A Tri-Laminated Splint for management of Anterior Disk Displacement

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ABSTRACT
There has been increase in the number of cases reporting to the clinic with complains of TMJ pain. The common reasons for increasing cases of Temporo mandibular disorders are stress and occlusal factors that act as potential risk factors. According to DC/TMD criterion, disk displacement is one of the common forms of TMDs. Occlusal splints are one of the common modalities for management of disk displacement. The purpose of this case report is to present an innovative chairside approach to manage cases having anterior disk displacement and severe pain with splint therapy. Also, it explains how helpful MRI is as a diagnostic tool to
manage such cases. It also identifies role of malocclusion as an etiological factor for development of TMDs and any treatment in such cases must be done after treatment of the temporomandibular dysfunction. Helkimo index was taken to categorize the case and was subjected to MRI for evaluating articular disk position in A-P and Coronal plane. A modified splint fabricated with Essix retainer, Memosil 2 (Kulzer) and Cold cure acrylic was delivered.

**Keywords:** Disk Displacement, Temporomandibular Dysfunction, Occlusal Splint, Malocclusion

1. INTRODUCTION

Anterior Disk Displacement is one of the most common forms of Temporomandibular Dysfunctions (Murphy et al., 2013). The bilaminar zone is interposed between the condyle and glenoid fossa leading to severe pain and also affecting the equilibrium between muscles of mastication leading to their hyperactivity (Karthikeyan et al., 2019). Reciprocal clicking is a red flag sign of anterior disk displacement. It shows an opening click and a closing click (Karthikeyan et al., 2019). The ideal position of articular disk is when the posterior band of disk is situated over the pole of Condyle. It is considered as a significant factor in TMJ dysfunction and is associated with clinical symptoms like pain, joint sounds and abnormal jaw functions (Okeson, 2013). One of the way, it is treated is by advancing the mandible to a position where clicking stops and the disk is recaptured via anterior repositioning splints (Al-Rubayee, 2008). MRI is considered as gold standard in evaluating soft tissue alterations in TMJ and is ideal tool to locate disk position according to DC/TMD criterion. T1 weighted images with pulse echo are ideal to locate changes in disk position (Schiffman et al., 2014).

Malocclusion is considered as a potential risk factor for development of TMDs (Awasthi et al., 2016). Class II Division 1 and Division 2 cases have high risk for TMDs (Cruz et al., 2015). The reason for these cases having high risk for development of TMDs are altered condylar position as well as altered disk position (Gupta et al., 2009). Anterior repositioning splints are one of the common ways for managing anterior disk displacement where a splint is fabricated with mandible advanced to a position where reciprocal clicking is eliminated. This is done by a clinical maneuver where mandible is advanced, not more than edge to edge relationship, to a point where the reciprocal clicking is eliminated. The disadvantage of such hard anterior repositioning splint is that, cases with severe pain find difficult in maintaining the advanced position and eventually are not motivated in wearing the splint. Another problem is attrition due to hard acrylic surface. So, a new method was created for a chairside method for fabrication of splint for management of cases with anterior disk displacement (Kurita et al., 2001).

2. CASE REPORT

A 36 year old male reported to Department of Orthodontics and dentofacial orthopedics with the chief complaint of pain in the TMJ area since 2 years. He had visited several clinics but failed to achieve any relief. The Patient had severe dull aching pain and reduced mouth opening (29mm). Pain was severe during mastication. On palpation, the patient experienced pain when lateral Pterygoid was palpated intraorally. No history of locking or luxation of mandible was present A reciprocal clicking was observed when mandible was manipulated by opening and closing movements.

**Figure 1** Intraoral: A- frontal view, B- Right view, C- Left view Extraoral: D- Profile view
Patient had Class I Molar and Class I Canine relationship. Patient was diagnosed as Angles Class I Division Dewey’s modification type 1 with severe deep bite and Horizontal growth pattern (Fig 1 and 2). Skeletally mandible was retrognathic. Facial Profile was slightly convex. Helkimo Index showed severe TMJ dysfunction. Patient was subjected to MRI with surface coils to obtain T1 weighted High Proton density weighted images, Slice thickness was set to 2 mm, Field view of 20-20 mm square, Repetition time TR 2500ms, Echo time TE 20 ms, the matrix size was 256 x 256 matrix. The MRI showed bilateral anterior disk displacement with reduced anterior joint space.

**Treatment Plan**
The treatment plan was to address the Temporomandibular Dysfunction via a new Tri-laminated splint therapy followed by orthodontic treatment.

**There were two stages of splint therapy**
1. Dual laminated splint with soft layer and Essix retainer A+ (Dentsply Raintree) for the purpose of deprogramming the condyle, relaxing the musculature thus alleviating the pain was used. Anterior disk displacement brings the innervated retrodiscal lamina in between condyle and glenoid fossa. Its compression leads to severe pain. Also, anterior disk displacement leads to over stretching and elongation of superior retrodiscal lamina causing it to lose its elasticity. The splint brings the condyle vertically down allowing healing of the retrodiscal lamina. The soft layer protects the dentition from further damage such as attrition of the dentition.
2. The third layer was fabricated with hard Acrylic resin to hold the mandible in a forward position. This ensures disk recapture by allowing superior head of retrodiscal lamina to heal and regain its lost elasticity. The hard layer was added after 20 days. The initial splint had increased the mouth opening to 36mm by eliminating the pain, allowing healing. The third layer was added to a position by clinically maneuvering the mandible anteriorly to the limit of edge to edge position exactly where the reciprocal clicking got eliminated. The reciprocal clicking got eliminated at this position and a construction bite was taken to record this position.

