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Review

Essence of Diagnosis and Management of Sleep Bruxism

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Abstract: It is common knowledge for dentists that sleep bruxism can produce destructive symptoms in the stomatognathic system, such as tooth wear. However, if it is not clear whether those symptoms are truly caused by sleep bruxism, overtreatment may result. The American Academy of Sleep Medicine has classified the diagnosis by polysomnography as "Definite sleep bruxism", "Probable sleep bruxism" by clinical signs, and "Possible sleep bruxism" by questionnaire. Clinically, the diagnosis should be made through objective evaluation using a wearable electromyograph or the International Classification of Sleep Disorders third edition criteria for diagnosis based on clinical signs (tooth grinding sounds during sleep and abnormal tooth wear or/and morning jaw symptoms). In addition, the underlying causes of sleep bruxism should be investigated. If it is associated with a background disease, such as secondary sleep bruxism, treatment should proceed in collaboration with medical professionals. If augmenting factors are present, sleep hygiene instructions should be provided. If these treatments are unsuccessful, a well-fitting, properly adjusted occlusal appliance (stabilization-type appliance) may be applied. However, once symptoms have improved, the patient should proceed to discontinue the occlusal appliance.

Introduction

Tooth wear is caused by various factors including age, residence, occupation, and food preferences, as well as bruxism[1, 2] (Table 1). However, there are still many dentists who diagnose sleep bruxism based on the presence of tooth wear alone and apply an occlusal appliance to their patients. Depending on the type of appliance, even the safest stabilization type occlusal appliance has been reported to cause side effects such as open bite, occlusal changes, and mild worsening of sleep-disordered breathing[3, 4] (Table 2). Thus, since an unreliable use of occlusal appliance may cause dental treatment-induced dental disease, dentists must accurately diagnose sleep bruxism and appropriately treat it. This article will explain how to diagnose and deal with sleep bruxism.

Diagnosis of Sleep Bruxism

The International Classification of Sleep Disorders-Third Edition (ICSD-3) of the American Academy of Sleep Medicine (AASM) defines bruxism as "repetitive masticatory muscle activity characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible and specified as either sleep bruxism or awake bruxism[5]". Repetitive masticatory muscle activity, that is Rhythmic

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Table 1 Causes of tooth attrition[1, 2)]

• Age	• Residence
• Tooth type	• Occupation
• Dental arch form	• Prostheses for opposing teeth
• Occlusal force	• Medication
• Saliva composition/secretion	• Abnormal oral behavior (preference for hard foods, soft drinks and alcohol, rest chin in hand, awake and sleep bruxism)
• Internal Diseases (gastroesophageal acid reflux, dry mouth)	

Table 2 Side effect of various occlusal appliances[3,4)]

• Open bite or/and occlusal change
• Worsening of breathing during sleep
• Alveolar bone resorption or/and tooth mobility
• Hypersensitivity
• Dry mouth or excessive saliva during sleep
• Difficulty swallowing or/and risk of aspiration
• Desorption of the appliance during sleep

Masticatory Muscle Activity (RMMA), occurs during sleep and is diagnosed as sleep bruxism when it occurs more than 2 times/hr of total sleep time[6)]. RMMA has three patterns of muscle activity: Phasic type, Tonic type, and Mixed type[5, 7, 8)]. Phasic type is 3 or more muscle bursts of 0.25-2 sec. Tonic type is a muscle burst of 2 sec or longer. Mixed type is a mixture of phasic and tonic types.

Gold standard for sleep bruxism diagnosis is the use of polysomnography (PSG), which also includes audio and monitor image recording[8)]. PSG can record many biological signals such as electroencephalogram (EEG), electrooculogram (EOG), electromyogram (EMG), electrocardiography (ECG), and pneumogram, and can be used to classified sleep stages. Since artifacts such as body movements can be removed from audio and video monitor images, sleep bruxism can be detected during pure sleep. Unfortunately, PSG is difficult to perform in dentistry in Japan and has almost not been applied clinically. It is very useful for research to elucidate the physiological mechanism of sleep bruxism.

