A Critical Review on the Relation and Impact of Bruxism and Prosthetic Treatment

1Haitham Ehab Y Jan, 2Hamza Abdulkareem Al Zahidy, 1Rahaf Essam O Yousef, 1Ranad Abdulkareem K Alghamdi, 1Abrar Aqeel A Jefri, 1Lamis Khalid M Albakri, 1Wejdan Ibrahim Alzahrani, 1Ghayda Saud S Mandili, 1Ameera Khalid M Alrasheed, 3Mohammed Khalid Y. Alzamzami, 3Sawsan Badr Eshaq, 1Ibn Sina National College, 2King Fahad General Hospital, 3battarjee college, Saudi Arabia

ABSTRACT

Background: Bruxism is defined as the medical term for clenching and grinding of teeth. It’s one of the most common parafunctional habit, occurring both during sleep “Eccentric Bruxism” and wakefulness “Centric Bruxism”. Bruxism can result in tooth wear and damage, jaw disorders, headaches and dental restoration damage. Bruxism is usually a subconscious reflex that is often not recognized by the patient. As a consequence, one of the most difficult aspects of this treatable problem is convincing the patient of this disorder. The early diagnosis and management can prevent the breakdown of the dentition and pain in the orofacial region. Although various treatment modalities are present, the successful management of bruxism lies in the precise diagnosis and isolation of the etiology.

Aim of the Study: raw conclusions about the existence of a possible relationship between the two, and its clinical relevance. Study selection: dental literature in bibliographic database like PubMed/Medline was searched for the terms ‘bruxism’ and ‘prosthetic treatment’, relevant studies were critically reviewed were conducted using, as well as combinations of these and related terms.

Results: there is no known treatment to stop bruxism, including prosthetic treatment. The role of bruxism is considered as a major cause in the tooth wear process and as informed by the present critical review, the relationship between bruxism and prosthetic treatment is one that relates mainly to the effect of the former on the latter

Conclusion: Bruxism may be included among the risk factors, and is associated with increased mechanical and/or technical complications in prosthodontic rehabilitation, although it seems not to affect implant survival. When prosthetic intervention is indicated in a patient with bruxism, efforts should be made to reduce the effects of likely heavy occlusal loading on all the components that contribute to prosthetic structural integrity. Failure to do so may indicate earlier failure than is the norm.

Keywords: Bruxism, Sleep bruxism, Awake bruxism, Current concepts in bruxism, Review of bruxism.

INTRODUCTION

Bruxism, which can be considered an umbrella term for clenching and grinding of the teeth, is the commonest of the many parafunctional activities of the masticatory system. Opinions on the cause of bruxism are numerous and widely varying. Current reviews indicate that the etiology is not fully known but that it is probably multifactorial (1).

Bruxism can occur during wakefulness or during sleep. The American Academy of Sleeping Disorders proposed the terms Sleep and Awake Bruxism. Bruxism during daytime is commonly a semi-voluntary 'clenching' activity and is also known as 'Awake Bruxism' (AB) or Diurnal Bruxism (DB) (2). Bruxism during sleep either during daytime or during night is termed as 'Sleep Bruxism' (SB). Awake bruxism is linked to life stress caused by familial responsibility or work pressure. Sleep Bruxism is an oromandibular behaviour that is defined as a stereotyped movement disorder occurring during sleep and (3), characterized by tooth grinding and/or clenching. Sleep bruxism was recently classified as sleep related movement disorder according to recent classification of Sleep Disorders(3). Prevalence rate of Awake and Sleep Bruxism is about 20% and 8–16% respectively in adult population (4). Awake bruxism occurs predominantly among females while no gender difference is seen for sleep bruxism (5). Onset of Sleep Bruxism is about 1 year of age soon after
the eruption of 7 deciduous incisors. The disorder appears more frequently in the younger population (9). The prevalence in children is between 14 to 20%.

Meanwhile, suggested solution to manage bruxism can result in problems that are as frustrating for the patient as for the treating dentist. Sequelae of bruxism that have been proposed include tooth wear, signs and symptoms of temporomandibular disorders (TMD), headaches, toothache, mobile teeth, and various problems with dental restorations as well as with fixed and removable prostheses (7,8).

