

Original Research

Clinical and MRI Evaluation of Articular Disc Repositioning of TMJ in Orthodontic Tooth Movement-A Prospective Study

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ABSTRACT:

Introduction: The utilization of orthopedic functional appliances to correct Class II malocclusions seen in the retrognathic mandibles is suggested in the first stage of orthodontic treatment. A second stage of treatment is done by fixed orthodontic appliances for the occlusal refinement. Hence in the present study we evaluated clinically and by MRI, the changes in the position and form of the temporomandibular joint articular disc after orthodontic appliance. **Materials and Methods:** Forty teenagers with each twenty boys and girls with Angle Class II division 1 malocclusion and mandibular retrognathism were selected. First Herbst appliance was given for an year, followed by the fixed orthodontic appliance. The TMJs were evaluated qualitatively by means of magnetic resonance images at the beginning of treatment (T1), during stage I (T2), at the end of stage I (T3), and at the end of stage II (T4). **Results:** Significant changes in disc position were not observed with the mouth closed between T1 x T3 (P =.3170), T3 x T4 (P = .2817), or T1 x T4 (P = .2611). At T2, on average, the disc was positioned regressively. With the mouth open, no difference was observed between T1 x T3 (P = .2213) or T1 x T4 (P = .0802). We did observe a significant difference between T3 x T4 (P < .05). Significant changes in the disc form were found with the mouth closed between T1 x T2 (P < .001) and T2 x T3 (P < .001). **Conclusion:** At the end of the two-phase treatment, in general terms, the position and form of the initial articular discs were maintained; however, in some temporomandibular joints some seemingly adverse effects were observed at T4.

Key words: Temporomandibular joint; Magnetic resonance; Angle Class II malocclusion.

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INTRODUCTION

The utilization of orthopedic functional appliances to address Class II malocclusions related with retrognathic mandibles is demonstrated for the primary phase of orthodontic treatment.¹⁻⁴ A second phase of treatment is attempted with fixed orthodontic appliances to acquire occlusal refinement.^{1,3} Among

orthopedic appliances, the Herbst is regularly used as a methods for keeping up the mandible in a constant anterior position.¹⁻³ Although different examinations have shown the effectiveness of this strategy for treatment, the instrument by which the temporomandibular joint (TMJ) reacts to the treatment is controversial.^{1-3,8}

A new report assessed examples of stress in the TMJ after mandibular protraction by utilizing a three-dimensional finite element method.^{9,10} The connection between temporomandibular messes (TMDs) and orthodontic treatment has been the material for much discussion. A few investigations propose that orthodontic treatment builds the danger of creating TMDs while two review and the information from a meta-examination show that orthodontic treatment doesn't expand the commonness of TMDs.¹¹⁻¹⁵ Taking into thought that the internal derangement can include, among different variables, changes in the position and type of the articular circle, and in light of the fact that the MRIs grant direct representation of the plate and the constructions of the joint, MRIs were picked to supply demonstrative data on internal derangement of the TMJs.¹⁶⁻²⁰ The target of this examination was to assess potential changes utilizing clinical and MRI, in the position and type of the articular discs in the TMJs of youths with Class II division 1 malocclusion related with mandibular retrognathism treated with the Herbst appliance (stage I) and fixed orthodontic appliance (stage II).

MATERIALS AND METHODS

Fourty teenagers with each twenty boys and girls with Angle Class II division 1 malocclusion and mandibular retrognathism were selected. Mean pretreatment age in the study was 12.8 ± 1.2 years. The Ethical Committee approved the research project and patients consented. The study was done as two stages. The first stage lasted an year, with a modified Herbst appliance. We notices a Rapid expansion in the palate in first 2 weeks. Approximately 6 mm mandibular advances were done in the beginning of the study. If required, 2– 3 mm complementary advances done in the third month. After stage I, they

continued treatment with a fixed orthodontic appliance with preadjusted 0.022 x 0.028 in. brackets. The average time for stage II was 2.2 ± 0.9 years.

