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Diagnosis and treatment of bruxism: Concepts from past to present

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Abstract

Activities of the masticatory system can be divided into Functional, which includes chewing, speaking, and parafunctional, which includes clenching or grinding of the teeth. Bruxism is the abnormal, non functional contact of teeth, if ignored leads to the breakdown of dentition and oro facial pain. Hence, early diagnosis and treatment is considered to be of utmost importance. Bruxism has multifactorial causes which have to be identified and managed by various treatment modalities. As bruxism events bring about tooth and restoration damage, it is of major concern for the dentists. This review article discusses about the history to the current concepts in the diagnosis and treatment of bruxism.

Keywords: Bruxism, clenching, teeth grinding

1. Introduction

In simple terms, bruxism is a clenching and grinding of teeth when the individual is not chewing or swallowing. It is noted as the commonest of the many parafunctional habits of dento facial system. Bruxism activity is of major concern for the dentists as it leads to tooth wear and damage, restoration fractures, temporal headache and other temporomandibular disorders. The prevalence range is from 8-31% in the general population and 14-20% in children [1] The people over the age group of 60years are less likely to be affected showing a prevalence dropping down to around 3%. In most of the cases, bruxism does not cause serious complications, but in severe conditions it can lead to damage of teeth and restorations, tension type headaches, facial or jaw pain and temporomandibular disorders. Hence a proper diagnosis and management of bruxism is of major concern, in order to prevent complications.

2. History

The term "bruxomania" is derived from french word "la bruxomanie," suggested by Marie and Pletkiewicz² in 1907. In 1931, Frohman coined the term bruxism [3]. The term bruxism originates from the greek word "brychein", meaning to grind or gnash the teeth. Miller put forward a differentiation between nocturnal grinding of the teeth which he called as bruxism and the habitual grinding of the teeth in the daytime, which he called as bruxomania [4] In 1960's, Ramfjord put forward the theory that occlusal factors were responsible for bruxism and he defined bruxism as the habitual habit of grinding teeth when the individual is not chewing or swallowing.

In 1983 a distinction was made between clenching and grinding: clenching as centric bruxism and grinding as eccentric bruxism. However, the majority of the researchers now disfavour that malocclusion to be the main etiological factor and consider it to be multifactorial.

In 1995, Vanderas defined bruxism as the nonfunctional movement of the mandible with or without an audible sound occurring during the day or night [5]. And bruxism at night was recently classified as sleep related movement disorder according to recent classification of sleep disorders [6] In 2001, Lobbzoo and Naeije, stated that various neurotransmitters in the central nervous system appeared to modulate bruxism [7].

According to GPT 9, bruxism is defined as "the parafunctional grinding of the teeth; an oral habit consisting of involuntary rhythmic or spasmodic non-functional gnashing, grinding, or clenching of teeth, in other than chewing movements of the mandible, which may lead to occlusal trauma.

3. Types of bruxism

Bruxism can occur during day time known as diurnal bruxism or awake bruxism. Bruxism during sleep at day time or night time is known as sleep bruxism. Awake bruxism is related to the stress due to familial responsibility or work pressure, anxiety, anger or frustration. Awake bruxism is more commonly seen in females compared to males. The prevalence rate of awake bruxism is noted to be 20%. Whereas, sleep bruxism is considered as a sleep related oro mandibular movement disorder.

Individuals who brux during sleep are more likely to have other sleep disorders, snoring and pauses in breathing (sleep apnea). It was classified as a sleep related movement disorder according to recent classification of sleep disorders. Sleep bruxism occurs with no gender difference. This is noted frequently in the younger population, in children with a prevalence rate of 14-20%.

4. Causes of Bruxism

Bruxism is said to have multiple causes. They include central factors, psychosocial factors and peripheral factors.

4.1 Central factors

The physiology of sleep has been studied extensively especially the 'arousal response', as bruxism usually occurs during sleep. Arousal response is a sudden change in the depth of the sleep during which the individual either arrives in the lighter sleep stage or actually wakes up. And such a response occurs along with body movements, increased heart rate, respiratory changes and increased muscle activity. Macaluso *et al.* in their study showed that 86% of bruxism episodes were associated with arousal response along with involuntary leg movements. Hence proving a close association of arousal response with bruxism activity^[8]

It is hypothesized that the direct and indirect pathways of the basal ganglion, a group of five subcortical nuclei that are involved in the coordination of movements is disturbed in bruxism patients^[7]. An imbalance between both the pathways, results in movement disorder like Parkinson's disease and this imbalance occurs with the disturbances in the dopamine mediated transmission of action potential. In case of bruxism there may be an imbalance in both the pathways. Acute use of dopamine precursors like L-dopa inhibits bruxism activity and chronic long term use of L-dopa results in increased bruxism activity^[9].

