This article describes the prosthodontic treatment for a patient with cerebral palsy, in which complete dentures were successfully stabilized using treatment dentures.

A 69-year-old edentulous male with no medical complications or mental retardation presented to our clinic. Opening movement of the jaw was possible, but a conspicuous mandibular shift towards the right was observed. He had never received any prosthodontic treatment.

Initially, treatment dentures with flat tables were fabricated to rectify his erratic mandibular movements. During the first 3 weeks, the treatment dentures functioned poorly. Eventually, the patient could make tapping movement to some degree and have a meal with less effort. Indentation marks from the cusps of the opposing maxillary denture could be clearly seen on the flat tables. After six weeks, as he did not complain of any pain, definitive dentures were fabricated.

When flat table treatment dentures are used, it is considered that the mucosa provides information regarding the vertical stop and bite force. In addition, it is speculated that there is an increase in the response from masseter muscle. In the present case, flat tables were effective for rehabilitation of the mandibular movement.

Key words: disabled patient, cerebral palsy, treatment dentures, flat tables, habituation

Introduction

Cerebral palsy is a physical disorder leading to failure of balance and unpredictable motion. The frequent erratic movement of the limbs and trunk often interfere with daily life. Individuals with cerebral palsy often have difficulties in mastication, speech, and deglutition because of the involuntary muscle spasms caused by their condition.

Few reports have discussed the difficulty of dental treatment in patients with cerebral palsy. Ogata reported that severe functional disability was the primary reason for failure of prosthodontic treatment in these patients.

It is often observed that mandibular movements of edentulous patients are unstable. Most edentulous patients often have irregular mandibular movements due to long-term use of ill-fitting dentures. Hence, it is difficult to make complete dentures for edentulous patients with cerebral palsy.

It has been suggested that the mandibular movements of these patients should be analyzed and adjusted when necessary. Use of intermediate treatment dentures with flat occlusal tables is one of the techniques applied in severe cases. This method
enables the patient's condition to be analyzed prior to delivery of the definitive dentures\(^8\). Here, we report a case in which we were able to make complete dentures for a patient with cerebral palsy by initially fitting treatment dentures. The patient's condition was very severe, with very irregular or erratic mandibular movements.

**Case Report**

A 69-year-old edentulous male with athetoid type cerebral palsy, diagnosed at the age of three years, presented to our clinic (Figure 1). He had no medical complications or mental retardation. His lower limbs were paralyzed. He was able to move his arms voluntarily to a certain extent. However, the movement disorder was evident when performing actions such as crushing a paper cup in his hand.

Opening and closing movements of the jaw were possible, but a conspicuous mandibular shift towards the right was observed (Figure 2). He could not perform limiting or tapping movement of his mandible when instructed. Previously, he had received simple dental treatment such as extraction and restoration of teeth. However, he had never undergone prosthodontic treatment. Residual root stumps in maxilla and mandible were extracted three years earlier and he had remained edentulous thereafter. The patient provided informed consent to participate in this study.

**Treatment**

Impressions were taken for study models. Custom trays were then prepared on these for taking precise impressions with silicone rubber impression material (Hydrophilic Exaflex\(^9\), GC Ltd., Japan). Bite plates were made on the working models. We determined his bite plane using the conventional method based on Camper's plane\(^9\). However, it was difficult to determine his occlusal vertical dimension because he could not

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Fig. 1. Oral cavity of the patient

Fig. 2. Mandibular shift towards the right side on opening
maintain the position while biting on the bite plates. Therefore, we held his mandible in position to obtain the occlusal vertical dimension.

With the occlusal bite registered, we proceeded to make the treatment dentures. Artificial teeth (Duradent®, GC Ltd., Japan) were arranged in lingualized occlusion on an average value articulator (Gisi simple articulator, ONUKI Dent. Ltd., Japan). Dentures were fabricated by the conventional method. After occlusal adjustment on the articulator, posterior artificial teeth were removed from the mandibular denture to make the occlusal tables. Self-curing resin (Unifast Trad®, GC Ltd., Japan) was applied to these surfaces. Maxillary and mandibular dentures were occluded on the articulator to mark the position of the palatal cusps of the maxillary teeth, before the resin was completely cured. Self-curing resin was reduced until all palatal cusps were in even contact. The occlusal tables were flattened as much as possible (Figures 3, 4).

