

TREATMENT MODALITIES OF TEMPOROMANDIBULAR DISORDERS-HARD AND SOFT SPLINTS

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Abstract:

AIM/PURPOSE: The purpose of this review article is to compare the efficiency of hard and soft splints that have been used to treat temporomandibular disorders.

RESULTS: Both forms of occlusal splints (soft and hard) improved temporomandibular disorders.

CONCLUSION: In spite of numerous disagreements regarding the efficacy of occlusal splints many studies proved that occlusal splints are the most common and efficient treatment for TMD patients with a success rate of 70-90 %.

INTRODUCTION

The temporomandibular joint is referred to as "ginglymodiarthrodial" ginglymoid means rotation and arthrodial means translation. During initial mouth opening condyle rotates followed by translation. Temporomandibular joint should harmonize with the different components including mandibular condyles, meniscus, glenoid fossa, ligaments, and muscles that is well documented.^{1,3} The function of TMJ is well maintained until it is disturbed by external factors that affect the joint function, such as mechanical, psychological, occupational, and habits. Pain, clicking, noise, grating in the jaw joint or problems in chewing

or opening of jaw are the common signs and symptoms of temporomandibular disorders.^{5,6} Anderson et al. reported that approximately 75% of the total population manifest at least one sign of joint dysfunction. This review article is intended to evaluate the use of hard and soft splints as a treatment modality for temporomandibular disorders

Treatment options for TMD

Reassurance (patient education, self-care and behavior therapy), transcutaneous electric nerve stimulation (TENS), occlusal splint therapy, physiotherapy (such as ultrasound, acupuncture, short wave diathermy laser, heat exercises, and biofeedback) drug therapy, occlusal adjustment, surgical intervention and combined treatment were the numerous treatment options available today.

Occlusal splint therapy has been frequently used treatment modality for patients with sleep bruxism to protect teeth from damage caused by forceful jaw muscle contractions or to reduce orofacial pain, if present. However, little knowledge is available regarding the mechanism of the action of occlusal splints.^{3,4,5} Most of the studies have examined changes in the masticatory muscles activity before and after application of an occlusal splint.

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VARIOUS ORAL APPLIANCE DESIGNS AND RELATED CONCEPTS

Okeson classified the occlusal splints as 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. According to Dawson occlusal splints are classified into permissive splints/muscle deprogrammer and directive splints/non-permissive splints.⁹

Flat plane stabilization appliance

Flat stabilization appliance is otherwise known as michigan splint, muscle relaxation appliance, or gnathologicsplint. According to Manns et al Ideally, when a stabilization appliance is placed intraorally, it should produce minor alterations to the maxillomandibular relationship other than that produced by the thickness of the material. This is the most commonly used appliance and when properly fabricated it has the least potential to cause adverse effects to the orofacial structures.⁸ A stabilization splint should provide an ideal occlusion in both the static and dynamic situations. Ash and Ramfjord describes the ideal occlusion :

1. The teeth should be in contact in centric relation, which is considered to be the end point of the terminal hinge axis.
2. Centric occlusion is slightly anterior to centric relation but in the same sagittal and horizontal planes
3. Unrestricted glide from centric relation to centric occlusion
4. Smooth gliding eccentric movements.
5. No non-working-side interferences during lateral and protrusive excursions.

The aim, therefore, a stabilization splint is to provide the patient with a static occlusion in which

the maximum number of occlusal contacts are made simultaneously and with equal force between the opposing teeth and the splint.⁶

Soft splints

The stabilization splint is well tolerated in the lower arch than the upper arch as there is no satisfactory way of thinning the margins of the splint while keeping good retention. These appliances are usually worn only at night and, if they are to be successful, will produce some symptomatic relief within 6 weeks. They should be replaced after 4 - 6 months as they lose their resilience with the passage of time. The appliance is generally made out of 2 mm polyvinyl. If a thinner splint is required, overheat the material before vacuum forming, and if a selectively thicker appliance is required (for instance in a patient with an anterior open bite) then layers can be added in particular areas (i.e. anteriorly) to establish even occlusal contact.⁶