MATERIALS AND METHODS
The study team searched Medline (via PubMed), for the terms ‘bruxism’ and ‘prosthetic treatment’. The results were filtered out to include articles focusing on the relationship between bruxism and prosthetic treatment, implant-supported and implant-retained prostheses and including fixed and removable prostheses. A manual search of the reference lists and textbooks referred to in the included PubMed listed articles was also performed in parallel. This additional search identified 10 relevant studies and reviews. Some articles were excluded due to inability of retrieval, sharing the same cohort or aiming at irrelevant study endpoints. Finally, a total of 49 relevant papers remained, and are discussed in the review that follows.

Etiology of Sleep Bruxism
The exact etiology of SB is still not known and probably multifactorial in nature. Central issues can be categorized into pathophysiological and psychosocial factors such as stress, frustration, poor social support, and personality issues as well as pathophysiological factors including sleep disturbance, use of certain medications or drugs, smoking, allergies, genetic factors and nutrition deficiencies (calcium, magnesium,) and other medical conditions (9). The link between SB and psychosocial factors such as emotional stress was supported by the studies reporting elevated levels of urinary catecholamine in patients with SB (9). In addition, SB activity had been related to higher levels of perceived psychological stress and salivary cortisol (10). A controlled laboratory study reported that SB patients were more competitive and felt more anxious than normal subjects (11). Patients with both AB and SB, also showed significant differences in anxiety, depression, hostility, phobic anxiety, and paranoid ideation when compared to non-bruxers (12).

Tooth wear
Bruxism was for long considered a major cause of tooth wear. A systematic review concluded that “attrition seems to be co-existent with self-reported bruxism” (13). Tooth attrition coupled with Gum recession and abfraction is a common condition for profound Buxism (see figure 1 and 2 for illustration) – also, Wear facets (small circular indentations mainly in the back teeth) can be as well noticed as a sign of Buxism on a grinder (Figure 3).

A recent review concluded that a number of published observations strengthen the concept of the multifactorial etiology of tooth wear. The review went on to state that it seemed fair to conclude that the overall significance of bruxism as a causative factor for tooth wear is not fully known, but it is even fairer to say that it is probably overestimated (14). It follows that there are significant limitations with self-reports to provide a reliable diagnosis of sleep bruxism. Therefore, in much of the discussion that follows, the use of the term bruxism implies an acceptance of this limitation, and that what it refers to might equally be just heavy loading through high biting/chewing forces operating as a direct factor, rather than it being categorically due to parafunctional activity.

Irrespective of the etiology, restoration of worn teeth that will frequently involve prosthetic treatment will be needed in some patients. Because such treatment is typically complex and often extensive, there is a tendency to defer treatment until the tooth wear is well advanced. This complicates treatment further, and with greater mechanical vulnerability to the restoration provided. There is a scarcity of studies on the outcome of prosthetic restoration of worn dentitions, leading to widely differing opinions among prosthetists in different countries about how these complex treatment situations should be managed (14,15).

Effects of bruxism on the masticatory system
Since bruxism is considered a possible etiological factor for TMD and tooth wear, its clinical
importance is obvious. Other effects of bruxism may include tooth movement and tooth mobility, as well as changes in oral soft tissues and jawbone (16).

**Treatment of bruxism**

The absence of a definitive treatment to permanently eliminate bruxism has led to the development of strategies to reduce its deleterious effects. The most common method used to prevent the destructive effects of bruxism is through different types of interocclusal appliances (e.g. occlusal splints, nightguards, etc.). Recent reviews have concluded that interocclusal appliances are useful adjuncts in the management of sleep bruxism but do not offer a definitive or “curative” treatment of bruxism, or the signs and symptoms of TMD (17). Similarly, their efficacy in reducing nocturnal muscle activity and craniofacial pain is unclear (18).

Occlusal splints are commonly used to prevent tooth wear caused by bruxism and/or heavy loading. A survey among general dental practitioners in Sweden showed that they considered the first indication for hard interocclusal appliances was for protecting the dentition from wear, followed by for managing TMD problems (19). An earlier long-term study of patients with extensive tooth wear provided with stabilization splints showed that usage patterns by patients varied widely. Only a few patients continued to use the splints for the whole follow-up period and the mean period of usage was approximately 2 years. In most patients, tooth wear progression rate over 6–10 years was slow and the amount was small. The role of the splints in the minimal continuing tooth wear observed was not conclusive: in general, the splints were used for less than a third of the follow-up period and, besides bruxism, several other possible causes of tooth wear were evident (20). Nevertheless, in spite of the paucity of strong evidence, a recent book on bruxism states that there is “total consensus that bruxism splints play a positive role in protecting dental hard tissues” (21).

