Effect of a full-arch maxillary occlusal splint on parafunctional activity during sleep in patients with nocturnal bruxism and signs and symptoms of craniomandibular disorders

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This study was designed to investigate the effects of the occlusal splint on parafunctional oral motor behavior (grinding and clenching) during sleep in patients with bruxism and craniomandibular disorders. The results revealed that the splint does not stop nocturnal bruxism. In 61% of the patients, wear facets on the splint were observed at every visit (2-week intervals) and in 39%, from time to time. The wear facets reappeared in the same location with the same pattern and were caused mainly by grinding. The extension of the facets showed that, during eccentric bruxism, the mandible moved laterally far beyond the edge-to-edge contact relationship of the canines. (J Prosthet Dent 1993;69:293-7.)

The occlusal splint is the most widely accepted form of therapy for nocturnal bruxism and ensuing signs and symptoms of craniomandibular disorders (CMD). It has been reported that in patients with nocturnal bruxism, the level of cumulative nightly electromyographic (EMG) activity of the masseter muscle is reduced after insertion of a full-arch maxillary occlusal splint1 or a bite plate.2 When patients discontinued use of the occlusal splint, the level of EMG activity increased to the pretreatment level.3 However, because of methodological limitations and technical difficulties in recording parafunctional activity of nocturnal bruxism over long periods, the long-term effects of the occlusal splint in patients with nocturnal bruxism have not been studied.

There have also been attempts to evaluate parafunctional activity during sleep by means of sound transduction and electromyography. Unfortunately, because of methodological limitations of recorded data, such as single-muscle EMG recording, these studies have not provided adequate information concerning the kinesiology of bruxism.

The purpose of this investigation was to study the long-term effects of a full-arch maxillary plane occlusal splint on the mechanical activity, or kinesiology, of parafunctional oral motor behavior (grinding and clenching) during sleep in patients with nocturnal bruxism and signs and symptoms of CMD.

Fig. 1. Pattern of wear facets on occlusal splint of a patient with bilateral mandibular movements.

MATERIAL AND METHODS

Thirty-one patients (26 women and five men, 18 to 38 years of age, median age of 27 years) with nocturnal bruxism and signs and symptoms of CMD were included in this study. The patients were selected according to the following criteria: (1) awareness of grinding and clenching during sleep, (2) pain and a tired feeling in the masticatory muscles and/or headache on waking in the morning, (3) tenderness of the masticatory muscles on palpation, and (4) complete natural dentitions except for third molars.

A full-arch maxillary occlusal splint in heat-cured acrylic resin was made for each patient4 to wear during sleep. The splint was adjusted with the patient in supine position to provide a stable occlusion in the retruded contact position and in habitual closure. To avoid restricting the mandible during parafunction, the canine ramps were removed, so
that it was possible for the patient to make smooth lateral and protrusive movements. The stability of the splint was also controlled and adjusted if necessary with the patient seated upright. The patients were instructed strongly and repeatedly not to clench or grind on the splint before falling asleep.

The patients were reexamined at 2-week intervals during the course of this study. In each visit, the location of wear facets caused by bruxing and the retruded contact position on the occlusal splint were recorded and photographed. The splint was then very gently polished with fine sandpaper only to remove the shiny area of the active facets. The stability of the splint was also reexamined, and in case of alteration, it was readjusted. There were no alterations to the occlusion, such as fillings and crowns, made during the course of this study.

The patients were instructed to take no medication such as tranquilizers, muscle relaxants, or sleeping tablets during the course of treatment. Treatment with the occlusal splint continued until total elimination of signs and symptoms or up to 6 months.

The signs and symptoms of CMD were recorded from 2 to 4 weeks before until 3 to 6 months after insertion of the splint, and when the patients stopped using it. Nonparametrical statistical analysis (chi-square test) was used to compare before- and after-treatment observations of signs and symptoms of CMD.

RESULTS

Insertion of the occlusal splint

Insertion of the splint resulted into a mean increase of the vertical dimension by an average of 3.7 mm (range 3 to 4.5 mm) in the incisal area.

Active shiny facets caused by nocturnal bruxism appeared on the occlusal surface of the splints of all patients. However, the reappearance frequency of these facets varied from patient to patient. In 61% of the patients, active shiny wear facets were found at every visit (2-week intervals), whereas in the remaining 39%, they were observed from time to time.

The active wear facets on the splint reappeared in the same location with a similar pattern and direction. In 71% of the patients, these facets were created by bilateral mandibular clenching excursions (Fig. 1) and in 13%, by unilateral excursions (Fig. 2). In one patient (3%) the facets were created by protrusive movements. In the remaining 13% the facets were created by isometric clenching of the jaw elevators with very small lateral movements (Fig. 3).

The extension of the facets on the occlusal splint showed that during eccentric bruxism the mandible moved laterally far beyond the position of the canines' edge-to-edge contact relationship.

