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Clinical Report

CHANGES AND EQUALIZATION IN HEARING LEVEL INDUCED BY DENTAL TREATMENT AND INSTRUCTION IN BILATERALLY EQUALIZED CHEWING: A CLINICAL REPORT

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Abstract

Hearing problems such as hearing loss and susurrus aurium are said to improve with occlusal treatment, but few objective clinical reports have been published in the dental field.

We looked at the effect of occlusal treatment and chewing instruction on hearing ability in five patients who had an occlusal disorder and the unilateral chewing habit. The following results were obtained:

1. Unilateral chewing due to occlusal disorder may cause differences in hearing ability between the right and left sides (Cases 1, 2 and 3).

2. A reduction in the vertical dimension of occlusion is considered to be one of the factors that cause a decrease in hearing ability (Cases 4 and 5).

3. In all cases, occlusal treatment and chewing instruction lead to an improvement in hearing and to equalizing of hearing ability between low and high frequencies.

These clinical findings indicate that there is a relationship between changes in hearing ability and oral function.

Key words: Occlusal treatment—Dental treatment—Equalization of hearing—Unilateral chewing—Bilateral chewing instruction

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INTRODUCTION

Over the past few decades, a considerable number of studies have discussed the relationship between occlusal conditions and hearing\(^1\)-\(^5\),\(^10\),\(^11\). To date, however, there have been no studies that have looked at how hearing problems can be improved by dental treatment or chewing instruction\(^6\),\(^9\). We have shown that hearing loss can be caused by unilateral chewing\(^7\) and that dental treatment or chewing instruction relieves this hearing loss in many clinical cases\(^6\),\(^9\).

This paper discusses clinical cases in whom improvement of hearing loss and equalizing of hearing ability were induced by occlusal treatment and bilateral chewing instruction.

PATIENTS AND METHODS

We selected five patients aged between 30 and 81 from a large number of cases in whom an improvement in occlusal conditions in relation to unilateral chewing were noted. At the first dental visit, the patients underwent a conventional dental examination in which their unilateral chewing habit was confirmed and evaluated and their hearing measured. Occlusal treatment and chewing instruction were given to address the unilateral chewing habit. At the second dental visit, the patients’ hearing was again measured after further chewing instruction and training. We then compared the two sets of hearing measurements.

Table 1 is a list of methods used to investigate the unilateral chewing habit. Hearing ability was evaluated by audiogram (Rion Co., model AA-56). The methods used to improve the unilateral chewing habit and the chewing instruction given, which focused mainly on bilateral chewing, were as follows.

1. **Elimination of unilateral chewing habit as a result of dental treatment**

   Initial treatment is given for pain relief when a patient reports a sharp pain in an oral cavity. Prosthodontic treatment is then given to prevent tooth loss. Finally, occlusal treatment is applied to ensure right- and left-harmonized occlusal conditions so that the patient can chew anywhere between the anterior teeth and the molars.

   The following treatments were given to harmonize the occlusal conditions.
   1. Occlusal treatment against premature contact as indicated by an Occluzer\(^3\) (GC Co.) and/or occlusal registration paper.
   2. Improvement in the vertical dimension of occlusion with denture prosthetics.

2. **Chewing instruction (including training in bilateral chewing)**

   The purpose of chewing instruction is to get the patient into the habit of bilateral chewing. This is done two or more times a day to ensure the patient forms the habit. Depending on each patient’s particular condition, he or she is instructed to chew gum or food between 5 and 30 times in four places: on the right and left premolars and molars. Patients were asked to do the following when they chewed. They had to:
   1. confirm the teeth they most often used to chew
   2. try to chew food, gum, and any meals on the side opposite to their usual chewing side by using the tongue to move the bolus to the opposite side.

3. **Treatment with a stress-breaking splint**

   The splint used for patient \#4 was a 0.7-mm-wide soft splint (Elco Press Co.). It was used to break the stress on the upper canines and
second molars.

