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INDIRECT VERSUS DIRECT ANTERIOR REPOSITIONING SPLINT IN MANAGEMENT OF TEMPOROMANDIBULAR JOINT ANTERIOR DISC DISPLACEMENT WITH REDUCTION (RANDOMIZED CONTROLLED TRIAL)

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ABSTRACT

Purpose: This study aimed to compare patient satisfaction numerically, pain and non-assisted maximal mouth opening after the use of indirect anterior repositioning splint using a protrusive record versus direct anterior repositioning splint in management of anterior disc displacement with reduction of the temporomandibular joint.

Materials and methods: Twenty patients suffering disc displacement with reduction were included in the study. Each patient is asked to use the selected splint for 6 hours daily. Patient satisfaction with splint fabrication was measured by visual analog scale, pain was also measured by visual analog scale and non-assisted maximal mouth opening in mm using a caliper. Study intervals were pre-treatment, 1 and 6 months post-treatment.

Results: Patient satisfaction with splint fabrication was better for group I 7.7± 0.95 compared to group II 3.3 ± 1.49 and there was statistically significant difference between the 2 groups (p value <0.001). There was no statistically significant difference between the 2 groups in pain neither through all study intervals nor in pain change between study intervals. Also, there was no statistically significant difference between the 2 groups in maximal mouth opening in mm neither through all study intervals nor in the change between study intervals.

Conclusions: Fabrication of indirect anterior repositioning splint using a protrusive record is a more acceptable procedure to patients suffering disc displacement with reduction in comparison to direct anterior repositioning splint. Pain and maximal mouth opening are not significantly different when using either indirect or direct splint.

KEYWORDS: Anterior repositioning splint, disc displacement with reduction.

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INTRODUCTION

As Schiffman et al. reported, disc displacement with reduction (DDWR) is an intracapsular disorder in the temporomandibular joint structure. In the closed mouth position, the disc is is located anterior to the condylar head and it is recaptured during mouth opening. Disc reduction may be accompanied by clicking, popping or snapping noises. Occurrence of locking in the closed position with simultaneous interference in mastication excludes this disorder entity. [1]

DDWR accounts for 41% of the symptomatic intra-articular disorders of the TMJ [2] and 33% of asymptomatic individuals. [3] DDWR is characterized by an anteromedially displaced articular disc relative to the condyle in closed mouth position and the disc reduces to its normal position during mouth opening.

Mandibular movements are passively affected in comparison to normal subjects because of the momentary sliding of the condyle in relation to the disc. [5] But, when the open mouth position is acquired, the disc assumes a reduced position inside the joint that is almost indistinguishable from a healthy subject. [6] Discal movements are accused of causing opening and closing click. [7]

Patients with anterior disc displacement with reduction (DDWR) most frequently suffer from pain which is one of the most common orofacial pains with a prevalence of about 6 % worldwide. [8]

Magnetic resonance imaging (MRI) will remain as the gold standard of diagnostic aids for examination of the TMJ region. [9] Nonetheless, in a study carried out by Pullinger, et al, computed tomographic of the position of the condyle in relation to the shape and proportions of the fossa showed that in DDWR patients are characterized by a longer slope of the articular eminence and a shallower fossa.[10] Buduru et al carried out a study to assess the accuracy of the CADIAX Compact 2 axiograph in approving the clinical diagnosis of temporomandibular dysfunction. The study showed a sensitivity of 100%. [11]

In a study held by Fayed et al to compare the anterior repositioning plate and the canine plate regarding relief of signs and symptoms of DDWR, they concluded that both splints are efficient in elimination of joint pain and noise with superiority for the canine splint in recovering the length and shape of the TMJ disc. [12] Kurt et al stated that the nighttime application of eigther anterior repositioning splint (ARS) or stabilizing splints in conjuction with behavioral therapy leads to improved maximum mouth opening. [13] Tecco, et al compared fixed orthodontic treatment to occlusal splint treatment through a 6-month follow-up. Results showed that orthodontic patients had a significantly lower level of discomfort than patients wearing splints. [14]

Arthrocentesis, hyaluronic acid injections, and injection of platelet-rich plasma are considered minimally invasive techniques used in patients not responding to non-invasive therapy. [15]

This study aims to compare patient satisfaction with splint fabrication numerically on visual analog scale (VAS), pain on VAS and non-assisted maximal mouth opening (MMO) in mm after the use of indirect ARS using a protrusive record or direct ARS in management of DDWR.

