Review Article

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ROLE OF SPLINTS IN MANAGEMENT OF TEMPOROMANDIBULAR DISORDERS:A LITERATURE REVIEW

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ABSTRACT:

Temporomandibular disorder is a condition which involves the muscles of mastication, temporomandibular joint and associated structure or both. It is multifactorial in origin which characterized by pain in temporomandibular joint and surrounding structures, discomfort in joint, restricted movement of mandible and clicking sound in the joint. An occlusal appliance (often called a splint) is a removable device, usually made of hard acrylic or soft material, used for management of TMJ disorders. They have been shown to be effective in treating myofacial pain and intracapsular disorders. However no clear hypothesis about the mechanism of action has been proved.

This article describes basic concepts about temporomandibular disorders and occlusal splints. However emphasis is given on reviewing the investigations done by various researchers related to the efficacy of splints in temporomandibular disorders.

Key words: Temporomandibular disorders, myofacial pain, intracapsular disorder, occlusal splint, review.

INTRODUCTION:

Over the years functional disturbances of the masticatory system have been identified by a variety of terms. This has led to some of the confusion in this area. In 1934 James Costen [1] described a group of symptoms that centered around the ear and temporomandibular joint (TMJ). Because of his work, the term *Costen syndrome* developed. Later the term *temporomandibular joint disturbances* became popular, and then in 1959 Shore [2] introduced the term *temporomandibular joint dysfunction syndrome*. Later came the term *functional temporomandibular joint*

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disturbances, coined by Ramfjord and Ash [3]. Some terms described the suggested etiologic factors, such as *occlusomandibular disturbance* [4] and *myoarthropathy of the temporomandibular joint* [5] Others stressed pain, such as *pain-dysfunction syndrome* [6] ,*myofascial pain-dysfunction syndrome* [7] , and *temporomandibular pain-dysfunction syndrome* [8] . Because the symptoms are not always isolated to the TMJ, some authors believe that the previous terms are too limited and that a broader, more collective term should be used, such as *craniomandibular disorders* [9] . Bell [10] suggested the term *temporomandibular disorders* (TMDs), which has gained popularity. This term does not merely suggest problems that are isolated to the joints but includes all disturbances associated with the function of the masticatory system. The American Dental Association adopted the term *temporomandibular disorders*.

There are various approaches for treating the TMDs which are invasive and non-invasive. Non-invasive approach involves physiotherapy, sedatives, muscle relaxant and occlusal splints and invasive treatment involves surgical intervention. In dentistry, dental occlusal splint have been considered a backbone of TMDs treatment. Thus it was deemed necessary to review scientific evidence regarding role of splints in treatment of TMDs.

For the sake of clarity the part mentioned below has been divided into two categories. First part deals with basic terminologies & concept and the second part reviews the efficacy of these splints in management of TMJ disorders.

PART I

Basic terminologies have been reviewed as follows.

1. What is temporomandibular disorder?

A condition producing abnormal, complete, or impaired function of the temporomandibular joint. (GPT 8)

Temporomandibular joint disorders is a condition characterized by pain in the temporomandibular joint or its surrounding tissues, functional limitations of the mandible, or clicking in the TMJ during motion.

2. Etiology of Temporomandibular Disorder's [11]

TMDs are multifactorial in origin. But a review of scientific literature reveals five major factors that lead to temporomandibular disorders. They are

1. Emotional stress,
2. Deep pain output,
3. Occlusal condition,
4. Trauma
5. Parafunctional habits.

3. Treatment by occlusal splints

The treatment of TMDs always starts with a conservative approach, so that there will not be any irreversible effect on the TMJ joint. Most of the TMDs are cyclic in nature. Therefore, symptoms of the disorders do

not get worse, so treatment should be simple and effective.

a. Definition

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 "*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. It may be used for occlusal stabilization, for treatment of temporomandibular disorders, or to prevent wear of the dentition".

b. Aims of occlusal splints

1. Subjective
    I. To reduce pain
2. Objective
    I. Increase mouth opening
    II. Reduce TMJ clicking sound
    III. Decrease the muscles and joint palpation tenderness.

c. Types of splints

The use of splints in the treatment of temporomandibular disorders is still advocated by clinicians. The therapeutic efficacy of splint depends upon the type of splint being used.