**Effects of bruxism on prosthetic restorations on natural teeth**

The attachment of natural teeth through periodontal ligaments and osseointegrated implants with a rigid bone contact in the jaw presents a significantly different environment, and this needs consideration. A natural tooth can be intruded about 50 μm by a light force (20 N) compared to only 2 μm for an osseointegrated implant (22). In an animal study, Miyata et al. investigated the relationship between occlusal overload and peri-implant tissue and suggested that peri-implant bone resorption occurred under occlusal overload (23). On the other hand, Heitz-Mayfield et al. demonstrated that a period of 8 months of excessive occlusal load on titanium implants did not result in loss of osseointegration or marginal bone loss when compared with nonloaded implants in animal study (24). However, much of oral and masticatory function seems to be similar in natural and implant-supported dentitions (25). The periodontal ligament is lost after tooth extraction, but most of its functional role as related to occlusion and mastication seems to be taken over by other mechanisms, such as, muscle spindles, mechanoreceptors in the temporomandibular joints (26). Since successful long-term results of implant prostheses have been reported repeatedly, it may be concluded that the variety of methods related to occlusal morphology used in fixed prosthodontics on natural teeth are equally acceptable for rehabilitation on dental implants. The simple principles described for conventional prosthodontics may therefore be followed also for implant prostheses (22). A literature review concluded that the occlusal scheme for an implant prosthesis should be designed to decrease cuspal interferences, centralize forces along the long axis, and minimize lateral forces; that is, it should be like that of a similar prosthesis on a natural dentition (27).

Since the occlusal perception level is higher for implant prostheses than for natural teeth, complaints of implant patients should be carefully considered when checking their occlusion. It is established that the lack of periodontal receptors leads to impaired fine motor control of the mandible in implant patients (28). However, early studies concluded that the functional clinical capacity of patients with implant prostheses was almost equal to or approaching that of dentate subjects (29). A study showing that the tactile sensibility of single-tooth implants opposing natural teeth was similar to that of pairs of opposing natural teeth led to the
conclusion that the implants can be integrated in the stomatognathic control circuit \( (30) \).

**Occlusal Material for the Suprastructure in Implant Prostheses**

Based on biomechanical analyses, acrylic resin denture teeth were therefore predominantly used during the initial years of dental implant use \( (31) \). However, biomechanical calculations do not always stand the test in the clinic. In a clinical study on five subjects using fixed prostheses with either acrylic resin or porcelain occlusal surfaces, masticatory forces were recorded while the subjects chewed various foods. No differences related to tooth material could be detected in the load rates \( (32) \). In a study covering 6 years, the use of porcelain instead of composite resin as occlusal material had no influence on the marginal bone height around the implants \( (33) \). These findings can be interpreted as a support for the use of porcelain as occlusal material because no serious biological consequences of the hard material were reported. Furthermore, the most common complications of implant prostheses have been related to fractures of the acrylic resin of the prostheses \( (34) \). Wear of acrylic occlusal surfaces increased substantially with time, according to a 15-year follow up of fixed implant-supported prostheses in the edentulous maxilla \( (35) \).

**Effects of bruxism on implant restorations**

Although there is no evidence regarding the preferred restorative materials in implant prosthesis for patients with bruxism, some clinicians prefer metal restorations and not porcelain to protect the implant prostheses in patients with bruxism, especially for second molar teeth in the maxilla. Evidently, more clinical trials are needed to provide evidence for these recommendations. More recently, framework or crowns in zirconia was also developed in this field. However, in a clinical trial on fractured dental zirconia implants, Gahlert et al. reported that “the patient with the fracture of the 4 mm diameter zirconia implant was adversely affected by strong bruxism” \( (36) \). Recently, some investigators demonstrated zirconia as a new dental implant material \( (37) \). The development of new dental implant material might change the relationship between fractured dental implants and bruxism.

**Effects of bruxism on removable dentures**

Due to lack of evidence, systematic studies on the effects of bruxism on removable dentures are not available in the literature.

**Complete dentures**

Textbooks on complete denture fabrication often mention that clinical experience indicates that bruxism is a frequent cause of complaint of soreness of the denture-bearing mucosa. The relationship between oral parafunctions and residual ridge resorption has not been investigated, but it is tempting, even if anecdotally, to include parafunctions as a possible factor related to the magnitude of ridge reduction \( (38) \).

