
Occlusal Appliance Therapy for Temporomandibular Joint Disorders: Mechanisms, Efficacy, and Limitations

Karar Abdulzahra Mahdi¹, Ali A. Al-fahham²

¹ Department of Oral Pathology, Faculty of Dentistry, University of Kufa

² Faculty of Nursing, University of Kufa, Iraq

ABSTRACT: Disorders of the temporomandibular joint (TMJ) are chronic conditions that involve pain, muscle spasm, and dysfunction of the joint and surrounding structures. Occlusal appliances have come to be regarded as essential tools in the non-surgical treatment of these disorders as they help in the management of symptoms and protection of teeth and the structures of the TMJ. In various types of reviews of occlusal appliances, including stabilization splints, anterior and posterior bite planes, repositioning devices, and soft appliances, are discussed in detail with regard to their mechanism of action, indications, and limitations. Improvements in the material and the fabrication method, such as printing, have enhanced CAD/CAM systems accuracy and comfort, as well as the patients' cooperation in the use of these appliances. Thus, combining occlusal appliances with other treatments, including physiotherapy and Botox, offers a systemic approach to TMJ treatment, dealing with both appliances mechanical help and muscular factors. reduction Although there are certain risks involved, like occlusal changes and discomfort, which need close observation and patient counselling, of occlusal pain, muscle hyperactivity, and joint loading. This review focuses on the need to choose the right appliance, make the right fabrication and to ensure that there is a follow up to check on the progress of the patient. Further developments and multi-disciplinary work will continue to improve the effectiveness and applicability of occlusal appliances in the treatment of TMJ disorders.

INTRODUCTION

The temporomandibular joint, which comprises the condyle, the disc, and the glenoid fossa, is a complex structure that acts as a hinge and permits the primary jaw movements, such as opening, closing, and horizontal protrusive motion of the mandible, utilizing the crucial rule of the masticatory muscles.

The presence of pain, dysfunction, or both are essential signs and symptoms of temporomandibular joint disorder (TMDs); the etiology is multifactorial and includes trauma, habits, arthritis, occlusal disharmony, and stress. All these factors are predisposing to muscle tension and derangement of the joint. The clinical feature ranges from asymptomatic joint sounds to more advanced jaw lock and deterioration [1].

Occlusal appliances are an essential non-invasive type of management that is considered as a first-line therapy of TMDs to avoid surgical approaches and other irreversible options [2].

These appliances decrease muscular tension, prevent TMJ stress, and protect the teeth from parafunctional forces. All these positive effects are the result of the redistribution of occlusal forces and correcting jaw alignment, which will contribute to alleviation of pain and restoring normal jaw function [3].

The essential goal in the management of TMDs is to relieve pain and discomfort. The correlation between pain and inflammation, muscle hyperactivity, is theoretically and practically approved with the subsequent imbalance in TMJ structure [4].

The effect of an occlusal appliance is by improving the functional relationship between the condyle and the disc to promote more neutral balance and reduce discomfort.

Muscular hyperactivity contributes dramatically to muscle tension and joint dysfunction, so reducing this tension is important during the initial stage of TMDs management. To recover overworking muscles, it is essential to promote relaxation of the elevator muscles to alter the proprioceptive feedback, and this can be achieved by appliances like anterior bite planes, which help alleviates secondary symptoms like headaches, facial pain and jaw stiffens [5].

On the other hand, occlusal disharmony will aggravate the symptoms of TMDs, so the stabilization of the occlusion is crucial to ensure long-term TMJ health, the mechanism of such stabilization is by providing a uniform contact surface for all teeth and an even equalization of occlusal forces, with the concomitant positive results like teeth and jaw protection from stress to reduce the risk of future complications [6].

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Some parafunctional habits like night bruxism and day clenching will result in progressive teeth wear and deteriorated periodontal health. The use of occlusal appliances will protect against the enamel destruction, tooth fractures, and further TMJ stress. This cushioning effect can be achieved by soft or hard appliances. Additionally, to interrupt the neuromuscular aspect related to these habits, a complete separation between upper and lower teeth is effective to reduce the intensity of clenching and grinding. By considering these roles, intraoral appliances will contribute to the overall health of the TMJ and orofacial structures [7].