4.2 Psychosocial factors

A multifactorial large scale population study of sleep bruxism concluded highly stressful life as a significant risk factor. Inability to express emotions such as anxiety, rage, hate, aggression etc can also be a cause for bruxism. Awake bruxism or diurnal bruxism can be associated with stress due to familial responsibility or work pressure.

4.3 Peripheral factors

Bruxism is commonly considered to be related to deviations in dental occlusion and articulation. Giffin in his article has mentioned that for an effective management of bruxism, establishment of harmony between maximum intercuspation and centric relation is required^[10] Recent literature studies on this aspect agrees that there is hardly any relationship between bruxism and occlusal factors. Goncalves *et al.* in their study concluded that there was no significant relationship between bruxism and the occlusal factors^[11]

5. Risk factors

5.1 Age: Bruxism is more common in young children and noted to decrease by adulthood.

5.2 Stress: Increased stress and anxiety can cause bruxism.

5.3 Personality: Aggressive, competitive and hyperactive type of behaviour and personality can increase the chance of teeth grinding.

5.4 Family history: Sleep bruxism tends to give a family history, other members also may have teeth grinding or a history of it.

5.5 Medications and habits: Certain antidepressants can result in bruxism as an uncommon side effect. Habits like smoking, tobacco chewing, drinking caffeinated beverages may increase the risk of bruxism.

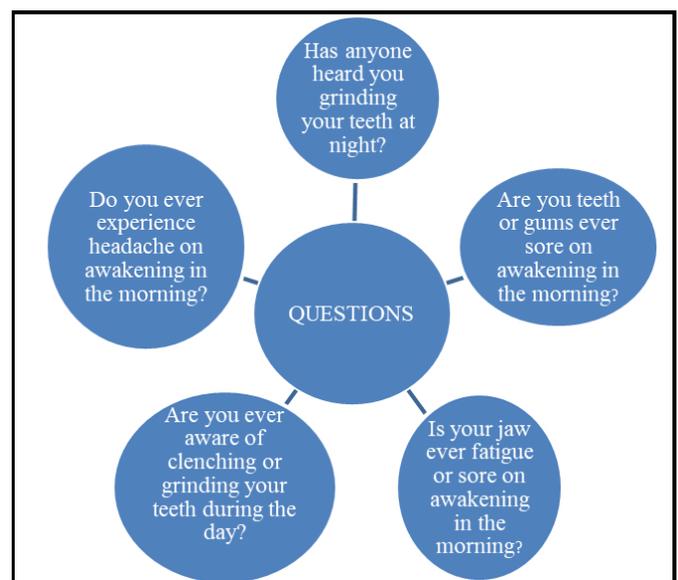
5.6 Other factors- Bruxism can be associated with medical problems like epilepsy, sleep related disorders, dementia, parkinson's disease and gastroesophageal reflux disorder.

6. How to Assess Bruxism

Early identification and management measures play a crucial role in bruxism patients, as bruxism activity if left unattended can harm the quality of life by leading to tooth damage, occlusal disharmony and TMJ disorders. So when the patient comes to the dentist, some of the assessment methods are to be followed for accurate interpretation and treatment. They are questionnaires, clinical evaluation, intraoral appliances and electromyographic recording.

