

A novel chair side oral splint for the management of Temporomandibular joint disorders - Oobleck Splint

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Abstract— Temporomandibular joint disorders, also known as TMD's, are complex set of disorders which are clinically manifested by pain near ear and limited out opening. Management of TMDs usually consists of conservative therapy and splint therapy. Splint Therapy is most commonly applied in the management. Hence this article aims to deliver a chair-side splint which helps to eliminate pain and subside other symptoms. The splint incorporates a thixotropic material in between which acts as cushion for the joints and acts as a shock absorber. The splint is easy to fabricate and can be delivered to the patient the same day.

Index Terms—Occlusion, Orthodontics, Splint, TMD

I. INTRODUCTION

Temporomandibular Joint (TMJ) is a compound joint formed by articulation between the condyles and articulating surface of temporal bone. TMDs refers to a cluster of disorders which are characterised by pain in the TMJ or its surrounding tissues. Other symptoms may include functional limitation of the mandible, clicking in the joint during opening or closing. The etiology of TMD's is multifactorial but some- times the etiology remains unknown. Treatment of TMJ disorders starts with conservative therapies which are simple and do not invade the tis- sues of face, jaw and joints. Since most TMJ disorders are temporary and do not get worse, simple conservative treatment is all that is usually needed to relieve discomfort.¹

Occlusal Splinting and occlusal adjustments are the most commonly employed method in conserve management of TMD's. Occlusal splint therapy may be defined as the art and science of establishing neuromuscular harmony in the masticatory system by creating a mechanical disadvantage for

parafunctional forces with removable appliances.” Whereas an Occlusal splint is defined as any removable artificial occlusal surface used for diagnosis or therapy affecting the relationship of the mandible to the maxilla. It may be used for occlusal stabilization, for treatment of temporomandibular disorders, or to prevent wear of the dentition. The main goal of an occlusal splint is to protect the TMJ discs from dysfunctional forces that may lead to perforations or permanent displacements.² Two main types of splints are available: Occluding and non- occluding. Occluding splints, also called stabilization splints, are specially fabricated to improve the alignment of the upper and lower teeth. Non- occluding splints, also called simple splints, primarily open the jaw, release muscle tension, and prevent teeth clenching. Non-Occluding splints are typically made of a soft- vinyl and are easier and cheaper to fabricate.³

In this article we aim to fabricate a chair side splint which can be cus- tomised and delivered to the patient the same day. This splint incorporates a thixotropic material which acts as a cushion to the TMJ.

II. TEMPOROMANDIBULAR JOINT DISORDERS AND ORTHODONTICS

TMD is related to every speciality in dentistry and hence its management becomes a topic of great controversy among dentists. Abnormal occlusion is seen as a major causation factor of TMD. Costen's syndrome as given by *Dr. James Costen* correlated TMJ pain, headache, limited mandibular opening, and ear symptoms with increased overbite. Here

comes the role of Orthodontists. In various situations, treatment of malocclusion merely will treat the underlying TMD.⁴ *Ramfford*, through an electromyographic (EMG) study on 34 patients, suggested occlusal equilibration to provide muscular balance and to eliminate the bruxism. The proposed causal chain of events suggested that interference acts as a trigger for bruxism, which in turn may result in overload of the masticatory muscle, tenderness, pain and TMJ clicking.⁵

Orthodontists like *Brodie*, *Moyers*, *Ricketts* have worked significantly to understand the concept of TMJ, Jaw function, and occlusion.

Ronald Roth introduced the concept of gnathology and prosthodontics into orthodontic patients. He suggested optimal functional occlusal goals by coinciding CR with CO. To achieve these goals, he suggested power bite registration and use of articulators.⁶

It was earlier suggested that premolar extractions in the upper arch can cause a posterior displacement of the condyle which in turn could be associated with increased risk of joint dysfunction. However, correlation between disc displacement and the posterior position of the condyle is controversial because of the large inter-individual variation in condylar position.

Even though many studies have been performed to determine the relationship of TMD and malocclusion but neither suggests adverse relation. But it becomes necessary for an orthodontist to properly diagnose a TMD prior to starting orthodontic treatment to prevent the exaggeration of signs and symptoms of TMD.⁷

If the patient presents signs or symptoms of TMD before starting orthodontic treatment, the first step is to make the diagnosis. When the patient's chief complaint is pain, it is important to make a differential diagnosis to determine whether the pain is because of TMD, i.e. musculoskeletal condition, or to another disease. The second step is to resolve the pain by following a conservative treatment protocol including pharmacotherapy, counselling, behavioural therapy, home exercises, physical therapy and/or occlusal appliances.⁸

III. APPLIANCE DESIGN AND USES

Occlusal splint therapy has been widely administered in the management of TMD. Although Soft splint is the most commonly used splint but we aim to fabricate a Chair side splint which incorporates a thixotropic material which acts as a shock absorber.

