievement of pseudo-dynamic images recorded on videotapes, improving analysis of the data.

All images were analyzed by five expert radiologists in MRI examination, who evaluated the TMJ from both a structural (bone structures, articular disc) and functional standpoint (alterations in movement, excursion of the condyle and disc displacements) after treatment with the stabilization splints.

With a view to define the outcomes and to clarify the effects of the stabilization splints on the condyle-disc complex and further TMJ structures, the clinical data gathered before treatment onset were taken into account.

The criteria employed for classification of the outcomes as worsening, no improvement, partial improvement and total improvement considered the patients' reports in a scale from 0 to 10 for evaluation of pain (0 = no sigs and symptoms and 10 = unbearable symptomatology), besides clinical and functional examination, as follows:

- worsening: patients demonstrating increased severity of the clinical status even after treatment;
- no improvement: individuals demonstrating no changes in the clinical status even after treatment;
- partial improvement: individuals presenting some improvement in the clinical status, yet with maintenance of some painful symptomatology and/or some signs (clicking and crepitation) that might interfere with function;
- total improvement: individuals demonstrating total remission of the painful symptoms, with no impairment in function even with the presence of unilateral or bilateral clicking.

After MRI, some patients were also referred to orthodontic treatment (2) and prosthetic rehabilitation (7), depending on the needs and on the socioeconomic background of the patient.

RESULTS

Evaluation of the outcomes related to symptomatology before and after treatment revealed a high number of asymptomatic patients after treatment.

These findings are further highlighted in Table 1, which demonstrates the degree of effectivity of the treatment in relation to symptomatology. Just 1 (2.5%) patient presented worsening in relation to the symptoms before treatment, 2 (5%) did not demonstrate any alteration in symptomatology and 37 (92.5%) exhibited total or partial improvement.

This means that 92.5% of the patients achieved some improvement, being 70% completely and 22.5% partially.

Tables 2 and 3 demonstrate the MRI results for the right and left TMJs as to the post-treatment symptomatology.

It is interesting to note that just two patients reporting maintenance of the bilateral pain presented with anterior disc displacement without reduction (ADWOR) on the right side, and one also demonstrated anterior disc displacement with reduction (ADWR) on the left side, whereas the other also demonstrated ADWOR on the left side. One of them displayed signs of reumatoid arthritis during treatment and

therefore was referred to proper treatment concomitantly.

From the 6 patients reporting pain on the left side, 4 presented normal MRI on the right side (Table 2) and 4 also on the left side (Table 3). Trigeminal neuralgia was found on 1 patient on the left side, which would explain the occurrence of pain. The individual with ADWR (right side) and symptomatology on the opposite side also presented ADWR on the left side, and the same was observed for the patient with ADWOR on the asymptomatic right side and ADWR on the left side with pain. The latter was submitted to an associated column treatment and is currently asymptomatic. Therefore, it was concluded that painful symptomatology was not directly related to the findings on the image, since just 2 (5%) patients (1 with ADWR, 1 with ADWOR) reported painful symptomatology on the same side of the disc displacement, and 2 (5%) presented bilateral pain and bilateral

TABLE 1- Distribution of the patients according to the symptoms presented before treatment and the final result in relation to the symptoms

	Final result achieved				
Symptoms before treatment	**Worsening**	**No improvement**	**Partial improvement**	**Total improvement**	**Total**
Bilateral pain	0	1 (4.7%)	2 (9.5%)	18 (85.7%)	21 (100%)
Unilateral pain	1 (5.2%)	1 (5.2%)	6 (31.5%)	11 (57.8%)	19 (100%)
Total	1 (2.5%)	2 (5%)	8 (22.5%)	29 (70%)	40 (100%)

TABLE 2- Distribution of the patients according to the MRI results for the right side and symptoms after treatment

	Symptoms after treatment				
MRI – right side	**Bilateral pain**	**Pain on the right side**	**Pain on the left side**	**No symptoms**	**Total**
Anterior with reduction	0	1 (16.6%)	1 (16.6%)	4 (66.6%)	6 (100%)
Anterior without reduction	2 (20%)	1 (10%)	1 (10%)	6 (60%)	10 (100%)
Normal	0	1 (4.1%)	4 (16.6%)	19 (79.1%)	24 (100%)
Total	2 (5%)	3 (7.5%)	6 (15%)	29 (72.5%)	40 (100%)