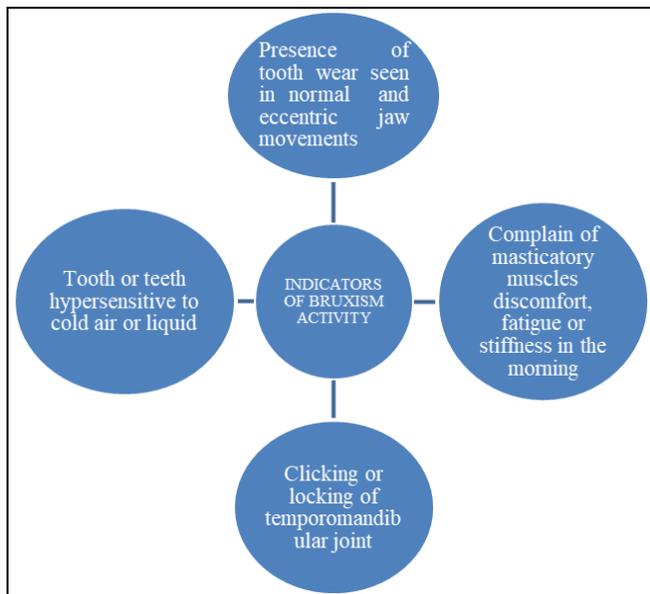
6.1 Questionnaires

Questionnaires form the simplest and easiest method of assessment. But the main disadvantage of this method of assessment is that it is subjective in nature. Bruxism events may or may not be accompanied by noise; hence most of the children and adults may not be aware of their bruxism activity. Hence the questions asked are^[12].



6.2 Clinical evaluation^[13, 14]

The diagnosis of bruxism can be traced out by taking a good case history and evaluating the tooth mobility, tooth wear and other clinical findings of TMJ.



Among these, assessment of bruxism event by evaluating tooth wear is controversial as tooth wear is a cumulative record of both functional and parafunctional activities and various factors such as age, gender, diet and bruxism are associated with tooth wear [15].

6.3 Intra oral appliance

Bruxism activity can be evaluated using intra oral appliances by assessing the wear facets on it and by assessing the bite load on the intra oral appliance [15, 16, 17]. But the accuracy of these methods has not been confirmed. Koriath *et al.* reported that parafunctional dental activity at night on full-arch occlusal stabilization splints resulted in wear, which was both asymmetric and uneven [18].

The Bruxcore Bruxism Monitoring Device (BBMD) was introduced to measure the nocturnal bruxism activity.¹⁹ Bruxcore plate is used to evaluate the bruxism events by counting the number of abraded microdots on its surface and by scoring the volumetric magnitude of abrasion. The BBMD uses 0.51-mm-thick polyvinyl chloride plate that consists of four layers with two alternating colors and a halftone dot screen on the topmost surface. The number of missing microdots is counted to evaluate the abraded area and the number of layers uncovered represents the depth parameter. Both of these parameters are combined so as to obtain an index for the amount of bruxism activity. The major disadvantage of this method is that it is difficult to count the number of missing dots with good accuracy.

Takeuchi *et al.* put forward a recording device for sleep bruxism, Intra-splint force detector (ISFD). It uses an intra-oral appliance to measure the force being produced by tooth contact on the appliance. The ISFD detects the force by using a thin, deformation-sensitive piezoelectric film, which is embedded 1–2 mm below the occlusal surface of the appliance. But ISFD was not suitable for detecting the magnitude of force during steady-state clenching behaviour [20].

6.4 Masticatory muscle electromyographic recording

Masticatory muscle electromyographic recording assesses bruxism by measuring the actual sleep bruxism activity directly. Hence the main advantage of EMG recording is that the occurrence of bruxism can be assessed without intra-oral appliances, which may change natural bruxism activity. In 1970s, sleep bruxism episodes were measured over an

extended period in patient's homes, with the use of portable battery-operated EMG recording devices, which can measure masticatory muscle activity in a detailed and accurate way by evaluating the number, duration and magnitude of bruxism events [21].

A miniature self-contained EMG detector-analyser (bite-strip) was developed as a screening test for moderate to high level bruxers, which measured the number of bruxism events by simply attaching it to the skin over the masseter muscle. Recently, a miniature self-contained EMG detector-analyser with a biofeedback function (grindcare, medotech, denmark) was developed as a detector and biofeedback device for sleep bruxism. It works by the online recording of EMG activity of the anterior temporalis muscle, online processing of EMG signals to detect tooth grinding and clenching and also biofeedback stimulation for reducing sleep bruxism activities [22].

Polysomnographic (sleep laboratory) recordings for nocturnal bruxism generally include electroencephalogram, EMG, electrocardiogram and thermally sensitive resistor (monitoring air flow) signals along with simultaneous audio-video recordings. In this the sleep laboratory setting offers a highly controlled recording environment, so other sleep disorders like sleep apnoea and insomnia can be ruled out and sleep bruxism can be differentiated from other orofacial activities like swallowing and coughing that occur during sleep. A change in the environment of sleep can influence the actual behaviour of bruxism, which is considered as a major limitation in polysomnographic recordings [23-25].