Portable EMG recorder is more convenient than PSG for evaluation of masticatory muscle EMGs. Several portable EMG recorders have been developed so far. In Japan, the EMG Logger (GC) was developed and was covered by national health insurance as “sleep dental electromyography” in 2020 (Fig.1). Since this device record only single EMG from the biological signal during sleep, it may include masticatory muscle activity during awakening. Therefore, a study matching the number of RMMA events of PSG have set the diagnostic criterion of 5.5 times/hr[9)]. Clinically, 4 times/hr is used as the threshold to account for interday variation. Although it is often assumed that the muscle activity of the phasic type is grinding and that of the tonic type is clenching, phasic clenching (phasic type RMMA) and slow grinding (tonic type RMMA) have also been observed. In fact, phasic clenching (phasic type RMMA) and slow grinding (tonic type RMMA) are also observed[10)].

The ICSD-3 has a diagnostic criterion based on clinical signs[5)] for dentists who cannot afford these devices (Table 3), and Palinkas et al. found the criterion to be somewhat useful, with 58% sensitivity and 82% specificity[11)].

The questionnaire is very simple. However, because even healthy people perform RMMA several times a night[12)] and clenching is not sound, the perception of sleep bruxism and its suggestion by bed partners is not reliable[8)]. AASM has graded the diagnosis by PSG as “Definite sleep bruxism”, “Probable sleep bruxism” by clinical signs, and “Possible sleep bruxism” by questionnaire[8)].

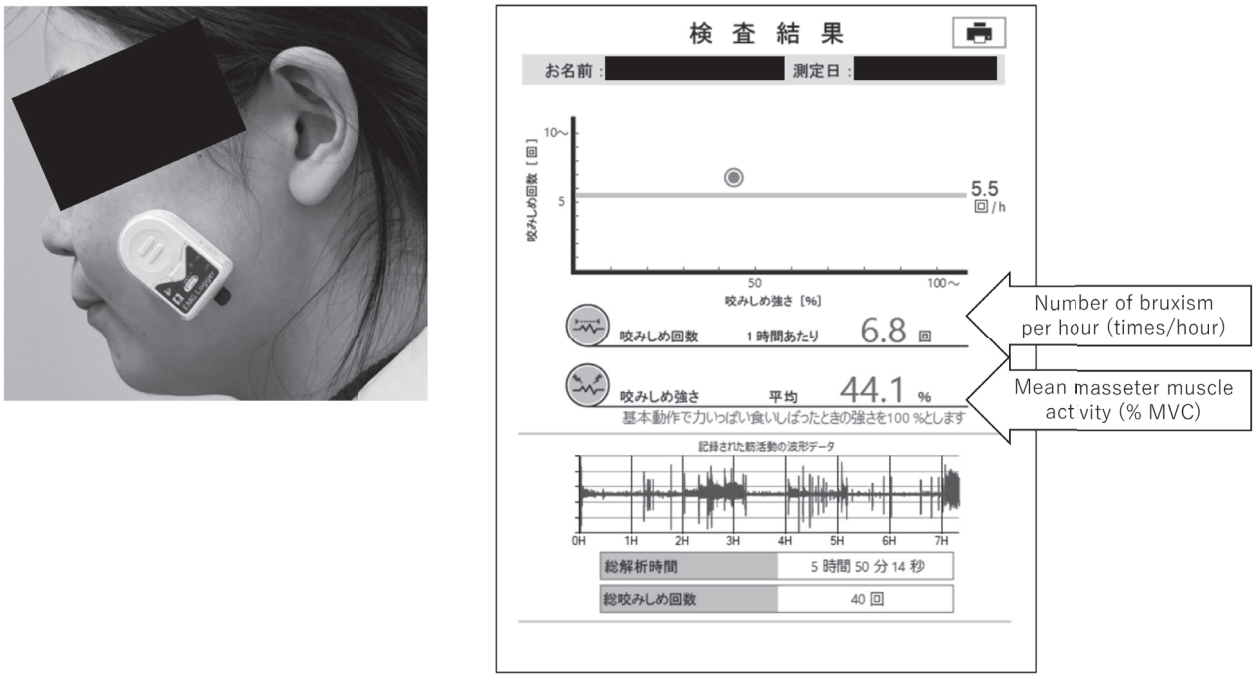

Fig.1 EMG logger (GC)
EMG logger is placed on the masseter muscle on one side and the patient sleeps. The number of bruxism per hour (times/hour) and the mean masseter muscle activity (% MVC: maximal voluntary contraction) can be easily analyzed.