Dawson [11] classified the splints into two types

1. Permissive splints/muscle deprogrammer
2. Directive splints/non-permissive splints

According to Okeson [12]

1. Stabilization appliance
2. Anterior repositioning appliances
3. Anterior bite plane
4. Posterior bite plane
5. Pivoting appliance,
6. Soft/resilient appliance
7. Hard splint

d. How occlusal splint works? [13]

To correct structural disharmony of both the TMJ's and the Occlusion. For the treatment of myofascial pain functionally. It will acts as a device to aid in cognitive awareness. Occlusal splints when placed intraorally can reduce the load on TMJ by decreasing the force intensity and duration of parafunctional activities. It deprograms the muscle and acts as a foreign body of occlusal platform. It improves the locking/catching symptoms of internal derangement upon awakening related to string nocturnal muscle activity. It disrupts neuromuscular engrams that determine TMJ-fossa relationships. Basically it is a deprogrammer of muscles.

e. What occlusal splints cannot do ? [11]

When the splint is removed, it retrains the muscle to be less active. It re-establishes the original/correct vertical dimension. It recaptures the displaced disk into its original position. It unloads the TMJ by distracting the condyle or by pivoting on molar contacts with help of pivot splints.

PART II

Review regarding efficacy

a. Efficacy of splints in treatment of myofascial pain

According to *CLARK* [14] (1984), stabilization splint has been shown to decrease the symptoms of myofascial pain in 70% to 90% of the cases.

Boero RP [15] (1989), the treatment of myofascial pain with resilient splint had good immediate results, while according to *Okeson* and *Shi* [16], hard splint is superior to a soft resilient one, if pain is related to bruxism.

Shi and *Wang* [17] (1989) had done an Electromyographic (EMG) analysis which showed that there was an increase in postural activity of masticatory muscles in patients with myofacial pain at rest, which was reversed when a flat plane occlusal splint was used.

Truelove and *Blasberg* [18] (1995) on the contrary stated that "signs and symptoms of temporomandibular disorders have traditionally been cyclic"

Wilkinson T [19] (1992) found that intermittent use of a splint was better than continuous use of the splint to relieve symptoms of myofascial pain.

Carlson and *colleagues* [20] (1993) compared the effectiveness of and difference between conventional and neuromuscular splint versus a placebo in which they have used cotton rolls which showed statistically significant reduction in jaw pain with the use of intraoral splint.

In a parallel randomized, controlled and blinded study performed by *Dao* and associates [21] (1994), the therapeutic efficacy of splint was evaluated.

- Group I- occlusal splint 30 minutes at each appointment
- Group II- palatal splint (no occlusal coverage) 24 hours a day
- Group III- full occlusal splint 24 hours a day

They found that over 10 weeks of period, there was a decrease in pain scale in all the group. These findings were support the study done by *Clark* [14] *, Greene* and *Laskin* [22] *, Rugh* [23] and *Stohler* [24] , they emphasized role of cognitive awareness and positive patient expectations which may be more important than the structural value of an occlusal appliance in treatment of TMDs.

b. Efficacy of splint in treatment of Intracapsular Temporomandibular disorder

Zamburlini and *Austin* [25] *, LeBell* and *Kirveskari* [26] (1991) studied the use of an anteriorly repositioning appliance versus a flat plane stabilization splint decreased jaw pain both in the muscles of mastication as

well as in the preauricular area, the area associated with the joint. The anterior repositioning appliance, however, decreased joint tenderness better than the flat plane stabilization splint.

Williamson and *co-workers* [27] (1993) evaluated patients that had anteriorly displaced disk with reduction. The EMG study showed the decreased muscular activity of masseter and temporalis in patients treated with anterior repositioning appliance.

Cohen and *MacAfee* [28] (1993) advocated the use of anterior repositioning appliances to achieve proper meniscal condylar relationship in preventing degenerative joint diseases.