7. Signs and Symptoms

1. Pain in the teeth and sensitivity to heat and cold.
2. Chronic muscular facial pain with tension headaches, caused by intense muscle contraction.
3. The noise noticed by parents, friends or relatives, that occurs as the teeth are ground together.
4. An abnormal alignment of the teeth, caused by uneven tooth wear
5. Flattened and worn tooth surfaces, which may reveal the underlying yellow dentine layer.
6. Microfractures of the tooth enamel.
7. Broken or chipped teeth
8. Loose teeth with possible damage to the tooth sockets
9. Stiffness and pain in the jaw joint (temporomandibular joint or 'TMJ') that cause restricted opening and difficult chewing; sometimes the jaw joint may suffer damage that is slow to heal.
10. Earache.

8. Effects of Bruxism on Restorations

8.1 Effect of bruxism on prosthetic restorations

The most common mechanical failures reported in case of prosthetic restorations on natural teeth included loss of retention and fracture of material and the occurrence of such failures is greatest in patients with bruxing habits. Metal or metal-ceramic restorations seem to be the safest choice in cases of high load conditions, although under extreme conditions, there is no material that will last for too long. Due to the risk of chipping of ceramic veneers in metal-ceramic restorations, many clinicians prefer gold-acrylic FDPs for heavy bruxers. Clinical studies published on wear of materials in bruxism patients indicate only minimal differences in wear resistance of gold and ceramic materials, whereas resin-based materials showed 3–4 times more substance loss than gold or ceramics [26].

Zirconia, which is the present material of esthetics and strength, have demonstrated improved mechanical properties in laboratory studies and hence may be promising in the treatment of bruxism related tooth wear [27, 28]. However, a systematic review of zirconia FDPs has shown that there are complications when the material is used clinically. Improvement of the veneering systems is especially required as chipping is considered to be the most frequent mechanical complication [29].

8.2 Effect of bruxism on implant restorations

In a prospective 15- year follow-up study of mandibular implant-supported fixed prostheses, smoking and poor oral hygiene had a significant influence on bone loss, whereas occlusal loading factors such as bruxism, maximal bite force and length of cantilevers were of minor importance.³⁰ Systematic reviews have concluded that there is no causative relationship between occlusal forces and loss of osseointegration [31, 32].

Although bruxism was included among risk factors, and was associated with increased mechanical and/or technical complications, it had no effect on implant survival. Several studies have indicated that patients with bruxism have a higher incidence of complications on the superstructures of

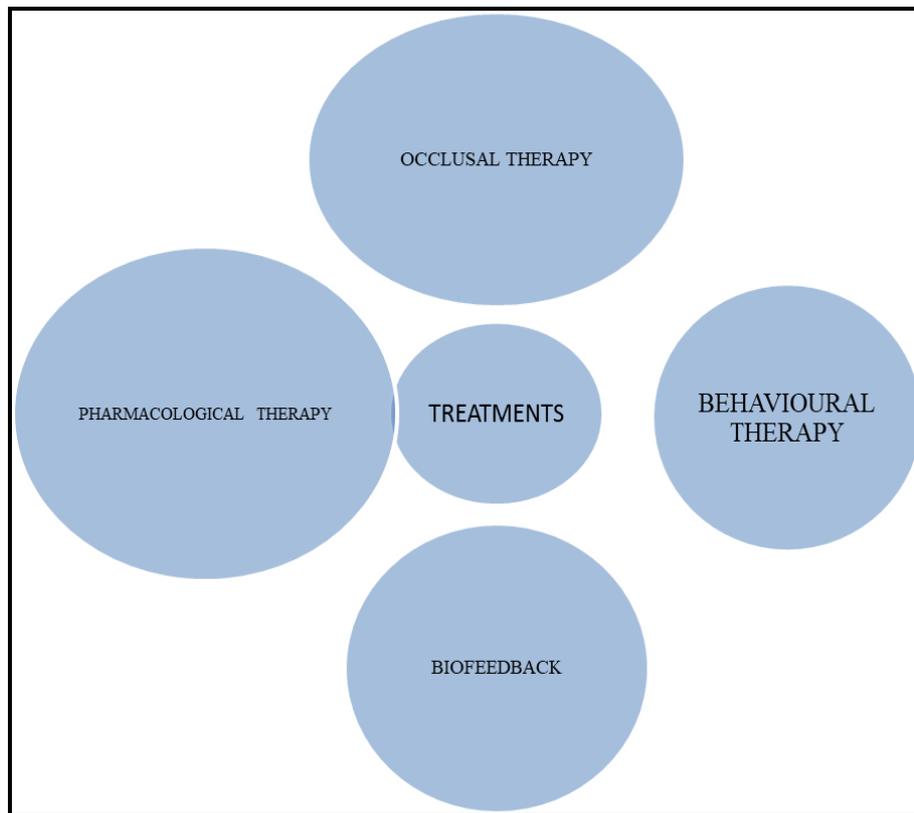
both of fixed and removable implant-supported restorations [33, 34]

