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E-mail: docritikkashwani@yahoo.com
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Occlusal trauma: Clinical impact and night guard support

Abinaya Raju[1,*], Meyvol Canales Aguilar[2], Carlos Jose Lima Chamero[3], Jasmine Kaur[4], Nashita Tabeen Shaik[5] & Puneet Sidhu[6]

[1]Department of Periodontology and Oral Implantology, Ragas Dental College and Hospital, Chennai, Tamil Nadu, India; [2]Department of Dentistry, Latin American University of Science and Technology (ULACIT), Barrio Turrón, San José, Costa Rica; [3]Department of Dentistry, Faculty of Medical Sciences of Cienfuegos "Dr. Raúl Dortičós Torrado", Cienfuegos, Cuba; [4]Department of Dentistry, Sudha Rustagi College of Dental Sciences & Research, Faridabad, Haryana, India; [5]Department of Dentistry, Narayana Dental College and Hospital, Nellore Andhra Pradesh, India; [6]Department of Dentistry, Manipal College of Dental Sciences, Manipal, Karnataka, India; *Corresponding author

Affiliation URL:
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Author contact:
Abinaya Raju - E-mail: abinayaselvam202@gmail.com
Meyvol Canales Aguilar - E-mail: mey254@gmail.com
Carlos Jose Lima Chamero - E-mail: cl.ch901127@gmail.com
Jasmine Kaur - E-mail: chawlajasmine31@gmail.com
Nashita Tabeen Shaik - E-mail: nashitashaik05@gmail.com
Puneet Sidhu - E-mail: psidhu7@live.ca

Abstract:
Occlusal trauma alters the periodontal supporting tissues when occlusal forces exceed their adaptive capacity, yet its contribution to periodontal disease progression remains controversial. Therefore, it is of interest to review the aetiology, biological mechanisms, clinical features, diagnosis and management of primary and secondary occlusal trauma, with emphasis on the role of night guard appliances. Contemporary evidence indicates that occlusal splints effectively reduce parafunctional muscle activity and protect the dentition, although long-term periodontal benefits remain inadequately established. Clinical outcomes depend on appropriate appliance selection, patient compliance, comprehensive occlusal assessment and adjunctive periodontal therapy. Thus, integrating current evidence on occlusal trauma and periodontal inflammation while providing evidence-based guidance for individualized night guard therapy is essential.

Keywords: Occlusal trauma, traumatic forces, bruxism, occlusal guards, night guard therapy, periodontal disease, temporomandibular disorders

Background:
Occlusal trauma is described as a periodontal supporting tissue injury caused by excessive occlusal forces that surpass the periodontium's adaptive capacity, leading to morphological and functional changes, but not acting as a primary aetiological factor in periodontal disease **[1].** The relationship between traumatic occlusal loading and periodontal inflammation has been extensively debated and it has been found that abnormal mechanical forces could be a contributing factor to tissue damage in the presence of inflammation **[2].** Parafunctional habits, especially sleep bruxism, have been identified as a key factor in excessive occlusal loading and are associated with tooth wear, muscle pain and functional disorders of the masticatory system **[3].** Occlusal appliances, such as night guards, are often used in the conservative management of the condition to redistribute forces and protect dental structures; however, clinical efficacy may depend on the appliance design and patient compliance **[4].** Therefore, it is of interest to evaluate the clinical impact of occlusal trauma and to the potential role of night guard therapy as a conservative adjunctive approach for improving periodontal stability and functional outcomes.

Overview of occlusal trauma:
The clinical manifestations frequently associated with traumatic occlusion include increased tooth mobility, periodontal ligament widening and functional discomfort during mastication **[5].** Recent clinical investigations have emphasised the importance of evaluating occlusal force distribution and functional loading patterns as part of periodontal diagnosis, since abnormal occlusal stress may influence periodontal stability and disease progression **[6].** Accordingly, modern periodontal treatment planning integrates occlusal assessment alongside conventional periodontal therapy to optimise long-term outcomes. Management of occlusal trauma often involves a multidisciplinary approach, including occlusal adjustment, periodontal stabilization and the use of protective occlusal appliances. Systematic clinical evidence suggests that occlusal splints may contribute to improved jaw function and reduction of orofacial muscle pain when incorporated into treatment protocols for bruxism and temporomandibular disorders **[7, 8].** These appliances function primarily by redistributing occlusal forces and minimising localised mechanical stress on teeth and supporting tissues. Advances in appliance design and digital manufacturing technologies have further enhanced the clinical performance of occlusal devices, allowing improved adaptation and individualised treatment planning. Contemporary systematic reviews continue to support occlusal splints as a conservative adjunctive therapy that can improve patient comfort and functional stability when used as part of a comprehensive treatment strategy **[9].**