MATERIALS AND METHODS

Trial design

This study included 20 patients suffering signs of DDWR and TMJ pain with age range of twenty to forty years. Patients were enrolled in the study from the outpatient clinic of the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Cairo University. Patients were randomly divided into two equal groups. In group I, patients were instructed to use indirect ARS using protrusive record while in group II, patients were instructed to use direct ARS.

Participants

Clinical evaluation of temporomandibular joints and muscles of mastication was done according to DC/TMD recommendations. [1] Inclusion criteria involved pain in pre-auricular region that increases by functional activity, reciprocal clicking and MRI to confirm presence of DDWR. (Figure 1) Exclusion criteria involved previous TMJ surgical interventions or any systemic conditions that may passively affect TMJ.

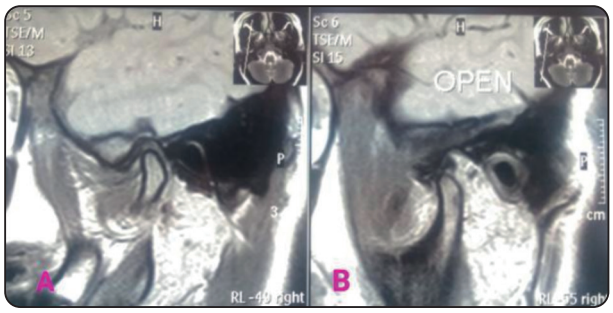

Fig. (1) Shows anteriorly displaced disc in TMJ in closed mouth position and reduced disk in open mouth position

Intervention

For all patients, alginate impressions were taken for the upper and lower jaws. Impressions were poured using dental stone.

Group I: A face bow record was taken for each patient to record relation of maxilla to TMJ and transfer it to semiadjusatble articulator. The maxillary cast was mounted on a semiadjusatble articulator. A protrusive record was made by placing soft wax over the occlusal surfaces followed by asking the patient to bite edge to edge on the wax and the horizontal condylar guidance was adjusted in accordance while lateral condylar guidance was fixed. (figure2 a,b,c) This was followed by readjustment of semiadjusatble articulator. A maxillary anterior positioning splint was formed and acrylic ramp was formed in palatal surface to keep occlusion in anterior direction by forcing patient to close anterior. (figure 3a)

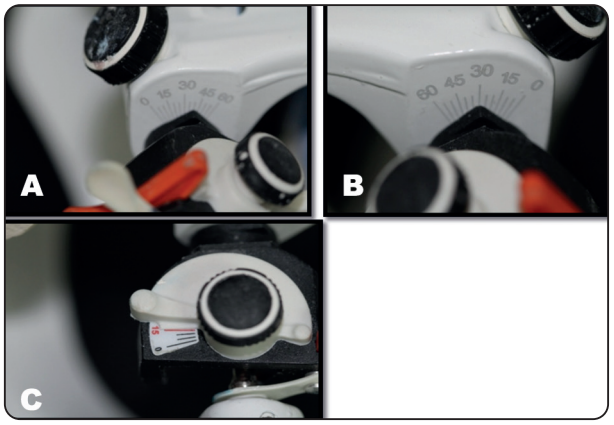

Fig. 2 (a,b,c) adjustment of posterior condylar angle, fixed lateral angle

Group II: A vacuum adapter is used to adapt a 2-mm-thick, clear hard sheet of resin over the cast. The labial border should terminate between the middle and incisal thirds of the anterior teeth and slightly longer in posterior teeth. A little amount of clear, self-curing, acrylic resin is mixed and adapted to the occlusal surface of the anterior region of the splint to serve as the anterior stop. It is 4 mm in width and should cover to the area of contact with mandibular central incisor. The splint is fitted to the maxillary teeth. The patient is instructed to slightly protrude the mandible accompanied by simultaneous opening and closing the mouth in this position.