In literature [29] , it has been reported that splints in anterior displaced disk without reduction are not effective. But study done by *Okeson JP* [30] , *Chung SC* [31] and *Sato* [32] treated few patients who were having "off the disk", with stabilization and anterior repositioning splints and stated that these patients may go through changes in retrodiscal tissue in which the retrodiscal tissue becomes fibrous and acts as a pseudodisk. In this treatment phase, if patient can tolerate the pain and decreased range of motion, then eventually fibrous tissue replaces the heavily innervated and vascularized retrodiscal tissue. This results in decrease in pain and increase range of motion.

Ewacarin ekberg et al [33] (1998) conducted a double-blind controlled study in a short-term perspective, the results showed that both the stabilization appliance and the control appliance had an effect on reducing the TMJ pain.

Marjaana Kuttila et al [34] (2002) evaluated a short term efficacy of splints and found that the use of a stabilization splint is beneficial with regard to secondary otalgia and active TMDs treatment need.

Steger W et al [35] (2002) evaluated the efficacy of anterior repositioning splint therapy studied by magnetic resonance imaging. The results indicate that in cases of internal derangement with a wide range of disc displacement combined with changes of the osseous joint surfaces, the recapturing of the articular disc with an anterior repositioning appliance was unsuccessful

Jude HD et al [36] (2007) conducted a study on pivot splint proving that occlusal pivots have no distractive effects on the TMJ. Instead they actually compressed the TMJ.

Macedo and *Mello* [37] (2002) evaluated the efficacy of the hydrostatic splint Aqualizer™, Microcurrent electrical nerve stimulation-MENS and Transcutaneous electrical neural stimulation-TENS therapies in patients with TMD in acute situations and concluded that the MENS and the Hydrostatic splint were more effective than TENS.

A 2009 Cochrane Database of Systematic Review study concluded "There is insufficient evidence either for or against the use of stabilization splint therapy for the treatment of temporomandibular pain dysfunction syndrome.

While in 2010 Systematic review and meta-analysis of randomized controlled trials evaluating intraoral orthopaedic appliances for TMDs found "stabilization appliances, when adjusted properly, have good evidence of modest efficacy in the treatment of TMD pain compared to non-occluding appliances and no treatment.

Ekberd et al [28] (2004) evaluated the efficacy of a traditional occlusal appliance compared with a nonoccluding occlusal appliance using a randomized double blind controlled study. Symptoms were improved in both the groups. Results from both short term and long-term led to conclude that traditional occlusal appliance are more efficient than non-occluding occlusal appliance.

Role of non-occluding appliance or placebo effect:

A study done by *Greene* and *Laskin* [23] investigated the clinical efficacy of nonoccluding occlusal appliance (NOA), in myogenous TMDs patients (masticatory muscle pain, limitation, deviation, and/or tenderness) who were treated by different occlusal appliance designs. In their study they found that, with the use of non-occluding appliance, there were 40% of the patients showed marked improvement in their symptoms.

The general trend reported from the studies is that nonoccluding occlusal appliance, at the minimum, have a considerable amount of positive effect on TMD signs and symptoms in a significant percentage of subjects.

CONCLUSION:

According to the existing literature, it may be concluded that occlusal splint have a considerable effect in improving the signs and symptoms of myofascial pain and intracapsular TMDs. Effect of splint is reversible in nature (particular design of splint only) if they are not used for long term. Before going directly for surgical treatment, splint is best option for both diagnosis and conservative treatment as it has no harmful effect in short period of time. One added benefit using occlusal splint is that they do give a placebo effect, rather than acting mechanically. It is a behavioral intervention to relieve the symptoms of temporomandibular disorders. Evidence derived from clinical studies [14] suggests that occlusal appliances are more effective for treating myogenous TMD problems than they are for intracapsular conditions, but they can be helpful for both in properly selected patients.

There is insufficient data on selecting effectiveness of occlusal appliance in the treatment of other types of TMD's. Randomized control studies are needed to determine the effectiveness of occlusal appliance in the treatment of TMD's. Also the long term studies are needed for understanding effectiveness of various designs of splints in treating TMDs.

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