8.3 Effect of bruxism on dentures

It is considered, clinical experience indicates that bruxism is a frequent cause of complaint of soreness of the denture-bearing mucosa. In a similar way, heavy bruxism may have deleterious effects on the residual dentition and the denture-bearing tissues in patients with RPDs, although this has not been systematically studied. A study mentioned the management of four patients with severe sleep bruxism, and who were using conventional RPDs. Each patient was provided with a splint-like RPD, called a night denture, and followed-up for 2–6 years using the night denture. The study concluded that the night denture appeared to be effective in managing problems related to sleep bruxism in patients with RPDs [35].

9. Current Treatments of Bruxism

Treatment aims to find and remove the causes of bruxism, change the behaviour that causes bruxism and repair the damage that bruxism often causes. The treatment aspect includes-



9.1 Occlusal therapy

Occlusal splints have been considered as the first-line of management for preventing dental grinding noise and tooth wear in case of sleep bruxism. These splints have different names such as occlusal bite guard, bruxism appliance, bite plate, night guard, occlusal device. They are classified into hard splints and soft splints. Hard splints are preferred over soft splints because soft splints are difficult to adjust than hard splints and hard splints are effective in reducing the bruxism activity [15, 36]. A study compared occlusal splints versus a medication doses gabapentin, and found that both treatments reduced similarly the muscle activity associated with sleep bruxism after 2 month of therapy [37].

9.2 Behavioural modification

Psychoanalysis, hypnosis, meditation, sleep, hygiene measures with relaxation techniques and self- monitoring have been considered for the treatment of bruxism. The treatment of sleep bruxism usually begins with counselling of the patient with respect to the sleep hygiene. It includes to instruct the bruxer to stop smoking and drinking of coffee or alcohol at night, to limit the physical or mental activity before going to bed, and to ensure good bedroom conditions like quiet and dark [38].

9.3 Biofeedback

Biofeedback works on the principle that “bruxers can unlearn their behaviour when a stimulus makes them aware of their adverse jaw muscle activities”. Mittelman described an EMG technique that provides the daytime bruxer with auditory feedback from his/her muscle activity letting him know the degree of muscle activity or relaxation that is happening.³⁹ Nissani used a taste stimulus to awaken the patient, in case of sleep bruxism^[40].

In recent years, contingent electrical stimulation (CES) has appeared in an attempt to reduce the masticatory muscle activity associated to sleep bruxism. The rationale for CES includes the inhibition of the masticatory muscles responsible for bruxism by applying a low-level electrical stimulation on the muscles when they become active, i.e. during the bruxism episode. Experimental studies have used CES in patients with signs and symptoms of sleep bruxism and myofascial pain, and found a reduction of the EMG episodes per hour of sleep while using CES, but with no changes in pain and muscle tension scores^[41, 42]

9.4 Pharmacological therapy

Certain drugs have paralytic effect on the muscles, by inhibiting acetylcholine release at the neuromuscular junction (NMJ) thereby decreasing bruxism activity in severe cases like coma, brain injury etc. In a study, botox injections over a period of 20 weeks showed decrease in bruxism activity in 18 subjects. This study suggested that botulinum toxin inhibited the release of acetylcholine at NMJ^[43]. Shim *et al.* found that the amplitude of the muscle contraction during bruxism events was reduced after 4 weeks of injection, but with no changes in the rhythm or number of bruxism episodes per hour of sleep^[44].

10. Conclusion

Bruxism is a common parafunctional habit, occurring both during sleep and wakefulness. Usually it causes few serious effects, but can have serious effects in some patients affecting their quality of life. As the etiology is multifactorial, there is no known treatment to stop bruxism, including prosthetic treatment. Counselling and behavioral strategies, splint therapy, medications, and contingent electrical stimulation can be used as different ways reducing the effects of bruxism. The management of bruxism should focus to prevent progression of dental wear, reduce teeth grinding sounds, and improve muscle discomfort and mandibular dysfunction in the most severe cases.

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