The conventional method for detecting the protrusive position is to ask patients to open their mouths until clicking occurs. Then, the mandible is protruded minimally for the elimination of reciprocal clicking, which is known as click-free position. [16]

The splint is removed and the area of the contact is marked with pencil to offer a positive contact area for the mandibular incisor. The splint is taken out to add self-curing acrylic to the all remaining occluding areas of the splint away from the anterior stop. A bulge of resin is added lingual to the future contact areas of the mandibular anterior teeth to form a protrusive guiding ramp prior to being

placed in the patient's mouth. The gross excesses are removed with a hard rubber wheel followed by smoothening the acrylic resin. The posterior teeth should have flat occlusal contacts. [17] (Figure 3 b)

Post-operative care and instructions Patients were asked to avoid wide mouth opening, hard food chewing and stressful situations. Non-steroidal anti-inflammatory drugs (NSAIDs) was prescribed only when needed. Moist heat can be used. All patients were informed to keep the jaw muscles relaxed with avoidance of excessive mouth opening and excessive bite on splint. Patients in each group were educated to wear the splint for 6 hours daily.

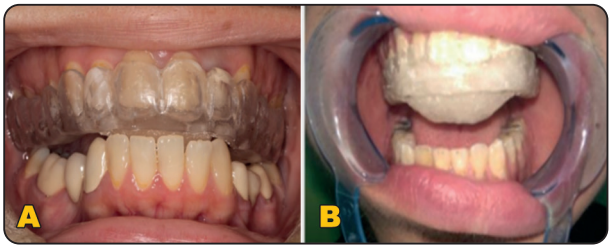

Fig. (3) (a,b): indirect anterior repositioning splint using a protrusive record, direct ARS

Outcomes

Patient satisfaction with splint fabrication was recorded on VAS where 0 indicated "complete non satisfaction" and 10 indicated "complete satisfaction". * Pain was recorded using VAS, where 0 indicated "negligible pain" and 10 indicated "the most severe pain" during palpation. Non-assisted maximum mouth opening (MMO) was recorded in mm using a calliper. (Vernier Caliper: Basti Danishmandan, Jalandhar) as the distance between incisal edges of upper and lower central incisors. Study intervals were pre-treatment, 1 and 6 months post-treatment.

Statistical analysis

SPSS (Statistical package for the social sciences-IBM® SPSS® Statistics Version 20 for Windows, IBM Corp., Armonk, NY, USA) was used for statistical analysis. Data was tested for normality using Kolmogorov-Smirnov and Shapiro-Wilk tests. Quantitative data was represented as mean ± standard deviation. For normally distributed data, Student's t-test was used to compare variables between the two groups. For non-normally distributed data, Mann-Whitney U test was used to compare the two groups variables. Qualitative data were represented as percentage. The Statistical significance was set at P value ≤ 0.05.

RESULTS

This study design was a randomized controlled trial involving 20 patients. The patients were divided into 2 equal groups. The mean age of patients was 29.8±7.64 and 28.6±5.36 years for group I and group II respectively.