To ensure the form and retention of the dentures, functional impressions were taken with the treatment dentures and tissue conditioner (Coe-Comfort®, GC Ltd., Japan). After the treatment dentures were delivered, we followed the patient on a weekly basis. We performed occlusal adjustment and tissue conditioning at all recall appointments. In this method, because the cusps of maxillary denture should indent the mandibular flat tables during occlusion, we did not grind the maxillary artificial teeth. Adjustment of the mandibular flat tables by grinding was also limited to removal of the premature contacts that seemed to tip the dentures. As the patient was unable to perform tapping movement, we positioned the mandible so that the flat tables contacted the artificial teeth of maxillary denture.

After this preliminary treatment, we observed his tapping movement and determined the frequency 4-6...
times at every visit (Table 1). While observing the tapping, we did not regulate the frequency, intensity, or jaw opening distance, thus permitting voluntary movement by the patient.

During the first 3 weeks, the dentures were not stable and he could only perform tapping continuously for 1 to 13 times. The patient suffered from frequent ulcers in the oral cavity and had difficulty in eating. However, after 4 weeks, the dentures became more stable and his tapping frequency improved to a maximum of 26 times.

On the flat tables, we detected the indentation marks from cusps of the opposing maxillary denture (Figure 5). No more ulcers were observed in the oral cavity and the patient found it much easier to eat.

After 6 weeks, the patient did not complain of any

<table>
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<th>Table 1. The number of Tapping movement</th>
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<tr>
<td>1week (n=5)</td>
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<tr>
<td>Max</td>
</tr>
<tr>
<td>Min</td>
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<td>Average ± SD</td>
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Trial number is noted in parenthesis
pain. He was able to tap a maximum of 31 times as instructed. In addition, the indentation marks could be seen more clearly and he could maintain his mandible in a position where each cusp of the maxillary denture contacted the indentation marks on the flat tables.

The bite was registered again with silicone material (EXABITE, GC Ltd., Japan). These treatment dentures were remounted on an average value articulator to arrange posterior artificial teeth in the mandibular denture with lingualized occlusion and to rebase the maxillary and mandibular dentures. The definitive dentures were thus fabricated (Figure 6). Using silicone material (Fit checker, GC Ltd., Japan) and occlusal papers, we checked and adjusted the fitting and occlusal relationship of the definitive dentures. After the definitive dentures were delivered, the patient was recalled regularly, and he remains satisfied with his dentures.

**Discussion**

The detailed mechanisms of involuntary movements associated with cerebral palsy have not been clarified. However, failure of muscular control is regarded as the main reason. Ogata recorded mandibular movements of four patients with athetoid type cerebral palsy using Mandibular Kinesiography (MKG) and reported extreme deviations to the right or left during opening movement. In addition, he reported that complex movements such as limiting the movement of mandible could not be made in severe cases. In the present case, a similar condition was observed. In addition, our patient had been edentulous for about 3 years.

For mandibular movement, the most important information originates from the receptors of periodontal ligament, temporomandibular joint and muscle spindles of masseter. Edentulous patients are not able to receive information from the periodontal ligament. Furthermore, input signals from the muscle spindles of edentulous patient are decreased. Thus, most edentulous patients cannot perform smooth and precise mandibular movements. For the above-mentioned reasons, our patient appeared to be in an unfavorable condition as he was unable to per-
form functional mandibular movements.

During the fabrication of complete dentures, occlusal vertical dimension is usually determined with bite plates based on the patient’s facial appearance, rest position of the mandible and other factors. The horizontal relation is determined by the Gothic arch method. To employ the Gothic arch method, patients have to keep the Gothic arch tracer in the oral cavity and move the mandible as instructed. However, for our patient it was impossible to follow these instructions. Thus, we did not apply this method but used the flat tables instead and analyzed the occlusion.