MRIs of the right and left TMJs with mouth closed (MC) and mouth opened (MO) were taken at four time points during treatment: proximately before the beginning of stage I of treatment (T1), 8 to 10 weeks after Herbst appliance placement (T2), at the end of stage I of treatment (T3), and immediately after the end of stage II treatment with a fixed orthodontic appliance (T4). The MRIs were inferred for the position and form of the articular discs in parasagittal images.^{22,23} $p < 0.05$ was taken as significant.

RESULTS

Position of disc:

In 57 joints (65% MC) the disc superior seen at position (T1, T3). At T2, the disc moved in retrusive position with he condyle. At MO position, the disc was interposed between the condyle and the articular eminence (T1, T2, and T3). In 37 joints (35% MC) where the discs were displaced at T1, there was recapture or partial recapture of the discs at T2, and they returned to their original position at T3. At MO, the disc was recaptured all most all cases (T1, T2, T3). For T3–T4 (MC) there were changes in 5. For T3–T4 (MO) there were changes in 6.

Disc Form:

For T1–T3 there were no variations(78 TMJs MC, 99%; 75 TMJs MO, 96%). Changes were observed in 6. The discs that showed non-biconcave shape (MC) in T1, turned biconcave in T2 and returned to their prior shape in T3. For T3–T4 variations seen in 7 cases. Later the collected data was formulated and validated.

Table 1: Assessment of the position and form of the temporo- mandibular joint disc, between left and right temporomandibular joint, at (MC), (MO) at T1, T2, T3, and T4

Disc Position	KAPPA		Concordance (%)
	K	P	
MC - T1	–		75.11
MO - T1	0.7620	**	90.61
MC - T2	–		84.41
MO - T2	0.8330	**	93.81
MC - T3	0.5440	**	75.11
MO - T3	–		93.81
MC - T4	–		60.81
MO - T4	–		91.31
Disc Form			
MC - T1	0.8550	**	93.71
MO - T1	0.6520	**	96.91
MC - T2	0.5290	**	90.71
MO - T2	1.000	**	100.01
MC - T3	0.9290	**	96.91
MO - T3	1.0000	**	100.01
MC - T4	0.9110	**	95.61
MO - T4	1.0000	**	100.01

Table 2: Assessment of the changes on the position and form of the TMJ disc, (MC) and (MO), among T1, T2, T3, and T4

Disc Position	McNemar	Concordance (%)
MC - T1 3 T3	.3171	98.400
MC - T3 3 T4	.2871	89.200
MC - T1 3 T4	.2611	91.400
MO - T1 3 T2	–	95.300
MO - T2 3 T3	–	96.902
MO - T3 3 T4	.046*	91.300
MO - T1 3 T3	.2230	95.401
MO - T1 3 T4	.08201	89.202
Disc Form		
MC - T1 3 T2	**	79.702
MC - T2 3 T3	**	78.101
MC - T3 3 T4	.50	95.701
MC - T1 3 T3	1	98.502
MC - T1 3 T4	.250	93.501
MO - T1 3 T2	–	95.300
MO - T2 3 T3	–	100.00
MO - T3 3 T4	–	95.704
MO - T1 3 T3	–	95.301
MO - T1 3 T4	1	89.101
*P, .05 ; **P, .001		

DISCUSSION

Because of the mandibular development and extension of the maxilla controlled by the utilization of Herbst appliance related to a Hyrax expander, sagittal, sagittal, transverse, and vertical changes happened.¹ In this way the harmony of the stomatognathic framework can be endangered, consequently expanding the danger of creating TMDs.^{11,12} in this study we did a prospective report where we assessed longitudinally the position and type of the articular plate of the TMJs, with MC and MO, during the entire treatment. The normal position of the posterior band of the disc in relation to the condyle is 12 o'clock in the MC position, albeit different examinations have noted variations in the position of the disc among asymptomatic populations.^{22,24} Various metric systems for analyzing the sagittal disc position have been proposed on the grounds that the 12 o'clock strategy for deciding circle position comparative with the condyle has prompted confusion. Nonetheless, there is agreement that normal variations happen in physiologic positions, and circle position may be depicted contrastingly relying upon the reference lines used.² In present examination, the posterior band of the disc was classified as being in a typical position when it was arranged somewhere in the range of 11 and 1 o'clock.³ MRIs have demonstrated themselves to be amazingly precise while assessing the type of the disc.²⁴ Thus, it is essential to recognize potential alterations in the form of the disc as a result of treatment with the Herbst appliance, due to compression of the condyle and articular disc against the articular eminence.²⁵ The outcomes showed that critical changes in position of the disc didn't happen with MC (P = .3170) and MO (P = .2230) at T1 and T3. At T1, in the MC position, the disc was in a superior situation in 57