Patient satisfaction with splint fabrication on VAS was better for group I 7.7±0.95 compared to group II 3.3±1.49 and there was statistically significant difference between the 2 groups (p value <0.001)

Regarding pain, pretreatment, 1 moth posttreatment and 6 months posttreatment pain on VAS in group I were 7.4±1.51, 6±1.76 and 2.6±0.84 respectively. Pain change after 1 moth of treatment was 1.4±1.51 and after 6 months was 4.8±1.14

Pretreatment, 1 moth posttreatment and 6 months posttreatment pain on VAS in group II were 7.1±1.20, 5.1±1.45 and 2.4±0.84 respectively. Pain change after 1 month of treatment was 2±1.33 and after 6 months was 4.7±1.57. There was no statistically significant difference between the 2 groups in pain on VAS in pretreatment, 1 month posttreatment and 6 months posttreatment (P value 0.63, 0.23 and 0.60 respectively) or in pain change after 1month and after 6 months (P value 0.36 and 0.87 respectively). (Figure 4)

Regarding MMO (Figure 5), pretreatment, 1 moth posttreatment and 6 months posttreatment

MMO in group I were 36.9±3.45 mm, 38.6±3.41 mm and 42.7±2.36 mm respectively. MMO change after 1 moth of treatment was 1.7±1.42 mm and after 6 months was 4.1±2.28 mm.

Pretreatment, 1 moth posttreatment and 6 months posttreatment MMO in group II were 36.7±3.20 mm, 38.7±3.09 mm and 42.3±2.58 mm respectively. MMO change after 1 moth of treatment was 2±1.70 mm and after 6 months was 3.6±1.17 mm. There was no statistically significant difference between the 2 groups in MMO in mm in pretreatment, 1 month posttreatment and 6 months posttreatment (P value 0.89, 0.95, 0.72 respectively) or in MMO change after 1month and after 6 months (P value 0.67 and 0.55 respectively). (Figure 6)

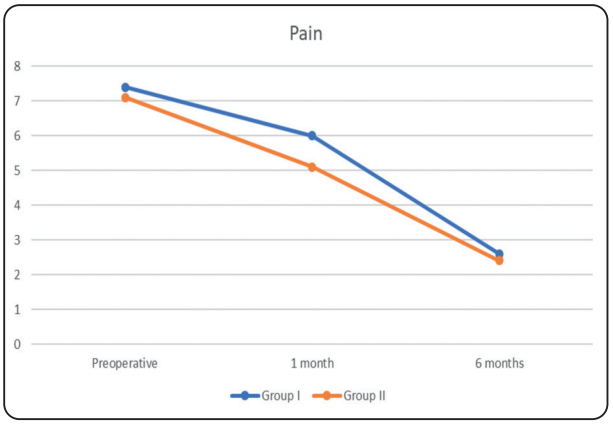

Fig. (4): Line chart showing pain on VAS pretreatment, 1 month posttreatment and 6 months post treatment

Fig. 5 (a, b) : preoperative measurement of MMO, : postoperative measurement of MMO

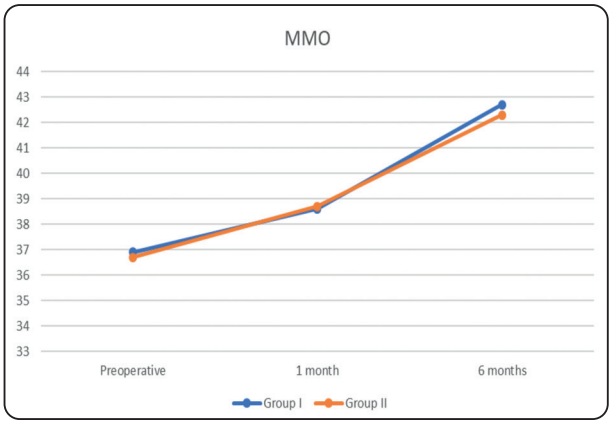

Fig. (6): Line chart showing MMO in mm pretreatment, 1 month posttreatment and 6 months post treatment

DISCUSSION

This study aimed to compare patient satisfaction with splint fabrication, pain on VAS and MMO in mm in 20 patients suffering DDWR that were equally distributed in 2 groups. In group I, indirect ARS were fabricated using a protrusive record while in group II direct ARS were fabricated. Study intervals were pretreatment, 1 month and 6 months posttreatment.