Signs and symptoms

In general, the intensity and score of signs and symptoms of CMD in these patients fluctuated day to day and from period to period, and successively improved or were eliminated with use of the occlusal splint (Figs. 4 and 5).

When the patients whose signs and symptoms were improved by the treatment (78%) were asked to stop using the splints, fluctuating signs and symptoms of CMD recurred in 80% of them within 4 weeks. Eighty-four percent of the patients also reported continuation of nightly bruxism.

DISCUSSION

The results of this study revealed that, in general, the occlusal splint does not stop the habit of nocturnal bruxism. This is in line with the findings of Gentz,6 and Kydd and Daly7 who reported that a plane occlusal splint did not stop nocturnal bruxism. The results also revealed that, in spite of continuation of bruxism, the signs and symptoms
of CMD were reduced successively with use of the occlusal splint. Therefore, it seems most likely that the therapeutic mechanism of the splint must be related to factors that modify and reduce parafunctional activity and/or redistribute its overloading in the masticatory system instead of eliminating bruxism. 

The etiology and neurologic mechanism that generates the episode of nocturnal bruxism are not well understood. However, a growing body of evidence suggests that nocturnal bruxism appears to be induced within the central nervous system and, in part, is associated with the phenomenon of arousal reactions during sleep. The findings of this study showed that changes in input feedbacks of peripheral oral receptors (alteration in the occlusal contact relationship and increased vertical dimension), do not stop the bruxism. Further studies however are needed to determine the effects of the occlusal splint on intensity and duration of the episode of parafunctional activity.

It should be noted that because of the criteria used for the selection of patients, the findings of this study are limited to bruxers with CMD. Therefore, the effects of the occlusal splint on parafunctional activity of bruxers without CMD remain to be studied for further comparison.

In 30% of the patients, the wear facets on the occlusal splint reappeared from time to time. The results indirectly are in line with the findings of Kardashi et al. and Rugh and Ohrbach, who reported that the level of cumulative EMG activity of nocturnal bruxism fluctuates from night to night and from month to month. The cause of this fluctuation is not understood. It has been reported that the number of episodes of nocturnal bruxing increases in individuals anticipating stressful situations and is closely related to the stress level of the previous day. It seems likely that changes in daily emotional stress can not be solely responsible for eliciting nocturnal bruxism, because 10% of the patients in this study have been grinding their teeth since childhood, and they continued to do so during the study and after discontinuing use of the splint.

The results showed that the location and pattern of wear facets on the occlusal splint did not change during the course of the study. This finding indirectly can explain the cause of the selective tooth attrition in patients with noc-

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**Figure 4.** Symptoms of craniomandibular disorders in 31 patients with nocturnal bruxism before and after occlusal splint therapy. Levels of significance as follows: ns, not significant, $p > 0.05$; *$0.01 < p < 0.05$; **$0.001 < p < 0.01$; ***$p < 0.001$. 

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**TABLE 4.** Proportion of patients with symptoms and signs of nocturnal bruxism before and after occlusal splint therapy.

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<td>80%</td>
<td>0%</td>
</tr>
<tr>
<td>Pain in joint region</td>
<td>70%</td>
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</tr>
<tr>
<td>Pain in neck region</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>Headache</td>
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<td>Reduced mobility</td>
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<td>10%</td>
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tural bruxism. In an electron microscopic study of the structural morphology of wear facets, Xhonga\textsuperscript{15} reported that the scratches on enamel had the same direction as those in the dentine into which the wear had progressed.

In more than 80\% of the patients, the wear facets on the occlusal splints were created by lateral mandibular movements (grinding). The result is in line with findings of Rugh and Ohrbach,\textsuperscript{12} who reported that the action in nocturnal bruxism is primarily grinding instead of clenching. The high frequency of grinding behavior in the patients in our study can also be the result of the selection criteria that were used.

The results revealed that during eccentric bruxism, the mandible moves laterally far beyond the edge-to-edge contact relationship of the canines. Therefore, occlusal adjustment seems to be an inadequate measure to harmonize the distribution of overloading during eccentric bruxism.

The recurrence of signs and symptoms of CMD in the majority of the patients after discontinuation of splint therapy suggests that long-term occlusal splint therapy does not treat the habit of nocturnal bruxism.

**SUMMARY AND CONCLUSIONS**

The effects of a full-arch maxillary plane occlusal splint on the activity of parafunctional oral motor behavior (grinding and clenching) during sleep were studied in bruxers with craniomandibular disorders. The results revealed that the occlusal splint does not stop the habit of nocturnal bruxism. In 61\% of the patients, active wear facets on the splint were observed at every visit (2 week intervals) and in 39\%, from time to time. The wear facets reappeared in the same location with the same pattern and were caused mainly by grinding. The extension of the facets also showed that during eccentric bruxism the mandible moves laterally far beyond the edge-to-edge contact relationship of the canines.

**REFERENCES**


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