CLASSIFICATION OF OCCLUSAL APPLIANCES

3.1. Stabilization Appliances

Also known as Michigan splints, it's a flat splint, which is one of the most common occlusal devices used in the field of occlusal stabilization, mostly made from hard acrylic that is fabricated on a custom cast. It fits on the upper or lower teeth to provide flat and smooth surface to enable even contact with the opposite teeth during night or day time [8].

The mechanism of action is by distributing occlusal forces evenly along all the dentition to minimize stress on individual teeth and reduce the load on the joints. This will contribute to a stable occlusal relationship and help in the relaxation of the masticatory muscles. The end result of regular use of such appliances will be a reduction in symptoms like jaw pain, headache, and facial spasm [9].

They are indicated for patients having bruxism, daytime clenching, and TMJ pain; they may also be used efficiently for managing myofascial pain and protecting dental restoration or natural teeth from parafunctional forces. They are durable and long-lasting splints, effective in relieving TMJ pain and muscle tension, protecting teeth from damage related to bruxism, and customizable for optimal fit and function. Disadvantages include the requirement for professional fitting and regular adjustments, may not be suitable for patients with severe malocclusion or severe gag reflex, and relatively expensive compared to over-the-counter devices [10].

3.2. Anterior Bite Plane Appliances

These are designed to cover only anterior teeth to create a separation between the posterior part of the jaws, they are usually smaller than Michigan appliance. This type of device is helpful in reducing muscle activity in the elevator muscles by changing proprioceptive feedback. The separation of teeth will minimize the forces applied by these muscles with the subsequent reduction of joint pain and muscles hyperactivity [11].

Indicated for immediate relief of acute facial pain and reducing muscular hyperactivity. Some limitations with prolonged use may cause posterior tooth intrusion or occlusal changes, and it's not suitable for long-term periods of management. Characterized by simple design and little chair-time required, easy to fabricate and provides rapid relief for acute symptoms. While the disadvantages include the risk of occlusal problems with prolonged use, and limited effectiveness in providing stabilization [12].

3.3. Posterior Bite Plane Appliances

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3.4. Repositioning Appliances

The purpose of using repositioning appliances is to guide the mandible into a new more stable position of the condyle and the disc within the joint, usually made from hard acrylic using adjustable articulator to record the patient's specific condition. The action of such appliances is to promote realignment of the disc in relation to the condyle, reducing stress on the joint, and decreasing symptoms like clicking, crepitation, and jaw lock, they contribute for restoring normal joint function and correcting the position of the condyle during function. Mostly used to treat disc displacement or advanced cases of locked jaw. Prolonged use may lead to permanent occlusal changes, and they require regular adjustments to avoid unwanted effects [14].

3.5. Soft Occlusal Appliances

Description: These are made from soft materials and are used as a temporary relief of mild TMDs. Act as a cushion to absorb occlusal forces and reduce the effect of clenching and grinding. This action is done by a soft barrier that separates the upper from the lower jaws and protects the teeth from progressive attrition, which will help to reduce mild discomfort. They are mainly used for those with mild TMJ disorders and patients suffering from bruxism, also be used as an interim appliance before the use of a more advanced one. But it's less effective in stabilizing occlusion compared to hard splints because of its flexibility and compressibility. Another limitation is that it may wear out after time [15].

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MECHANISMS OF ACTION

Neuromuscular Effects

By its action to modify proprioceptive feedback, these appliances play a crucial role in modifying muscle activity to reduce stress related to TMDs. They relax hyperactive facial muscles, mainly masseter and temporalis muscles, which are mostly affected in bruxism and clenching. Simple appliances like anterior bite planes ideally target elevator muscles to reduce their activity and provide a relaxation condition, while stabilization splints distribute the occlusal forces equally during rest and stress conditions to aid in muscle recovery. These neurotransmitter modifications contribute to enhancing TMJ comfort and improving function [16].

Occlusal Effects

The uniform contact surface created by occlusal appliances like stabilization splint will prevent unequal forces that can affect joint dysfunction or damage teeth, this redistribution of the loading during jaw movements will protect the TMJ structure from excessive stress. In cases of disc displacement or condylar malposition, some devices like repositioning appliances can correct alignment, reduce stress on the joint, and provide more stability [17].

Psychological Effects

The psychological benefits are also another aspect that can be provided by different kinds of occlusal appliances. The feeling of undergoing active management steps will reduce the stress and anxiety in patients. Moreover, the placebo effect related to the use of custom-made appliance can further manage perceived pain relief and enhance commitment to treatment [18].