Table 3 Diagnosis criteria of clinical symptoms from AASM[5)]

Below a) and b) must be met:
a) The presence of regular or frequent tooth grinding sounds occurring during sleep
b) The presence of one or more of the following clinical signs:
- Abnormal tooth wear consistent with above reports of tooth grinding during sleep
- Transient morning jaw muscle pain or fatigue; and/or temporal headache; and/or jaw locking upon awaking consistent with above reports of tooth grinding during sleep

Pathogenetic and augmenting factors of sleep bruxism

Sleep bruxism can be classified into two types, depending on the pathogenetic factors. Those with unknown etiology are called primary sleep bruxism. Secondary sleep bruxism is caused by some background disease. There are also augmenting factors that increase RMMA. The following are some of the possible underlying pathogenetic factors of secondary sleep bruxism.

In patients with gastroesophageal reflux disease, RMMA and swallowing events were increased along with gastric acid reflux events during sleep[13)]. It has also been reported that administration of proton pump inhibitors decreases RMMA[14)]. These findings suggest that sleep bruxism may have a functional role in promoting salivation or diffusion of the small amount of saliva remaining in the oral cavity. Frequency Scale for the Symptoms of GERD (FSSG) can be used to screen for gastroesophageal acid reflux disease.

There is no consensus regarding the association between obstructive sleep apnea (OSA) and sleep bruxism, as some reports[15)] deny the association. RMMA often occurs before and after apnea events[16)]. In reviewing the results of previous studies, OSA and sleep bruxism may be comorbid, in pediatric patients[17)], with arousal after apnea events[18)], and with gastroesophageal reflux events[19)]. Furthermore, hypoxia prior to the RMMA event and gradual hyperventilation occurring 6-18 seconds after the start of the event suggest that sleep

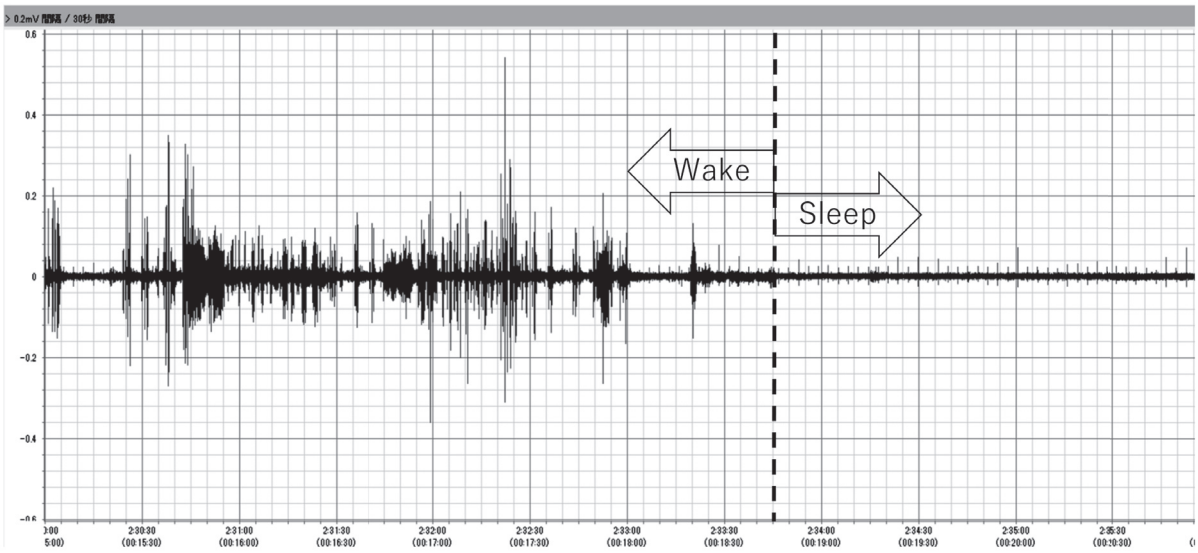

Fig. 2 EMG of dystonia patients
Continuous phasic masseter muscle activity disappears as dystonia patient enters sleep from wakefulness.