It was postulated that DDWR is the most predominant form of internal derangement of the condyle-disc system. [18] Occlusal splints are removable synthetic occlusal surfaces used for

treatment affecting mandible to maxilla relationship. Treatment of TMJ disorders are among its uses. The appliance can be made to cover maxillary or mandibular teeth and can be fabricated from various materials. [19]

Lakshmi et al stated that ARS contributed much to unloading the TMJ. [20] The mechanism of action of ARS is still not fully understood mostly due to the lack of visibility of the internal structure of TMJ. Moreover, the disc and related tissues are difficult to simulate with many differences between subjects. The mechanisms of action of ARS possibly depends on muscle relaxation and central nervous regulation. [21] Guo et al stated that ARS is effective in palliation, reducing the clicking and improving the joint range of motion when used for 24 hours for 3–6 months. [16]

In this study, there was a positive feedback from patients who were assigned in the indirect ARS group made using a protrusive guide in relation to the conventional direct ARS group. This is most probably due to the ease of fabrication regarding time.

The current study showed much better results than Kaymak et al who stated that only a minor reduction in TMJ sounds occurred over 6 weeks of ARS usage. This may be due to the shorter use of ARS (6 weeks) in Kaymak et al study. [22]

In this study, there was an improvement in pain scores on VAS in both groups but with no statistical significant difference between the 2 groups throughout all study intervals. Moreover, the rate of change in pain scores was not significantly different between groups. This may be attributed to the fact that upon ARS insertion, TMJ tends to attain ideal 3D disc–condyle relationship due to the marked forward and downward movement of the condyles and simultaneous backward movement of the discs. This was approved by Chen et al who correlated TMJ MRI findings to ARS Fabrication in an anterior protrusive edge to edge position. This is in turn decompresses the joint and helps pain relief. [23]

Regarding MMO readings in this study, there was an improvement in both groups with no statistically significant difference. This is coincident with the study held by Majid et al who compared Physiotherapy, ARS and combination regarding MMO. ARS alone group gave superior results in comparison to other groups. [24]

Within the limitations of this study, we can state that ARS is an efficient splint type in decreasing pain and increasing MMO in DDWR cases with special preference of the indirectly fabricated ARS due to ease of fabrication as stated by patients.

Conflicts of Interests

No conflicts of interest is present and this study was self-funded.

REFERENCES

1. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet J. -P, Dworkin F. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the 26 International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. Journal of Oral & Facial Pain and Headache.2014; 28(1): 6–27.
2. Talaat W, Adel O, Al Bayatti S. Prevalence of temporomandibular disorders discovered incidentally during routine dental examination using the Research Diagnostic Criteria for Temporomandibular Disorders. Oral Surg Oral Med Oral Pathol Oral Radiol. 2017;125(3):250-9.
3. Katzberg R, Westesson P, Tallents R, Drake C. Anatomic disorders of the temporomandibular joint disc in asymptomatic subjects. J Oral Maxillofac Surg. 1996;54(2):147-53.
4. Ahmad M, Hollender L, Anderson Q, Kartha K, Ohrbach R, Truelove EL, et al. Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD): development of image analysis criteria and examiner reliability for image analysis. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009;107(6):844-60.

5. Young A. Internal derangements of the temporomandibular joint: a review of the anatomy, diagnosis, and management. J Indian Prosthodont Soc. 2015;15(1):2-7.

6. Sener S, Akgänlü F. MRI characteristics of anterior disc displacement with and without reduction. Dentomaxillofac Radiol. 2004;33(4):245- 52.