joints (65%), and no progressions were seen in T3. Our discoveries were in concurrence with past investigations.^{2,3} As opposed to our outcomes, Foucart et al.,⁸ showed that Herbst subjects saw three patients who showed changing levels of DD in one or the two joints by MRI. In 37 joints (35%), where the discs were displaced at T1, these were regularly recaptured at T2 and gotten back to their normal position at T3. In concurrence with our outcomes Ruf and Pancherz³ saw that, on account of complete DD with decrease (DDWR), just a transitory repositioning of the disc could be gotten during the Herbst treatment.

When contrasting T1 x T2 and T2 x T3, huge changes were experienced with MC, (P<.001) in the form of TMJ discs that showed DD at T1 with a nonbiconcave structure. At T2 the discs were repositioned because of mandible movement instigated by the Herbst appliance. These discs assumed biconcave structure. Nonetheless, at T3 the position and form of the discs got back to their pretreatment state. In the current examination there were no huge changes in the form of the articular disc, with MC (P =1.000) and MO (concordance, 95.3%) from T1 to T3.

Our discoveries are like the outcomes of Franco et al.,⁴ in spite of the way that various methods were utilized. Ruf and Pancherz³ assessed the TMJs at three phases: pretreatment, during, and 1 year after treatment with the Herbst appliance. They didn't discover antagonistic impacts in the TMJs assessed throughout this brief timeframe. In our examination, the final assessment (T4) happened immediately in all subjects. Subsequently, following 27 months of T3, our outcomes showed that there were no huge changes in the disc position with MC (P = .2817) when T3 and T4 were thought about. However in 6 cases alterations were seen. Based on scientific evidence, we know that alterations in the form of the disc can be involved in

internal derangement of the TMJs¹⁶. Similarly, the presence of DD in the counterlateral joint could build the recurrence of event of DD in another joint by up to 60%.²⁶ It is hard to know whether the deteriorating of the function of these joints inclined them to the advancement of DD or if the treatment meddled in this interaction.

Simply by methods for a longitudinal followups of these TMJs will it be feasible to assess the effect of these progressions and their advancement. In the MO position, contrasting T3 and T4 ($P < .05$), we noticed changes in four joints. The classification of disc position changed from interposed (I) to DDWR, in light of the fact that the TMJs gave DD MC at T4. Albeit the classification may have changed, the plate was at between the condyle and the articular distinction in the two circumstances. While total period of the assessment (T1–T4), there was no critical change in the position (MC, $P = .2611$; MO, $P = 0.082$) or in the structure (MC, $P = .250$; MO, $P = 1.000$) of the articular discs. In spite of Ruf and Pancherz,³ in our investigation, the joints that gave DDWR MO at T1 didn't advance to DD with no reduction at T4. In opposition to current ideas confirming that occlusion is certainly not an essential factor in the multifactorial nature of the TMDs, some occlusal factors, for example, extreme overjet and distal molar occlusion, are related with signs and indications of TMD. This would recommend that people with Class II malocclusion have more danger of TMDs.

In current investigation, all the subjects that completed treatment with the fixed orthodontic appliance (T4) our treatment objective was consistently to get a stable occlusion with gnathological standards, looking to limit the local factors that could team up in the advancement of TMDs. Nonetheless, irregular alterations at T4 in the position and form of the articular plate can be noticed. This reality underscores the significance of a careful assessment of the patients to be treated so inevitable adjustments that may happen because of treatment might be legitimized.

CONCLUSION

Toward the finish of the two-stage treatment, it can be proposed that the position and form of the initial articular discs were preserved; nonetheless, toward the finish of stage II (T4) changes noticed might be related with the chance of future issues.

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