**Procedure for Splint Fabrication**
1. Take impressions of upper and lower arch.
2. Add 2mm of Kulzer memosil over the maxillary cast from premolar to last erupted tooth. Also, 1mm of composite material was added on labial surface of incisors that needed to be labialized (Fig 3)
3. Fabricate 2mm of Essix retainer (Dentsply Raintree) over this cast. (Fig 4)
4. Retrieve the splint and finish the splint. Deliver the splint to the patient for 24 hour wear for 20 days so that condyle gets deprogrammed with relaxation of muscles of mastication thus alleviating the pain. (Fig 5)
5. After 20 days when the pain gets subsided, a bite is taken in edge to edge bite where the clicking stops on opening and closing of the jaw. This confirms clinical disk recapture. Bite should be 2 mm in height in Incisal region.
6. Mount the two casts and fabricate the third layer with acrylic resin. (Fig 6)
7. Finish and deliver the splint for full time wear, only to be removed while chewing food.Splint has to be continued for 3 months and a Post treatment MRI can be taken after splint removal to check for stability of disk recapture.

**Figure 3** Soft putty Memosil 2 on occlusal surface

**Figure 4** Splint fabricated with Essix A+

**Figure 5** Intra oral placement of Phase 1 Splint, A- right view, B- Left view, C- Frontal View

**Figure 6** Splint fabricated in Acrylic after 20 days - A left view. B- Right View, C- Frontal view, D- Occlusal view.
3. DISCUSSION

Occlusal splint therapy is one of the common modalities for management of Temporomandibular Dysfunctions (Ooi et al., 2018) (Panchbhai and Bhowate, 2016). The above case had anterior disk displacement with elongated superior retrodiscal lamina as seen in the MRI. As the case had reduced mouth opening, it would be very difficult for the patient to maintain the lower jaw in advanced position. Hence the splint therapy was staged in two phases. In first phase, a soft liner, Memosil 2 was adapted on upper model upto the last erupted tooth with a thickness on 1.5mm-2mm. An Essix retainer sheet of 1.5mm was fabricated over the model and was delivered for 20 days. The purpose of phase 1 was to deprogramme the condyle and allow healing in the retrodiscal lamina to allow it to gain its lost elasticity. On next visit after 20 days, a construction bite was taken with mandible in advanced position. The reciprocal clicking (Red flag sign for anterior disk displacement) was eliminated when mandible was advanced to edge to edge relationship indicating disk recapture (Kurita et al., 2001). At this stage, impressions were taken and mounted on an articulator with the construction bite that was taken before. The splint was placed in the upper arch and acrylic was placed in the lower surface of splint. The splint was continued for 3 months to allow healing of retrodiscal lamina and hyperactive musculature. When the second phase of splint was started, the splint therapy was supplemented with TENS therapy (Fig 7). A low neurostimulator that generates stimuli every 1.5s with a duration of 500ms was used. The session lasted for 20 minutes and patient had received 15 sessions (Shanavas et al., 2014). After 3 months of treatment, Helkimo index and MRI were taken to evaluate the condition. Helkimo index showed Mild TMJ symptoms and MRI analysis showed disk recapture and condylar concentricity (Fig 8). The splint therapy supplemental with TENS was successful in reestablishing health of TMJ and associated structures. The Essix extension in sulcus was completely trimmed to allow bonding with 0.022 MBT prescription brackets and L loop archwire made with 0.014 wires was placed for labialization of retroclined upper incisors (Fig 9). Space analysis had shown requirement of single incisor extraction in lower arch and proximal stripping of 6 mm in upper arch for alignment and intrusion.

**Figure 7** TENS (Transcutaneous Electrical Nerve Stimulation)

**Figure 8** Pre and Post MRI showing anterior disk displacement and disk capture after the treatment. Redline- Glenoid fossa (superior compartment) Green line- Articular disk, Yellow line- Condyle
4. CONCLUSION
Orthodontic treatment can become an aggravating factor for TMDs if they are not identified and treated prior to orthodontic treatment. MRI is a gold standard for diagnosing temporomandibular dysfunctions. The modified Tri-laminated splint was effective in managing anterior disk displacement with severe symptoms and TENS served as supplemental aid.

Abbreviations

- TMJ - Temporomandibular Joint
- DC - Diagnostic Criteria
- TMD - Temporomandibular Disorders
- MRI - Magnetic Resonance Imaging
- TENS - Transcutaneous Electrical Nerve Stimulation

Author’s contribution
Dr. Zynul has planned the splint and treated the case and Dr. Sunita has guided the treatment progress

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The authors declare no conflict of interest.

Patient Consent
A proper consent was obtained with signatures for publishing the images of the case.

REFERENCE