CLINICAL CONSIDERATIONS

Diagnosis and Appliance Selection

The management of TMJ disorders starts with accurate diagnosis to determine the cause and the degree of the disorder. This is an important factor and involves the identification of the specific appliance that should be used for the TMJ disorder. Thus, stabilization splints are worn by patients with bruxism, clenching or any other TMJ problems while repositioning appliances are used in cases of disc displacement or jaw locking. Sometimes, anterior bite planes may be advised in case of acute muscle hyperactivity and for mild discomfort, soft appliances are used or as a temporary measure. Applying the right appliance to the patient helps in delivering the best therapeutic outcome as well as reducing the chances of developing some adverse effects [29].

Fabrication and Fitting

The optimal outcomes of the occlusal appliances require precision and customization during the fabrication and fitting of these appliances. The precision of dental impressions or digital scans is a crucial step to provide an optimum-fitting appliance compared to over-the-counter devices. This proper fitting will ensure equal occlusal contact, prevent unwanted occlusal changes, and maximize patient comfort. To align the appliance with the patient's occlusion and jaw function, regular adjustments and follow-up visits are important to record the effectiveness of the devices [20].

Compliance and Patient Education

To ensure maximum benefits of the appliances, patients should cooperate and commit to the procedure and steps required, so educating patients about the proper use and potential adverse effects is essential to the success of the treatment. Written instructions sometimes required about cleaning and maintenance, to help in building trust and adherence to the treatment plan [21].

Potential Complications

Some complications may arise during the prolonged use of these occlusal splints. although they are generally safe, they may cause some occlusal changes like teeth intrusion or inclination. Other patients could feel some discomfort or pain during the first few days, which can be managed through adjustment [22].

Comparative Efficacy of Occlusal Appliances

The efficacy of occlusal appliances in the treatment of TMJ disorders is variable and it depends on the type of the appliance, the specific disorder, and the patient's response to the treatment. Several studies have been conducted to compare various appliances and identify the strengths and weaknesses of each appliance to assist the clinician in decision making.

Among the stabilization appliances, there are the flat-plane splints, or Michigan splints, that are the most efficient in treating TMJ pain, bruxism, and clenching. They deliver equal distribution of the occlusal force thus reducing the load on the joint and the muscle hyperactivity. A review of the literature shows that stabilization appliances are particularly useful in the management of chronic TMJ pain and in the prevention of further dental wear. However, they are highly dependent on a proper fit and may not be ideal for all types of TMJ disorders including disc displacement [23].

Anterior bite plane appliances should be used in the treatment of severe muscle hyperactivity and acute pain only for a short period of time. In this way, by separating posterior teeth they can greatly decrease the elevator muscle activity and thus offer quick relief from the symptoms. However, they should not be used over a long period as they may cause posterior tooth intrusion and change the bite [24].

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Repositioning appliances are very effective in cases of disc displacement with reduction condyle or TMJ locking. articular They disc realign thus the reducing joint pain and dysfunction. They can be used for a prolonged period but may cause permanent change in the occlusion thus making them unsuitable for a long-term use [25].

The soft occlusal appliances though not as rigid and not as long lasting are usually preferred to accommodate the comfort of the patient and to reduce mild clenching and grinding. They are ideal for transitional use but have limited use in managing difficult TMJ conditions or establishing a stable occlusion [27].

According to the comparative analyses it can be stated that there is no appliance that is superior to the other; it all depends on the patient's condition, the desired results and the experience of the clinician. Customization, monitoring and the patient's cooperation are very important in order to gain the best results [28].

CONCLUSION

Occlusal appliances are one of the most common non-invasive treatments for TMJ disorders and are very effective in reducing pain, muscle spasm, improving occlusal stability, and preventing dental injuries. The various types of appliances including stabilization splints and repositioning devices provide options for treating patients according to their needs and the type of TMJ disorder they have. Developments in the material used as well as the use of digital technologies for the creation of the appliances through CAD/CAM and 3D printing and results.

Furthermore, the combination of occlusal appliance with other kinds of therapies like physiotherapy and Botox will produce more synergetic effect, controlling both mechanical and muscular aspects of the problem. Despite their high advantages, some adverse effects, such as occlusal changes and pain, require careful diagnosis, customization, and regular follow up and adjustments. With ongoing innovations and interdisciplinary approaches, occlusal appliances continue to evolve as an effective and essential component in the holistic management of TMJ disorders.

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