TABLE 3- Distribution of the patients according to the MRI results for the left side and symptoms after treatment

	Symptoms after treatment				
MRI – left side	**Bilateral pain**	**Pain on the left side**	**Pain on the right side**	**No symptoms**	**Total**
Anterior with reduction	1 (10%)	1 (10%)	1 (10%)	7 (70%)	10 (100%)
Anterior without reduction	1 (8.3%)	1 (8.3%)	1 (8.3%)	9 (75%)	12 (100%)
Normal	0	4 (22.2%)	1 (5.5%)	13 (72.2%)	18 (100%)
Total	2 (5%)	6 (15%)	3 (7.5%)	29 (72.5%)	40 (100%)

disc displacements (Table 2). Moreover, 10 patients (25% from the total group of 40) on which the displacement was observed on the MRI did not present any symptoms.

DISCUSSION

There is almost complete consensus in the literature as to the remarkable effectivity of the stabilization splints; however, there are no studies demonstrating the intra-articular effects by means of imaging methods. It was concluded that these aspects should be observed, in order to demonstrate them by imaging methods.

Pharoah[24] emphasized that clinicians often do not know the true nature of the temporomandibular disorders they treat, since they are based solely on clinical data for establishment of diagnosis. The author highlights the importance of MRI for detection of problems, and states that the professionals should be informed on the imaging techniques in order to request and interpret them.

Up to now, the MRI is regarded as the best imaging technique for evaluation of the TMJ function, since it is a non-invasive method with no side effects and is highly reliable, even being compared to artrographies as to observation of the structures during movements, as reported in the literature.

According to Bell, et al.[3], MRI provides evaluation of the disk/ligament complex and of the bone structures with sensitivity and specificity above 90%.

Another important aspect observed in the literature[20,25] is the high agreement between observers for MRI evaluation of the TMJ, making it highly acceptable.

MRI is effective for the analysis of both soft and hard structures[11,13] and provides an evaluation of their components both statically and during movement[4,22], therefore allowing an easier diagnosis of functional disturbances of the disk.

Due to these good properties, the MRI was selected as the imaging technique for association between the image data and signs and symptoms of patients with TMD after treatment with stabilization splints, employing the theoretical principles and concepts developed and establishing a protocol for the employment of MRI, similarly to other reports in the literature[6,27].

Stabilization splints are employed to provide a balanced function of the joint, protect the teeth, redistribute the forces applied to the jaws, relax the masticatory muscles and decrease the bruxism[26]. According to the study of Capp[8], the splints also provide relaxation of the masticatory muscles, yielding a more posterior positioning of the mandibular condyle during mouth closure.

The splints were utilized during a longer period than reported in other studies (4 to 6 weeks) [8,19,30] in order to maintain the comfortable position found and also in an attempt to achieve intra-articular changes such as remodeling of the condyle and a better functioning of the condyle-disc complex.

Goldstein[12] states that the splints are able to change the shape and function, however their outcomes are more remarkable as to the painful symptomatology. Clinical trials suggest that the stabilization splints should be regularly adjusted in order to compensate the changes in maxillomandibular relationship brought about by the muscle activity, inflammation and edema. The author further states that, in some cases, orthodontics and prostheses should complement the treatment.

Table 1 shows the symptoms before treatment and their improvement. Data are in agreement with the findings of other investigators such as Major and Neebe[21], who found total symptom remission in 70% of the patients and partial remission in 17%. Tsuga, et al.[30] also reported that 87% of the patients demonstrated some type of positive response to therapy. Moreover, Chung and Kin[10] reported more than 80% of total or partial symptom remission.

Boero[5] also reports success in 82% of the cases, being 37% of total improvement and 45% of remarkable improvement. Allen, et al.[1] reported a better positioning of the condyle on the articular fossa additionally to the reduction in symptoms.