Posterior bite plane appliances

Posterior bite plane appliances (mandibular orthopedic repositioning appliances) are generally fabricated for the mandibular arch. This appliance has claim to increase the overall physical strength and also enhance athletic performance. This appliance function by producing changes to the vertical dimension and also alter the horizontal maxillomandibular relationship. The major concern regarding this appliance design is the iatrogenically created posterior open bite, since the occlusion occurs only on the posterior teeth, allowing supraeruption of the unopposed anterior teeth and/or intrusion of the opposing posterior teeth

Traditional anterior bite plane

Palatal-coverage horseshoe shape appliance with an occlusal platform mostly covering six or eight maxillary anterior teeth (e.g., Hawley, Sved, Shore). Clenching was prevented by this

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appliance by leaving posterior teeth not in occlusion during closing or in parafunctional activities. Supraeruption of posteriors is the major drawback of this appliance which is extremely unlikely if worn only at night.⁴

Mini anterior appliances

The concept of making this oral appliance was first introduced in the mid 1900's as the lucia jig that engaged only a small number of maxillary anterior teeth usually two-four incisors. Nociceptive trigeminal inhibition tension suppression system, the anterior midline point stop devices and the best bite are certain variations that have appeared on the market

Anterior repositioning appliance

The anterior repositioning appliance (also referred to as an orthopedic repositioning appliance) is primarily used for patients with disc displacement with reduction. The appliance holds the mandible in the anterior location to seat the condyle on to the disc. It can be used as a temporary treatment modality to gain symptomatic relief of painful internal derangements, but not to "permanently" recapture the TMJ disk.⁷ This type of appliance should be used with caution, and just for short periods of time, mainly recommended after stabilization splint therapy.

Neuromuscular appliances

It has been claimed by the proponents of neuromuscular dentistry that the use of jaw muscle stimulators and jaw-tracking machines enables them to produce an oral appliance at the ideal vertical and horizontal position of the mandible relative to the cranium.⁷

Pivot appliances

The device is fabricated using acrylic resin material that covers the maxillary or mandibular

arch with one posterior occlusal contact which is placed as far posteriorly in each quadrant. These appliance function by reducing intra-articular pressure by condylar distraction. The pivoting appliance was recommended for patients with internal derangements or with osteoarthritis. Unilateral pivot placed in the posterior region is a modified version of this appliance. When the mandible close on this pivot contralateral joint will be loaded and slightly distract the ipsilateral joint. Unfortunately, a potential adverse effect with the use of this modified appliance may cause occlusal changes as a posterior open bite in pivot area.⁴

Hydrostatic appliance

This appliance was designed by Lerman which was primarily consisting of a bilateral water filled plastic chamber and acrylic palatal plate. The patient's posterior teeth would occlude with these water filled chambers. When a splint is inserted there is an increase in occlusal vertical dimension beyond the freeway space, allows a muscle relaxation to function more efficiently during contact and be less active during postural functions. This design was later modified to become a tool that would be retained under the upper lip, while the fluid chambers might be positioned between maxillary and mandibular posterior teeth.

Effect of hard and soft splints on EMG activity

Soft splints produced a slight increase in masseter and temporalis muscle activity, but particularly the masseter muscle. There is a shift in the balance of activity away from the anterior temporalis muscles with both splints, particularly at 10% of the maximum clenching level. The temporalis muscles shows a reduction in activity relative to the masseter muscles may be a factor in the therapeutic effect of both hard and soft splint, although the relief is clearly greater with the hard splint.³

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Effects of hard and soft occlusal splints on nocturnal bruxism

For symptomatic patients associated with increased nocturnal muscle activity, a soft occlusal splint is likely to be contraindicated. A hard occlusal splint appears a more likely successful treatment.¹⁰

