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Author(s): Nomoto, S; Nakamura, M; Sato, T; Hisanaga, R

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Case Report

Occlusal Treatment with Bite Splint Improves Dyskinesia in Parkinson’s Disease Patient: A Case Report

Syuntaro Nomoto, Minoru Nakamura*, Toru Sato and Ryuichi Hisanaga

Department of Crown and Bridge Prosthodontics, Tokyo Dental College, 1-2-2 Masago, Mihama-ku, Chiba 261-8502, Japan
*Nakamura Dental Clinic, 3-30-7 Umeda, Adachi-ku, Tokyo 123-0851, Japan

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Abstract

The patient was a 46-year-old woman requesting oral hygiene control. She had been treated for Parkinson's disease at the neurology department of another university hospital for 9 years. When the drugs were effective (drug efficacy), she could get out of bed and change clothes without assistance, albeit slowly. When the drugs were ineffective (no drug efficacy), however, she found it difficult to get out of bed, change clothes, or maintain posture during defecation without assistance. Occlusion was B-1 on the Eichner index, and neither dislocation of the temporomandibular joint nor mandibular tremor was observed. At her first visit, a medical history was taken and periodontal therapy commenced. Informed consent for bite splint therapy was obtained after examination of movement disorder. A bite splint was made for her, and any change in the grade of motor disorder using the bite splint evaluated. In addition, her grip strength was measured when wearing and not wearing the bite splint during periods of drug efficacy and no drug efficacy. The patient could get out of bed, change clothes, and maintain posture during defecation without assistance when wearing the bite splint, even during no drug efficacy. Grip strength in her left hand during drug efficacy and in both hands during no drug efficacy was greater when wearing the bite splint than without the bite splint. When this patient with Parkinson's disease wore a bite splint, her athletic ability and grip strength increased.

Key words: Parkinson’s disease — Occlusal treatment — Grip-attitude — Athletic ability

Introduction

The number of patients attending dental clinics with various underlying diseases is increasing as Japan’s population continues to age. Parkinson’s disease is characterized by impairment of neurotransmission resulting in muscle rigidity, postural instability, tremor, and akinesia. The incidence of this disease is 80 to 100 persons per 100,000 in Japan, indicating that it is not rare. Moreover, some patients with this disease require long-term care, depending on the degree to which it has progressed.
Studies in healthy volunteers on the relationship between chewing and physical exertion have shown that improvements in chewing and occlusion lead to an improvement in motor function\textsuperscript{19,12,15–18}. In addition, chewing has also been shown to exert a neurophysiological effect, especially when secure occlusal support is present\textsuperscript{8,17–19}. This effect has also been predicted in patients with Parkinson’s disease\textsuperscript{3}. Here, we report a patient with Yahr stage 4\textsuperscript{7} Parkinson’s disease in whom an improvement in motor function was observed with use of a bite splint.

**Case Report**

1. **Patient and diagnosis**

The patient was a 46-year-old woman who first attended our hospital on November 16, 2004 because she could no longer maintain adequate oral hygiene by herself. She had been treated for Parkinson’s disease since May 1998 at the neurology department of another university hospital. There she had been prescribed daily 7.5 mg bromocriptine mesylate, 3 mg cabergoline, 3 mg tizanidine hydrochloride, and 900 mg levodopa (Table 1). However, she could not get into bed without help, and had difficulty in maintaining posture during defecation when 8 hrs or more had passed after taking these drugs. For 2 hrs after taking the drugs, she could maintain posture during defecation, sit up slowly, and change clothes without assistance as serum drug levels were maintained. The Yahr stage was 4, and the degree of social dysfunction (Ministry of Health, Labour and Welfare) was 3. Her maternal aunt also had Parkinson’s disease.

Systemic findings: She was of small build and medium weight, and was right-handed. She used a wheelchair and required the services of a caregiver, but could walk slowly when the drugs were effective. Otherwise, her condition was excellent. Her face was symmetrical and her complexion good. Neither dislocation of the temporomandibular joint nor mandibular tremor was observed.

Oral findings: Her oral hygiene was excellent, but the mandibular right first molar and second molar, and the mandibular left first molar were missing; a stump was all that remained of the maxillary right second premolar. Occlusion was B-1 on the Eichner index (Fig. 1). She had no cold or warm water pain or pain on biting. A medical

<table>
<thead>
<tr>
<th>Table 1 Prescribed drugs for Parkinson’s disease</th>
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<tr>
<td><strong>Recipie</strong></td>
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<tr>
<td>Tizanidine hydrochloride 3 mg 3 times daily</td>
</tr>
<tr>
<td>Bromocriptine mesylate 7.5 mg 3 times daily</td>
</tr>
<tr>
<td>Cabergoline 3 mg 3 times daily</td>
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<tr>
<td>Levodopa 800 mg 8 times daily</td>
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<td>Levodopa 100 mg at bedtime</td>
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![Fig. 1 Panoramic radiograph at initial examination](image)
history was taken and an initial examination and panoramic X-ray examination performed on the first visit. She did not complain of masticatory disorder due to malocclusion. Invasive treatment such as tooth extraction for denture placement was not included in the treatment plan in consideration of her wishes. Therefore, we proposed oral hygiene control, scaling, regular occlusal control, and oral cleaning instead. We explained the bite splint therapy and obtained consent from the patient. This therapy was selected based on a review of the literature⁴, which revealed that the wearing of a bite splint in patients with Parkinson's disease might improve movement, including getting out of bed and maintaining posture during defecation.

