

Splints in Orthodontics

Avani Jha*, Vaibhav Vashishta, Stuti Raj, Shubhangini Kashyap, Shraddha Bind

Department of Orthodontics, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, Uttar Pradesh, India.

Abstract

Occlusal splints, commonly used in dentistry, are removable appliances designed to manage temporomandibular joint (TMJ) disorders, bruxism, and occlusal dysfunction. These devices play a crucial role in establishing neuromuscular harmony, protecting teeth from excessive wear, and alleviating muscle-related pain. This article explores the history, functions, classification, and mechanisms behind occlusal splint therapy, highlighting its importance in modern dentistry. Several theories underpin the efficacy of splints, including occlusal disengagement, vertical dimension adjustment, maxillo-mandibular realignment, TMJ repositioning, and cognitive awareness theories. These principles guide the use of splints in orthodontics, maxillofacial surgery, and sleep apnea management. Despite their benefits, challenges such as occlusal changes, compliance issues, and durability limitations must be considered.

Keywords: Bruxism, Occlusal dysfunction, Occlusal splints, Temporomandibular joint.

INTRODUCTION

Occlusal appliances, commonly known as splints, are removable devices typically made from durable acrylic materials to cover the occlusal and incisal surfaces of the teeth. They serve various therapeutic purposes and are often referred to as night guards, inter-occlusal devices, or orthopedic appliances. These appliances play a critical role in protecting teeth from excessive wear, stabilizing the temporomandibular joint (TMJ), and reducing muscle tension associated with bruxism and temporomandibular disorders (TMDs).

The fundamental principle of occlusal splints lies in their ability to establish neuromuscular harmony within the masticatory system. By creating a mechanical disadvantage for parafunctional forces, splints allow for a controlled, reversible modification of occlusion. They serve as a non-invasive, cost-effective, and reversible approach to treating various occlusal dysfunctions. Occlusal splint therapy is widely employed in the management of bruxism, TMJ disorders, headaches, cervical pain, and muscle pain linked to malocclusion. The effectiveness of these splints varies based on their design, fabrication, and clinical application.^[1,2]

DISCUSSION

Historical background of occlusal splints

The concept of occlusal splints dates back to 1901, when Karolyi first introduced an appliance to treat bruxism. Over

time, different designs and functions of occlusal splints emerged to address occlusal dysfunction and TMJ disorders. Early researchers, such as Monson (1921) and Goodfriend (1933), theorized that loss of vertical dimension was a major contributor to occlusal dysfunction, leading to the development of onlay splints for posterior teeth. However, it was later discovered that these onlays could obstruct posterior occlusion, leading to further complications.

In the 1950s, Posselt revolutionized the use of occlusal splints, advocating their use to reduce occlusal interferences and optimize condyle positioning. Today, occlusal splints are recognized as essential tools in diagnosing and treating TMJ dysfunction, muscle disorders, and occlusal disharmony.

Primary functions of occlusal splints

Occlusal splints serve multiple therapeutic functions, including:

- **Force distribution:** Occlusal splints aid in the even distribution of occlusal forces, reducing excessive stress on individual teeth and TMJ structures.^[3]
- **Muscular relaxation:** By preventing excessive contraction of masticatory muscles, splints help relieve pain and muscle fatigue.^[4]

Address for correspondence: Dr. Avani Jha,
Department of Orthodontics, Sardar Patel Post Graduate Institute of
Dental and Medical Sciences, Lucknow, Uttar Pradesh, India.
Email: avani.jha25@gmail.com

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- Reduction of proprioceptive feedback: Splints modify the perception of occlusal force, discouraging habitual clenching and grinding.^[5]
- Diagnostic tool: By observing wear patterns on splints, clinicians can gain insights into occlusal dysfunction and tailor appropriate treatment plans.^[3]
- Protection against dental wear: Splints prevent excessive enamel erosion resulting from bruxism and clenching.^[6]
- TMJ repositioning: Certain splints reposition the mandibular condyle to relieve pain and discomfort associated with TMJ disorders.^[7]

Classification of occlusal splints

Different types of occlusal splints are categorized based on their function and application:

Stabilization splints^[1]

Stabilization splints are used primarily to reduce muscle hyperactivity and provide even occlusal contact. They are designed to allow the condyles to rest in a musculoskeletally stable position, minimizing TMJ stress and muscle tension. These splints are particularly effective for patients experiencing nocturnal bruxism, myofascial pain, and headaches (Figure 1).