Kurita, et al.[19] observed an increase in the success rate up to 90% with the accomplishment of occlusal adjustment and oral rehabilitation associated to the employment of a stabilization splint.

Murakami, et al.[23] observed, on a follow-up ten years after treatment with splints, that 80% of the patients regarded themselves as excellent and 20% considered their status as good, with no report of dissatisfaction.

This demonstrates that the occlusal stabilization appliance combined to occlusal adjustment brings intra-articular benefits or avoids progression of the dysfunction as to the symptoms and function. This agrees with the study of Kirveskari, et al.[18], who reported elimination of the premature contacts and occlusal interferences, therefore significantly reducing the occurrence of temporomandibular disorders.

Considering the results in Tables 3 and 4, it can be stated that the patient with disk displacement reporting symptoms before treatment will be able to cope with the displacement after treatment, with normal function and no painful symptomatology.

The findings on the MRI scan (in case of disc displacement) do not necessarily indicate the presence of painful symptomatology, and vice versa. It should be highlighted that pain is a personal factor, the threshold of which may present large variations between patients. Its type and location may represent distinct etiologic factors. Concerning temporomandibular disorders, several factors may contribute to the occurrence of pain.

Brooks, et al.[7] reported that asymptomatic patients may also present mild flattening and sclerosis of the condyle.

Katzberg, et al.[14,15] observed a high prevalence of patients without symptoms who presented with disc displacements with and without reduction (33%). However, symptomatic patients are more frequently observed and represent up to 77% of the total amount of displacements.

The number of patients with suggestive findings on the

MRI and reporting symptomatology is the same on the two tables, however the subjects without symptoms increased from 10 (25%) on Table 3 to 16 (40%) on Table 4.

This reinforces the hypothesis that disc displacement after treatment does not necessarily bring about pain.

Chu[9] observed the outcomes of a pilot study on seven symptomatic patients with MRI and found that those individuals presenting with normal aspects on the image achieved better outcomes as to the clinical symptomatology.

On the other hand, Augthun, et al.[2] did not find any correlation between the degree of disc displacement and pain to palpation of the masticatory muscles, joint sounds or occlusal findings. These findings are reinforced by the study of Tenenbaum, et al.[29], who did not observe any relationship between severity of the symptoms and the degree of disc displacement.

A better interpretation of the results may be achieved by means of individual analysis of those patients who did not respond well to treatment or even worsened. As previously discussed on Tables 3 and 4, the patient reporting worsening in the symptoms after onset of the splint therapy was referred to column treatment and this association provided complete reduction of the painful symptomatology. It was concluded that pain was associated to problems not related to the craniomandibular complex.

The patients who did not improve and had no other diagnosed systemic problems were referred to prosthetic rehabilitation, however with no success.

All other 37 patients reported some type of improvement in symptomatology and function, being that 28 (70%) had full recovery and 9 (22.5%) presented partial improvement.

Keith[16] highlights that patients with untreated TMJ dysfunctions and ADWOR have a tendency to present worsening in symptomatology along time, thus confirming the need to treat the temporomandibular dysfunctions.

Kirk[17] evaluated repositioning splints by means of MRI and concluded that there is no real recapturing of the disc, and that clicking is decreased because of an increase in the intra-articular space, allowing better condylar movement over the irregularities of the disc surface.

The present study allowed the conclusion that stabilization splints are largely valid for symptom remission and can also reduce the signs, leading to functional reestablishment in most cases due to elimination of the main etiologic factors. Moreover, through the MRI it was observed that this type of treatment provides conditions for the organism to adapt to unfavorable situations such as disc displacements and degenerations, being able to cope with them with no development of painful symptomatology.

CONCLUSIONS

- Temporomandibular disorders may be treated with stabilization splints and the best outcomes are related to total or partial remission of the painful symptomatology and functional reestablishment.

- The MRI allowed evaluation of the TMJ and the conclusion that stabilization splints provide conditions for the organism to develop means to resist to the temporomandibular disorders by means of elimination of several etiologic factors.

- The MRI also demonstrated that, after treatment, the patients are able to cope with disc displacements with larger or smaller tolerance.

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