A 13 year old boy reported to the Department of Orthodontics and Dentofacial Orthopaedics, MGDCH, Complaining of restricted mouth opening and pain while opening of mouth. On Clinical examination and palpation, it was found that mouth opening reduced to less than 20 mm and the patient experienced pain in both the TMJ's during mouth opening. The patient was diagnosed with Anterior disc displacement with Reduction. Since the patient reported to the department in acute phase, muscle relaxants were prescribed for 2 days for the symptomatic relief. When the pain intensity was relieved, impressions of the lower arch were taken with alginate and the cast was poured in die stone. Trimming of the cast was performed for accommodation of thermoform retainer splint.

Since the patient experienced reduced mouth opening and pain, an oral splint which provides cushion to the TMJ was decided to be fabricated. Two thermoforming sheets were selected to solve the purpose. The sheet which was first adapted to the cast was a 1 mm of Duran sheet, on which an Isofolane spacer was adapted to create space for the material to flow in. A 1 mm of Bioplast sheet was then adapted over these two sheets. The Duran provides strength and the bioplast provides softness to the appliance. Trimming of the sheets were performed and the peripheral borders were sealed using clear acrylic leaving the posterior area open to create a sleeve for the insertion of the material.

A thixotropic material are odd solids and fluids that change their viscosity when loaded by stress by becoming less viscous. This ability is a non-Newtonian property. This means that, at rest, the material becomes more solid than it is when compressed. They are also called non-Newtonian Fluid. Hence an Oobleck which exhibits thixotropic properties was used in this splint. Oobleck can be

fabricated using cornstarch mixed with water in proportion. But a variation was used instead. Toothpaste which is also a thixotropic material was inserted between the two sheets with the help of a syringe, and the open end was sealed using the Clear acrylic (Fig. 1 & 2).



Figure 1: Oobleck splint



Figure 2: Splint Fabricated

The splint was delivered to the patient and the patient was advised to wear the splint at night initially for 10 days and then during day for the next 20 days (Figure 3).



Figure 3: Splint Delivered to the patient

Alternate day report of the patient was taken over telephonic conversation. The patient reported relieve in symptoms after 2 days of splint therapy. Mouth opening increased to 30 mm when patient visited for checkup after 10 days (Figure 4).



Figure 4 : After 10 days of Splint Therapy

IV. DISCUSSION

Temporomandibular disorders is a collective term embracing all the problems relating to the TMJ and related musculoskeletal structures. Many therapies have been advocated for treating TMD.⁹ A therapy that is commonly provided is an occlusal orthotic, also called a dental or occlusal appliance or a splint. Occlusal splint/occlusal device can be defined as “Any removable artificial occlusal surface used for diagnosis or therapy affecting the relationship of the mandible to the maxilla”. It may be used for occlusal stabilization, for treatment of TMJ disorders, or to prevent wear of dentition.¹⁰

Splint therapy is considered an adjunct to pharmacologic therapy and most appropriate when nocturnal parafunctional activities can be identified. Typically, a flat- plane maxillary occlusal splint designed for bilateral contact of all teeth is fabricated. Such splints are thought to unload the joint by disarticulating the dentition and increasing the vertical dimension of occlusion. By unloading the joint, there will be a reduction in both synovitis and masticatory muscle activity. Therefore, the result is a reduction in symptoms. These appliances may also change condylar position and the existing occlusal relationship, thereby reducing abnormal muscle activity and spasm. Most occlusal splints have one primary function that is to alter an occlusion so they do not interfere with complete seating of the condyles in centric relation. Okeson classified the occlusal splints in stabilization appliance and anterior repositioning appliances with other types of occlusal splints which includes, anterior bite plane, posterior bite plane, pivoting appliance, soft/resilient appliance. Dawson classified the occlusal splints into permissive

splints/muscle deprogrammer and directive splints/non-permissive splints.

The Oobleck splint provides bilateral balance and perfectly distributed occlusal forces. Muscle pain can be dramatically relieved and healing can begin immediately. The splint's smooth, flexible surface permits the teeth to easily slide across it. Proprioceptive guidance is neutralized as the dominant factor in functional mandibular placement. The muscles respond instantly by moving the mandible into its most comfortable, least accommodated position. Generally within the first few minutes, this occlusal-muscle harmony eliminates occlusally triggered facial jaw pain and muscle spasm. The Oobleck splint responds dynamically, continuously re-equilibrating and balancing bilaterally as the mandible shifts to the position most comfortable for the muscles to function. The ease of fabrication of the splint and cost effectiveness makes the splint more effective.

V. CONCLUSION

TMD should be treated like any other musculoskeletal complaint. If TMJ/TMD is left untreated, symptoms can worsen and extend far beyond the jaw and mouth area. Conservative therapy is best as a first-line approach for treating the patient. Soft oral splints can be used as effective means of treatment for such patients. This can be easily made and gives good comfort to the patient. The Oobleck splint is a breakthrough in pain therapy. It is a muscle relaxing, floating action temporary splint which does not cause permanent or irreversible changes in the structure or position of the jaw or teeth. It has better patient compliance, fewer side-effects, and is more cost-effective than surgical treatment.

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