Etiology and biological mechanisms:
The aetiology of occlusal trauma is multifactorial and includes local, functional and parafunctional factors. Local causes include premature occlusal contacts, occlusal interferences, excessive or improperly shaped restorations, malocclusions, drifting or extrusion of teeth and improper denture designs. Functional overload can occur when regular masticatory forces act upon

teeth with insufficient periodontal support. Parafunctional forces, such as bruxism and clenching, generate the greatest loading magnitudes, placing significant pressure on the periodontium **[10].** Primary occlusal trauma occurs when there is excessive occlusal loading of teeth that have normal levels of periodontal support. Secondary occlusal trauma results when normal or excessive loading acts on teeth with reduced attachment due to decreased tissue resistance**.** Trauma caused by occlusion is predominantly non-inflammatory and affects the periodontal ligament, alveolar bone and cementum. Compression of blood vessels, ischaemia, hyalinisation and necrosis of periodontal fibres characterise pressure sites. At tension sites, adaptive bone apposition and periodontal ligament fibre reorganisation occur in the absence of inflammation **[11].** The vascular supply of the periodontal ligament is segmental and primarily derived from alveolar bone, which limits the spread of injury. Consequently, occlusal trauma typically produces localised tissue alterations. When traumatic forces are eliminated, periodontal tissues show a significant capacity for repair and adaptive remodelling, often without loss of connective tissue attachment or pocket formation **[12].** Glickman proposed that excessive occlusal forces could modify the pathway of plaque-induced inflammation, introducing the concepts of the zone of irritation (gingiva) and zone of co-destruction (PDL, cementum, alveolar bone), redirecting inflammatory spread into deeper periodontal tissues and contributing to angular bone defects and infrabony pockets **[13].** The periodontal response to occlusal trauma progresses through injury, repair and adaptive remodelling. Injury occurs when forces exceed tolerance; repair involves increased cellular activity and bone formation; and adaptive remodelling allows the periodontium to accommodate persistent forces, resulting in widened periodontal ligament space and buttressing bone formation without pocket development**.** Occlusal trauma represents a biomechanical challenge rather than a primary inflammatory aetiology; while it does not initiate periodontal disease, it can influence the severity of periodontal breakdown in the presence of plaque-induced inflammation **[14].**

Diagnosis and clinical assessment of occlusal trauma:

The diagnosis of occlusal trauma requires a complete assessment including signs and symptoms observed in the patient as well as evaluation of the periodontal status of the affected teeth**.** Patients commonly report parafunctional activities-predominantly clenching and grinding during sleep – along with morning headaches, morning jaw pain and excessive destruction of dental restorations. The diagnosis of bruxism is made using standardised criteria incorporating self-report, clinical examination and, where feasible, instrumental assessment with polysomnography (PSG) or electromyography (EMG)**.** Patients with recently placed or improperly contoured restorations causing premature occlusal contacts may present with localised periodontal ligament inflammation, increased tooth mobility and tenderness to percussion and mastication **[15].** The intraoral examination assesses increased tooth mobility, fremitus during functional movements, wear facets, pathologic tooth migration and tenderness to lateral percussion. The occlusal examination evaluates static contacts during maximum intercuspation and functional contacts during lateral and protrusive movements; premature contacts and interferences must always be assessed in the context of the patient's periodontal status. Radiographic findings, including widening of the periodontal ligament space or adaptive bone remodelling, complement clinical findings but must not be interpreted in isolation **[16].** Night guard appliances are frequently incorporated into the management of occlusal trauma, particularly in patients with signs or symptoms of sleep bruxism. Occlusal night guards function by redistributing occlusal forces and reducing the mechanical load associated with parafunctional activities. Although evidence regarding their ability to reduce bruxism activity is inconsistent, night guards remain an effective preventive measure for minimising tooth wear and protecting restorations from mechanical damage **[17].**

Night guards – rationale and types:

A night guard is a non-invasive removable occlusal appliance fabricated for either the upper or lower arch**,** acting as a protective layer between the two opposing arches**.** Failure to comply with night guard therapy can lead to long-term sequelae including compromised tooth structure, gingival recession and temporomandibular joint disorders. Occlusal guards alleviate muscular tension, reduce muscle activity and protect against the long-term damaging effects of bruxism by distributing forces across a larger surface area, thereby achieving muscular balance and restricting maximum intercuspation clenching. Primary indications include masticatory myalgia, TMJ arthralgia, myospasms and history of trauma, bruxism, unstable occlusion, tension headaches and neck pain **[18].** Despite their benefits, night guards have been associated with anterior open bites and occlusal derangement in some patients**.** These appliances primarily protect hard tooth surfaces and do not directly address the underlying aetiology of temporomandibular joint or muscular dysfunction, which involves musculoskeletal problems, joint ligament laxity, internal derangements, arthritis and psychosocial stress factors. Occlusal guards are classified into three main types. A permissive guard (*e.g.* the Michigan Splint or flat-plane stabilisation appliance) allows full condylar separation with balanced occlusal contact and is indicated for TMJ disorders, muscle disorders and severe bruxism; an anterior bite plane variant eliminates posterior tooth contact to prevent parafunctional over activity **[19]**. A directive (non-permissive) guard repositions the mandible anteriorly and is indicated in cases of severe trauma with retrodiscal effusion and symptomatic disc displacement (*e.g.* anterior repositioning splint, posterior bite plane, distraction splint). A pseudo-permissive guard is fabricated from resilient material to disengage maxillary teeth and create uniform contact; examples include the soft rubber splint for acute temporomandibular disorders and the hydrostatic (equalizer) splint for headaches and mandibular repositioning **[20].**

Clinical evidence and therapeutic considerations:

Bruxism, characterized by tooth grinding during sleep, is a risk factor for temporomandibular disorders (TMD) and is commonly managed with night guards to reduce pain and protect the dentition and temporomandibular joint from excessive occlusal forces **[24]**. Although occlusal splints are widely prescribed, current evidence does not conclusively show a reduction in bruxism episodes compared with no treatment **[21]**. In secondary occlusal trauma, particularly where periodontal support is compromised, night guards help redistribute occlusal forces, reduce tooth mobility and improve masticatory efficiency when combined with periodontal therapy. Both anterior and full-coverage stabilization splints effectively reduce parafunctional muscle activity, while custom fabrication enhances comfort, compliance and treatment effectiveness **[22]**. However, clinical outcomes depend on patient adherence, appliance design and duration of use. Night guards primarily provide symptomatic protection rather than correcting the underlying causes of bruxism or occlusal trauma and should be used as adjuncts to comprehensive periodontal and occlusal management **[23]**.

Clinical considerations and future perspectives:

Systematic reviews suggest that although occlusal splints may provide a protective benefit, high-quality evidence supporting long-term effectiveness in preventing occlusal trauma progression remains limited. Management of parafunctional habits should therefore be individualised and supported by careful clinical monitoring. Effective long-term outcomes require a multidisciplinary approach integrating dental appliance therapy with behavioural modification, stress management and physiotherapy **[24].** Future developments in CAD-CAM technology and three-dimensional printing offer the prospect of enhanced customisation, increased production speed and improved patient outcomes for occlusal appliance fabrication. Long-term longitudinal research is needed to evaluate durability, occlusal wear resistance and fracture resistance of digitally manufactured splints under prolonged use **[25]**. Large-scale randomised controlled trials comparing 3D-printed, milled and conventionally fabricated appliances for temporomandibular disorders sleep bruxism and specialised applications should form the primary focus of future investigation. Standardised testing protocols and integration of smart sensor technologies may further enhance clinical utility, provided these innovations are underpinned by robust long-term clinical evidence **[26].**

Conclusion:

Occlusal trauma represents a biomechanical condition that may modify periodontal tissue response without acting as a primary aetiological factor of periodontal disease. Occlusal appliances and occlusal management strategies remain important adjunctive therapeutic approaches aimed at reducing excessive functional loading, protecting dentition and improving patient comfort. Further long-term controlled clinical studies are required to clarify the impact of occlusal therapy on periodontal stability and disease progression.

Conflict of interest:

The authors declare no conflict of interest

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This is a narrative review article based on previously published data. No primary data collection involving human participants or animals was undertaken; formal ethics committee approval was therefore not required.

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