7. Jussila P, Kiviahde H, Näpänkangas R, Päkkilä J, Pesonen P, Sipilä K, et al. Prevalence of temporomandibular disorders in the Northern Finland Birth Cohort 1966. J Oral Facial Pain Headache. 2017;31(2):159-64

8. Bagis B, Turgut S, Durkan R, Özcan M. Gender Difference in Prevalence of Signs and Symptoms of Temporomandibular Joint Disorders: Int J Med Sci. 2012; 9(7): 539-544

9. Yang Z, Wang M, Ma Y, Lai Q, Tong D, et al. (2017) Magnetic resonance imaging (MRI) evaluation for anterior disc displacement of the temporomandibular joint. Med Sci Monit 23: 712-728.

10. Pullinger A, Seligman D, John M, Harkins S. Multifactorial comparison of disk displacement with and without reduction to normals according to temporomandibular joint hard tissue anatomic relationships. J Prosthet Dent;2002: 87: 298-310.

11. Smaranda B, Silvia B, Alexandru C, Andreea K, Cosmin C, Oana A, Manuela M, Marius N. Temporomandibular dysfunction diagnosis by means of computerized axiography MEDICINE AND PHARMACY REPORTS. 2020: 93(4) : 416 – 421

12. Fayed M, El-Mangoury N, El-Bokle D, Belal A. Occlusal splint therapy and magnetic resonance imaging. World J Orthod;2004(5): 133-140.

13. Kurt H, Mumcu E, Sülün T, Diraçoğu D, Ünalan F, et al. Comparison of effectiveness of stabilization splint, anterior repositioning splint and behavioral therapy in treatment of disc displacement with reduction. Turkiye Fiz Tip ve Rehabil Derg.2011; 57: 25-30.

14. Tecco S, Teté S, Crincoli V, Festa MA, Festa F (2010) Fixed orthodontic therapy in temporomandibular disorder (TMD) treatment: An alternative to intraoral splint. Cranio. 28: 30-42.

15. Hanci M, Karamese M, Tosun Z, Aktan TM, Duman S, et al. (2015) Intra-articular platelet-rich plasma injection for the treatment of temporomandibular disorders and a comparison with arthrocentesis. J Craniomaxillofac Surg. 43:162- 166

16. GUO Y, CUI S, ZHOU Y, WANG X. An Overview of Anterior Repositioning Splint Therapy for Disc Displacement-related Temporomandibular Disorders China Current Medical Science.2021; 41(3):626-634.

17. J. P. Okeson, Management of Temporomandibular Disorders and Occlusion. vol. 69, no. 1. 2003.

18. Al-Khotani A, Naimi-Akbar A, Albadawi E, Ernberg M,Hedenberg-Magnusson B, Christidis N. Prevalence ofdiagnosed temporomandibular disorders among Saudi-Arabia children and adolescents. J of Headache and Pain. 2016; 1: 1-11.

19. Lindfors E, Nilsson H, Helkino M, Magnusson T. Treatment of TMD with a combination of hard acrylic stabilization appliance and a soft appliance in the opposing jaw. A retro and prospective study. J. Swed. Dent.2008;32 (1):9-16.

20. Lakshmi M, Kalekhan S, Mehta R, et al. Occlusal Splint Therapy in Temporomandibular Joint Disorders: An Update Review. J Int Oral Health. 2016,8:639-645

21. Lotze M, Lucas C, Domin M, et al. The cerebral representation of temporomandibular joint occlusion and its alternation by occlusal splints. Hum Brain Mapp. 2012,33(12):2984-2993

22. Kaymak D, Karakis D, Dogan A. Evolutionary Spectral Analysis of Temporomandibular Joint Sounds Before and After Anterior Repositioning Splint Therapy in Patients with Internal Derangement. Int J Prosthodont. 2019; 32(6): 475-81.

23. CHEN H, LIU M, YAP A, FU K. Physiological effects of anterior repositioning splint on temporomandibular joint disc displacement: a quantitative analysis. 2017 Sep;44(9):664-672.

24. Majid I, Mubeen, Alikutty F. Physiotherapy and anterior repositioning splint in the treatment of disk displacement with reduction-a randomized controlled trial. J Evolution Med Dent Sci. 2020;9(52): 3926-3934