**Removable partial dentures**

The question of restoring lost posterior support by means of mandibular distal extension removable partial dentures (RPDs) in moderately shortened dental arches remains controversial \( (39) \). However, systematic reviews have concluded that shortened dental arches comprising anterior and premolar teeth generally fulfill the requirements of a functional dentition without the need for prosthodontic extension, especially in older patients \( (40) \) and \( (41) \). In this regard, the findings of a study of occlusal activity, including bruxism, in subjects with moderately shortened dental arches with or without mandibular distal extension removable partial dentures and subjects with complete dentitions which reported similar awareness of bruxism, similar occlusal wear of lower anterior teeth; in contrast, premolars had significantly more occlusal tooth wear; similar frequencies of signs and symptoms related to TMD \( (42) \).

**Night Guard and Pharmacological Approach for Bruxism**

A night guard fabricated for the maxillary teeth can be a useful tool to evaluate the influence of the occlusion scheme and its relationship to nocturnal bruxism \( (43) \). Occlusal schemes and designs of fixed and removable implant prostheses must satisfy the requirements for an innocuous vertical loading of dental implants. Parafunctional habits (clenching or grinding) can transmit forces to the supporting bone that may result in destructive lateral stresses and overloading. The consequences of nocturnal
parafunctional habits may be prevented by acrylic resin night guards. A hard stabilization splint for nightly use (night guard) contributes to optimally distributing and vertically redirecting forces that go with nocturnal teeth grinding and clenching. A night guard that promotes even occlusal contacts around the arch in centric-related occlusion can be helpful to prevent fractures of implant prostheses. This device may be fabricated with 0.5- to 1-mm colored acrylic resin on the occlusal surface. If the patient wears this device for 1 month, the consequences or intensity of the bruxism habit may be directly observed. If the colored acrylic is not worn through, the parafunction was not excessive. As examples, when partial implant prosthesis is present in the maxilla, the night guard is hollowed out at the implant sites so no occlusal force is transmitted to the implant prostheses. When the partial restoration is in the mandible, the occluding surface of the guard is relieved over the implant prostheses so no occlusal force is transmitted to the implants. A soft material may also be placed around the crowns for stress relief and to decrease the impact force on the crowns.

DISCUSSION
Few relevant articles with the search terms used were listed in PubMed since Research focusing on the relationship between bruxism and prosthetic therapy is scarce, and additional valuable texts were found by means of manual searching of the reference lists of articles found and in recent textbooks. There is not enough evidence that prosthetic therapy, or any other available treatment, can eliminate bruxism. Equally, there is no evidence that bruxism can be caused by prosthetic therapy. On the other hand, some few investigators proposed a pharmacological approach for bruxism patients with implant prostheses, especially in cases where oral implants failed as a probable consequence of severe, polysomnographically confirmed sleep bruxism. As the patient had the wish to be reimplanted after this failure, the operators decided to try diminishing the frequency of bruxism and duration first. The selected management strategies, the administration of low doses of the dopamine D1/D2 receptor agonist pergolide finally resulted in a substantial and lasting reduction in the bruxism outcome measures under study.

The use of interocclusal appliances is the most common and accepted way to prevent wear of teeth and prosthodontic restorations in spite of lack of strong evidence for its efficacy.

CONCLUSION
The etiology of bruxism is not well known, but it is agreed that it is multifactorial. There is no specific treatment available at this time to stop bruxism, so that the focus has been to reduce the adverse effects of the habit. feel that the overload caused by bruxism may result in failure of implant supported prostheses. Following the recent developments with the introduction of immediate or early loading, the clinical management of bruxism will become an important subject for implant prostheses. The lack of well-designed clinical trials regarding the consequence of bruxism on implant prostheses poses a serious problem. At present, expert opinion and cautionary approaches are still considered the best available sources for suggesting good practice indicators which urges clinical research centers to dig deeper into the matter and provide a strong evidence on whether the subjective feeling of clinicians regarding the approach of bruxism in implant patients is correct or not. When prosthetic intervention is indicated in a patient with bruxism, efforts should be made to reduce the effects of heavy occlusal loading on all the components that contribute to prosthetic structural integrity.

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Figure 1: shows a typical manifestation of teeth and gums which is characteristic to Bruxism.
Figure 2: shows abfraction lesions driven by the abnormal load created by bruxing

Abfraction is a mechanical loss of tooth structure that is not caused by tooth decay, located along the gum line.

Figure 3: another sign of Bruxism is wear facets (small circular indentations mainly in the back teeth)