2. Treatment and evaluation

A full mouth impression was taken using alginate impression material to make a working model for the bite splint. The results of examination of the oral cavity and model showed that the distance between the labial cervical lines of the maxillary and mandibular central incisors at the intercuspal position was 10 mm.

A bite splint was made on the model using a dental press mold (Erkopress ES2002®, Erkodent, Germany), and the distance between the labial cervical lines of the maxillary and mandibular central incisors set at 20 mm.

The patient was instructed to place the splint in her upper jaw (Fig. 2). No limit was placed on the length of time she could wear the splint, except at bedtime, at which time she was required to remove it. Change in the grade of motor disorder with use of the bite splint was evaluated. Grip strength in both hands was also measured 3 times while wearing the bite splint (with BS) and not wearing the bite splint (without BS) during periods of drug efficacy and no drug efficacy.

The patient could get into bed and change clothes by herself with BS, even during no drug efficacy. In addition, even though she had previously experienced difficulty in maintaining posture during defecation without BS during drug efficacy, she was now able to maintain posture with BS during no drug efficacy.

Table 2-a shows the results of the grip strength measurements taken during drug efficacy. Grip strength in the left and right hand without BS was 19.83 kg and 21.87 kg,
respectively, while with BS it was 22.17 kg and 24.00 kg, respectively. Table 2-b shows the results of the grip strength measurements taken during no drug efficacy. Grip strength in the left and right hand without BS was 16.67 kg and 19.00 kg, respectively, while with BS it was 19.50 kg and 25.00 kg, respectively. Grip strength in the left hand during drug efficacy and in both hands during no drug efficacy was greater with BS than without BS.

## Discussion

Studies in healthy volunteers on the relationship between chewing and physical exertion have shown that improvement in chewing function and occlusion led to an improvement in motor function\(^{7,9,12,15-18}\). However, none of these studies took psychological effects into consideration, and there has been some criticism to the effect that such improvement in athletic ability along with change in occlusion might be attributable to psychological factors\(^{2,14}\) and doubts about the effect\(^{4,5,13,19}\). The bite splint used in the present case increased the occlusal vertical dimension between the maxillary and mandibular incisors by 10 mm. This was done in reference to the theory that movement of the maxilla and mandible centers on the atlantoaxial joint, and that an increased occlusal vertical dimension frees jaw movement\(^{11}\).

Grip strength measurement was used to evaluate the maximum voluntary isometric muscle strength as the degree of physical exertion in this case. Grip strength measurement requires no training to maintain posture. In addition, grip strength in both hands can be measured under the same conditions, which enables a comparison of strength between the dominant and non-dominant hands. In the present patient, no significant difference was observed in the dominant hand when the drugs were effective, but grip strength in the dominant hand was significantly greater when the drugs were ineffective.

The Hoffmann reflex (H reflex), which is an index of spinal cord motor neuron excitability, demonstrates the validity of the neurophysiological argument that wearing a bite splint improves athletic ability, which has been closely analyzed\(^{6,8,10,12,16}\). Furthermore, the H reflex is facilitated in association with voluntary contraction of muscles located far away from the muscle evoking the H reflex (Jendrassik maneuver)\(^{6,8,10,12}\). Miyahara reported the presence of a similar effect on the periodontal mechanoreceptors when chewing\(^{12}\).

Hayashi and Tanaka\(^{6}\) reported a relationship between the H reflex and reciprocal innervations in Parkinson’s disease patients, and speculated that reciprocal inhibition was decreased during antagonistic muscle contraction, which corresponds to the Jendrassik maneuver, in such patients.

The present Parkinson’s disease patient showed an improvement in athletic ability when she was able to chew after the vertical dimension of her occlusion was increased. She could extend her temporomandibular joint and chew because the H reflex was facilitated by stimulating the periodontal mechanoreceptors, which increased spinal cord motor neuron excitability, improving muscle activity. In addition, wearing the bite splint increased abdominal pressure, which also contributed to improving her athletic ability and performance. In particular, improvement in her ability to perform activities of daily living seemed to have favorably influenced the stretch and flexion reflexes between the neck and trunk.

However, oral appliances such as a bite splint for Parkinson’s disease patients are not covered by national health insurance in Japan, and the financial cost involved in such treatment should be considered. In addition, it should be noted that wearing a bite splint may also improve mental function in addition to physical function and ability in such patients.

## Conclusion

A combination of wearing a bite splint and oral medication for major symptoms of Parkinson’s disease improved motor dysfunction in this patient with Yahr stage 4 disease.
The effect was evaluated by examination of the degree of motor dysfunction and measurement of grip strength. In addition, this effect was observed when wearing the bite splint, regardless of the presence or absence of drug efficacy. These results suggest that a combination of drug treatment and wearing a bite splint could improve the quality of life in Parkinson’s disease patients.

Conflict of Interest Statement

The authors declare no conflict of interest.

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References


Reprint requests to:
Dr. Syuntaro Nomoto
Department of Crown and Bridge Prosthodontics,
Tokyo Dental College,
1-2-2 Masago, Mihama-ku,
Chiba 261-8502, Japan
Tel: +81-43-270-3938
Fax: +81-43-270-3937
E-mail: nomotos@tdc.ac.jp