Effects of hard and soft occlusal splints on myofascial pain

Both the hard and soft occlusal appliances had similar effects with no significant differences regarding the pain intensity and muscle tenderness reductions. However this should be taken with caution because limited number of the included publications that considered at a high risk of bias.²

SL NO	TYPES OF SPLINT	FUNCTION	CLINICAL USAGE
1	Stabilisation splint/ Permissive splint	Creates uniform contacts on all teeth. Allow complete seating of condyles CI=MI Cuspid ramp for anterior guidance	TMJ pain, muscle pain and dysfunction
2	Anterior bite plane	Designed to disengage all teeth except incisors	Muscle disorder
3	Anterior Repositioning Splint	Guide condyles away from fully seated joint position. Guide the mandible into a forward position on closure	Acute trauma to the TMJ, jaw locking or noises painful clicking on opening or closing
4	Soft splints	Resilient material	Myofacial pain dysfunction
5	Hydrostatic splint	Fluid filled reservoir covering the teeth	TMJ pain, Head ache, neck and shoulder pain & stiffness, orthodontic triggered muscle pain, Pre surgical DD, post surgical pain and inflammation
6	Michigan splint	Even contacts at habitual closure. All mandibular teeth are discluded during lateral movements because of cuspid contact.	Signs and symptoms of jaw muscle hyperactivity
7	Pivot splints	Mandibular splint having occlusal contact only on most posterior tooth.	Unload TMJ can be used in conjunction with vertical pull chin cup.

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DISCUSSION

Minimally invasive and conservative mode of therapy is more beneficial for patients suffering from temporomandibular disorders. Occlusal splints are the best recommended treatment option but there are numerous disagreements regarding the durability and mechanism of action of these appliances. Even though both hard and soft splints can be used their efficiency is contradicted.^{7,9,11,16}

Many studies have obtained recordings and assessed the relationship between masseter and anterior temporal muscles with TMDs. However, Rugh and Solberg suggested that increasing OVD would be responsible for the appearance of muscle symptoms and that this increase would lead to the worsening, rather than the amelioration, of symptoms. It has been recommended that stabilization splint therapy can significantly relieve pain in patients with disc displacement without reduction, in comparison with TENS.^{3,8}

Pettengill et al did not find any difference between HS and SS. Clinician should consider low-cost therapies such as counselling and self-care and be as much conservative as possible. The type of splint design or material did not affect the results¹² There is no significant differences in maximum occlusal force with the use of canine protected hard stabilization splint and use of a Bruxogard-soft splint was accompanied by decrease in occlusal force in patients with sleep bruxism³ Truelove et al. (2006) did a randomized trial in which they found that all patients shows significant results irrespective of splint design¹⁴. According to okeson Hard acrylic maxillary splints significantly reduce nocturnal muscle activity in the majority of patients while wearing the soft splint there is significant increase in nocturnal muscle activity.⁹

In a nutshell it can be stated that both materials has its own pros and cons so both hard or Soft materials can be used for the fabrication of occlusal splints. Hard acrylic resin splints which

can be made from self-cured or heat cured acrylic resin, forming hard and rigid occlusal surface that resist wearing and lasts longer time, but with long use of this splint a significant occlusal changes can occur. Soft splints forms a flexible occlusal surface that can be easily adjusted to adequate contact pattern. However, this pliable splints can exacerbate bruxism because the soft material cannot be balanced leading to premature posterior contacts.²

Conclusion

Many studies has proven that occlusal splint is the most common and efficient treatment for TMD patients with a success rate of 70-90 %. Based up on much research, despite the many disagreements regarding its efficiency, the both splints exhibit successful outcome in patients who suffer from functional disorders of the masticatory system. Finally, the effect claimed by occlusal splints remains to be confirmed, and more research is needed to conduct further analysis.

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