Anterior repositioning splints (ARS)^[8]

ARS are designed to position the mandible in a forward posture to correct disc displacement and TMJ clicking. By temporarily repositioning the mandible, these splints allow the TMJ structures to function more optimally (Figure 2a and b).



Figure 1: Stabilization splint



Figure 2: (a and b) anterior repositioning splints

Permissive splints

Permissive splints, such as the Lucia Jig and nociceptive trigeminal inhibition splint, disengage occlusal contacts to allow free mandibular movement, minimizing TMJ strain. These splints are effective in treating occlusal disharmony and muscle hyperactivity (Figure 3).

Directive splints^[9]

Directive splints guide mandibular movement and condylar repositioning. They are commonly used for patients experiencing retrodiscal edema, severe TMJ pain, and chronic disc displacement disorders (Figure 4).

Soft splints

Soft occlusal splints are fabricated from resilient materials and are primarily used in cases of acute TMJ pain and muscle disorders. They offer immediate comfort but may need frequent replacement due to wear (Figure 5).

Hydrostatic splints^[10]

These splints utilize water-filled compartments to balance occlusal forces, making them highly effective in treating malocclusion and TMJ dysfunction (Figure 6).



Figure 3: Permissive splint



Figure 4: Directive splint



Figure 5: Soft splint



Figure 6: Hydrostatic splint

Pivot splints

Pivot splints, or distraction splints, are used to manage joint loading problems by reducing interarticular pressure. However, their long-term effectiveness remains controversial.

THEORIES BEHIND SPLINT THERAPY

Several theories explain the mechanisms by which occlusal splints provide relief:

1. Occlusal disengagement theory: Eliminating occlusal interferences reduces muscle activity and occlusal trauma^[11]
2. Vertical dimension theory: Adjusting the vertical dimension of occlusion with a splint alleviates muscle tension and pain
3. Maxillomandibular realignment theory: Correcting the relationship between the maxilla and mandible relieves musculoskeletal discomfort
4. TMJ repositioning theory: Proper condylar positioning improves TMJ function and minimizes joint compression^[12]
5. Cognitive awareness theory: Wearing a splint increases patient awareness of jaw positioning, leading to behavioral modification and reduced parafunctional habits.

APPLICATIONS IN ORTHODONTICS AND MAXILLOFACIAL SURGERY

Occlusal splints are widely utilized in:

- Maxillary intrusion therapy: Addressing deep bites and preventing excessive vertical growth^[13]

- Mandibular advancement devices: Treating obstructive sleep apnea by repositioning the lower jaw forward^[14]
- Orthognathic surgery: Serving as reference bases for surgical occlusal adjustments.^[13]

CHALLENGES AND CONSIDERATIONS

Despite their benefits, occlusal splints have certain limitations:

- Occlusal changes: Prolonged use of splints can lead to alterations in occlusal relationships, requiring periodic monitoring
- Compliance issues: Some patients may find splints uncomfortable or challenging to wear consistently
- Durability: Soft splints may degrade over time and require frequent replacement.

CONCLUSION

Occlusal splints play a vital role in modern dentistry by addressing occlusal dysfunction, TMJ disorders, and muscle pain. Their design and application are determined by the specific needs of each patient. Understanding the principles, functions, and classifications of occlusal splints allows clinicians to select the most appropriate therapy for optimal patient outcomes.

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