Table 4 Modified sleep hygiene instruction based on Valiente Lopez method[26]

- Perform relaxation before going to bed
- Ensure good bedroom condition (ex. Warm bedroom, Use favorite pillow)
- Provide a good bed and a quiet, well-ventilated dark room
- If you have small children, try at least 1 night per week non-interrupted sleeping
- Wake up at the same time every day, regardless of the previous night's condition
- Naps are no longer than 30 minutes
- Stop smoking 4 hours before sleeping
- Eat a regular diet, and avoid eating heavy or/and spicy meals 2 hours before sleeping
- Take a warm bath 30 minutes 60-90 minutes before bedtime.
- Stop the intake of coffee, tea and alcohol 4 hours before sleeping or represent decaf and non-alcohol drink
- Avoid strenuous exercise and watching TV, PC and smartphone before sleeping

bruxism is related to compensatory breathing[20]. The STOP-BANG test and Epworth sleepiness test can be used to screen for OSA.

REM sleep behavior disorders are "sleep disorders characterized by abnormal behaviors emerging during REM sleep that may cause injury or sleep disruption"[5]. Abe et al. reported an increase in RMMA during REM sleep[21], when antigravity muscles are most relaxed.

Other conditions such as insomnia and ADHD (attention-deficit/hyperactivity disorder) have been shown to be involved in sleep bruxism[16, 22]. On the other hand, dystonia and dyskinesia, in which involuntary continuous jaw or/and tongue movements are observed during wakefulness, disappear during sleep (Fig. 2).

Augmenting factors of sleep bruxism include caffeine, stimulant, alcohol, nicotine, stress and anxiety[23]. Drugs such as Selective Serotonin Reuptake Inhibitors (SSRI) exacerbate sleep bruxism[24, 25].

Management of Sleep Bruxism

The management of sleep bruxism should first involve treatment of the background disease in collaboration with medical professionals. Sleep hygiene instruction also should be provided to eliminate augmenting factors at the same time. Although sleep hygiene instruction (Table 4) itself has not been shown to be effective[26], it makes sense, given that RMMA occurs with arousal[27] and that a meal before bedtime increases gastric acid reflux events[28]. Miyawaki et al. reported

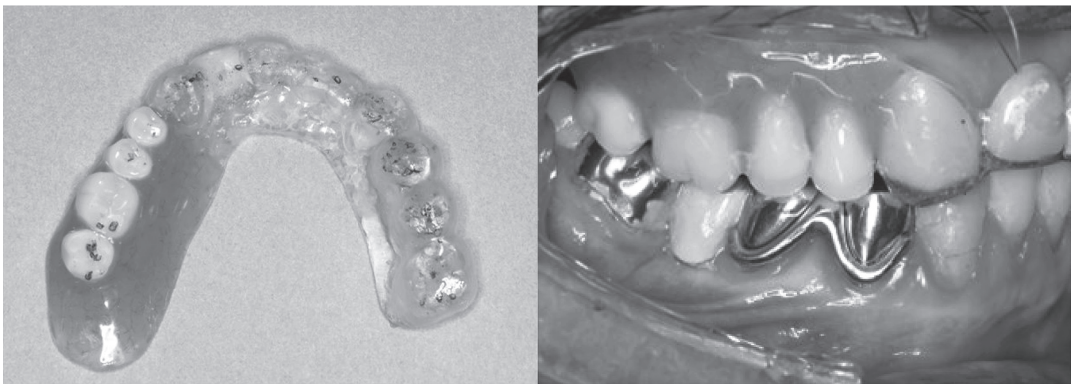

Fig. 3 Maxilla night denture
Instead of artificial tooth arrangement into the defect, occlusal rim shape maybe given. (Provided by Dr. Ikuko Kubo of Oki Ophthalmology Kubo Dental Clinic)

Table 5 Requirements in fabricating stabilization appliance

• Basically maxillary type for easy guide adjustment
• Thickness: 1.5 to 2.0 mm at anterior teeth
• Made with acrylic resin if possible
• Cover a little bit of the lip side and buccal side
• Intercuspal position on habitual open/close jaw trajectory
• Occlusal surface of the molars should be as flat as possible and in point contact with internal slope of buccal cusp of mandible
• During anterior excursion, upper anterior teeth guided lower anterior teeth, and upper and lower molars detach.
• Canine protected occlusion or group function (canine and premolar guidance) during lateral excursion
• Mesial type guidance (e.g. Guidance of the proximal surface of upper canine and the distal surface of lower canine)
• Remove balancing side guidance (Leave the guidance if appliance is not stable during lateral excursion)
• Inclination of sagittal incisal path should be the same as or slightly greater than inclination of sagittal condylar path
• Smooth excursion without occlusal interference

more RMMA in supine sleep compared to non-supine sleep (lateral decubitus and prone sleep)[29]. Thus, it may be a good idea to try sleep position therapy to suppress supine sleep.