We followed a modified version of Sakurai’s method for the treatment of this patient. While making definitive dentures from treatment dentures, Sakurai used silicon and plaster cores to register details of the occlusal relation and the polished surface of dentures. This method requires insertion of the materials into the buccal vestibule and molding by the buccal musculature. As our patient could not perform this procedure, we adopted a simple method in which the patient had to bite the material.

Ideal flat tables must have moderate elasticity and softness so that the cusps of the maxillary denture form indentations on them. In the present case, we used only self-curing resin, as it is simple and easy. However, it took a long time to register the indentations. Previous studies have mentioned the addition of baby powder or sealing resin to self-curing resin is helpful when making flat tables. However, application of these materials must be studied further.

By using treatment dentures with flat tables, the occlusal condition can be analyzed by observing the indentations on them. If the indentations are spread out or Gothic arch-shaped, the centric occlusion of the patient is not stable. In such cases, cuslessless teeth are recommended in the dentures. If the indentations are narrow and spot-shaped, rather than wide and imprecise or Gothic arch-shaped. In the present case, the indentations were spot-shaped. Moreover, after 6 weeks the patient could perform tapping in the exact point where the cusps of the maxillary denture contacted the indentations on the flat tables. Thus, we concluded that our patient’s mandibular movement was stable.

Irregular mandibular movements might recur in cerebral palsy. Hence, it might have been appropriate to manage his irregular mandibular movements by applying cusless teeth. However, we thought that the possibility of recurrence would be higher if we applied cusless teeth. Therefore, we set normal artificial teeth in a linguallized occlusion in order to regulate his mandibular movement to some degree. It is considered that the linguallized occlusion rarely causes distortion or lateral movement of dentures and is superior in terms of mastication rhythm and efficiency.

Iwata et al. reported that linguallized occlusion was suitable for patients with cerebral palsy who grind teeth involuntarily.

When flat table treatment dentures are used, it is considered that the mucosa provides information regarding vertical stop and bite force. In addition, it is speculated that there is an increase in the response from the masseter muscle. Due to these reasons, we believe that our patient was able to perform mandibular movements smoothly.

The following requirements should be satisfied before insertion of the definitive dentures: 1) The patient does not complain of pain. 2) Indentation marks can be clearly seen on the flat tables. 3) Treatment dentures are stable in the oral cavity. 4) The mandibular movement is smooth.

After 4 weeks, the patient found it much easier to eat. The indentations on the flat tables could be clearly seen. Abe reported that formation of indentation marks resulted from the stability of dentures and patients became capable of performing smooth and precise mandibular movements with the help of indentations. Therefore, it was considered that irregularities in the mandibular movement were rectified in our case. No more ulcers were observed in the oral cavity and the frequency of tapping improved to a maximum of 26 times after 4 weeks. After 6 weeks, the patient did not complain of pain and the indentation marks were more conspicuous. Moreover, he could maintain his mandible in an exact position, where cusps of the maxillary denture contacted the indentations on the flat tables. His tapping movement had significantly improved and reached a maximum of 31 times. Hence, we decided to make the definitive dentures after 6 weeks.

It is known that the tapping movement is influenced by the jaw opening distance, frequency, attitude, and vertex presentation. In cases of cerebral palsy, controlling tapping movements is difficult. It is considered that restraint by head dipping may disturb replication of a tapping exercise. Feeling tense might also negative-
ly affect tapping\textsuperscript{21}. We, therefore, did not advocate any restraints and permitted voluntary exercise by the patient.

As the patient could perform tapping movement to some degree, it was possible for him to bite on the treatment dentures and to have a meal more easily than before. This implies that flat tables were effective for rehabilitation of mandibular movement. However, to the best of our knowledge, this is the first case to successfully apply this technique for a patient with cerebral palsy, and the details of the mechanisms are unclear. Further studies are necessary to elucidate the underlying mechanisms.

References