When these treatments are unsuccessful, an occlusal appliance is used, which itself has a variety of uses; an appliance worn only during sleep for sleep bruxism may be called “Nightguard”. There are many different types, but the safest and most effective is the hard-type stabilization appliance made of acrylic resin. “Night denture” (Fig. 3) may also be used in cases with missing teeth[30]. Soft appliances made of Ethylene-Vinyl Acetate sheet are used in cases intolerant of hard type, in case the teeth bite the opposing gum (non-vertical stop occlusion), or in children who are growing or undergoing orthodontic treatment. Mandibular advancement device has been shown to be effective for sleep bruxism even in the absence of OSA[31].

It would be better to follow the requirements specified in Table 5 in fabricating stabilization appliance. Another hard-type appliance by a thin polyethylene terephthalate glycol (PETG) sheet might be fabricated. In the small amount of habitual open/closed mouth, the mandible is in an approximate rotation around the mandibular condyle (fig. 4). When using an PETG-sheet pressured appliance, occlusal adjustment must be made by grinding or autopolymerizing resin build-up.

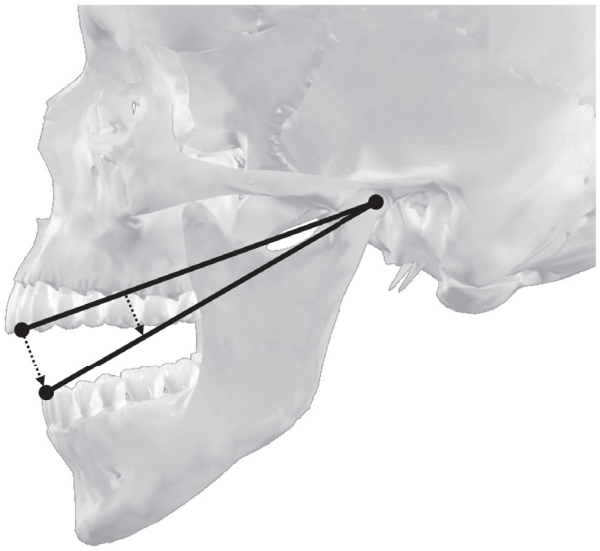

Fig. 4 The difference of the bite raising amount between incisors and molars
Habitual opening and closing is not strictly a complete rotation, but the bite raising amount differs between incisors and molars during bite raising on the habitual opening and closing trajectories.

It is important to understand that the occlusal appliance is not a fundamental treatment for sleep bruxism, but only a symptomatic treatment to buffer the excessive occlusal forces of sleep bruxism. Therefore, after symptoms have improved, the occlusal appliance should be discontinued. Until the appliance is discontinued, regular maintenance should be performed to check for occlusal interference and to adjust the occlusion.

Clonidine, an antihypertensive drug, is reported to be effective against sleep bruxism[32, 33]. On the other hand, it has also been reported to cause severe hypotension upon awakening. Recently, non-toxic Botulinum toxin type A (BonT-A) has also been used[34]. BonT-A does not decrease RMMA itself but is effective in decreasing muscle activity[35]. However, BonT-A also has some side effects, and the influence of these agents in the presence of background disease has not been investigated. Whichever treatment is used, it should be applied with the awareness that the benefits outweigh the adverse events for the patient.

Conclusion

If dentists suspect sleep bruxism, they must diagnose by objective evaluation (e.g PSG or Portable EMG recorder) as much as possible. In addition, the pathogenetic and augmenting factors of sleep bruxism should also be investigated by conducting a medical interview and questionnaire survey. Based on these examinations, the background disease should be treated in collaboration with medical professionals, and augmenting factors should be eliminated through sleep hygiene instruction. If sleep bruxism still does not improve, the application of an occlusal appliance should be considered. When prescribing an occlusal appliance, dentists should apply a stabilization appliance fabricated with occlusal contact of the entire dentition in the habitual occlusal position.

COI statement

Nothing

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