**TABLE 2 Oral conditions**

<table>
<thead>
<tr>
<th>Case 1: 61-year-old male with a right-side chewing habit</th>
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<tr>
<td>Upper jaw</td>
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<tr>
<td>Kinds of teeth</td>
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<tr>
<td>Lower jaw</td>
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**Case 2: 81-year-old male with a right-side chewing habit**

| Upper jaw | PD | B | P | P | P | B | S | J | S | S | PD | PD | B | P | B | PD |
| Kinds of teeth | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Lower jaw | PD | B | P | B | PD | S | S | S | S | S | S | S | D | D | A |

**Case 3: 30-year-old female with left-side chewing habit**

| Upper jaw | M | S | S | I | K | B | P | B | J | J | S | S | K | I | I | M |
| Kinds of teeth | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Lower jaw | A | K | K | D | D | S | S | S | S | S | S | S | B | P | B | M |

**Case 4: 62-year-old male with an infraversional occlusion at molars**

| Upper jaw | M | K | PD | K | PD | PD | PD | PD | PD | PD | PD | PD | PD | PD | PD | PD |
| Kinds of teeth | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Lower jaw | M | PD | K | PD | PD | K | K | S | S | S | S | S | K | K | K | PD | M |

**Case 5: 64-year-old female with an infraversional occlusion at molars**

| Kinds of teeth | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Lower jaw | M | PD | PD | PD | B | B | P | B | B | B | B | B | PD | PD | PD | PD | M |


**CASE REPORTS**

1. **Case #1: Sixty-one-year-old male**

1) Oral conditions (see Table 2)

The chief complaint of this patient was a sharp pain caused by an ulcer of the mucosa at the edge of the left molar side of the upper complete denture. The patient reported that this sharp pain had induced the habit of unilateral chewing on the right side.

2) Figure 1a shows the profile of the audiogram measured with an audiometer at the first visit. There was a fall in the intensity in all frequency bands between 250 and 8,000 Hz on the right side.

3) Dental treatment: To mitigate the sharp pain, grinding of the denture location corresponding to the ulcer was performed.

4) Chewing instruction: A cotton roll was put on the occlusal surface on either side between the first premolar and second molar. The patient chewed on each side 30 times, and the patient’s hearing was measured for the second
time immediately afterwards.

5) Hearing ability after dental treatment and chewing instruction: Figure 1b shows the reduction in the difference in intensity between the right and left sides. Equalizing of hearing ability and improvement in hearing in all frequency bands were observed.
2. Case #2: Eighty-one-year-old male

1) Oral conditions (see Table 2)
   This patient presented with a unilateral chewing habit on the right side. He had fallen into the habit of unilateral chewing on the right side because of decayed teeth on the left side after the setting of a crown prosthesis on the right molars.

2) Profile of audiogram at the first visit
   The profile of the audiogram one week after the prosthesis was set on the right molars is shown in Fig. 2a. An improvement in hearing intensity on the right side was observed.

3) Dental treatment:
   Caries treatment was performed on the lower left first and second molars and a crown prosthesis was set.

4) Chewing instruction:
   This was given after the crown prostheses were set.

5) Audiogram after the treatment and instruction:
   Except at 8,000 Hz on the right side, a significant improvement in hearing and a reduction in the right-left difference were observed.

3. Case #3: Thirty-year-old female

1) Oral conditions (see Table 2)
   This patient presented with unilateral chewing on the left side; she could not bite on the right because of the setting of a temporary prosthesis from the right first premolar to the second molars in the mandible.

2) Profile of audiogram at the first visit
   A fall in the hearing intensity between 250 and 1,000 Hz on the left side was observed as shown in Fig. 3a.

3) Dental treatment:
   Crown and bridge prostheses were set from the right premolar to the second molar in the mandible.

4) Chewing instruction:
   The patient was asked to chew 30 times on each side from the premolar to the molar.

5) Audiogram after the treatment and instruction:
   Equalizing of the profile of the audiogram and a reduction in the difference in hearing intensity on the two sides between 1,000 and 8,000 Hz were observed as shown in Fig. 3b.
2) Profile of audiogram at the first dental visit:

Figure 4a shows the fall in hearing intensity between 250 and 8,000 Hz.

3) Dental treatment: A 0.7-mm-wide stress-

Fig. 4 Change in the audiogram of Case #4 (62-year-old male)
(a: before dental treatment, b: after dental treatment and chewing instruction)

Audiogram with the Former Denture

Audiogram with the New Denture

Fig. 5 Change in the audiogram of Case #5 (64-year-old female)
(a: before dental treatment, b: after dental treatment and chewing instruction)

4. Case #4: Sixty-two-year-old male

1) Oral conditions (see Table 2)

This patient experienced a drop in hearing ability because of overclosure of the molar.

2) Profile of audiogram at the first dental visit:

Figure 4a shows the fall in hearing intensity between 250 and 8,000 Hz.

3) Dental treatment: A 0.7-mm-wide stress-
breaking splint was applied over the first premolar to the second molar bilaterally on the maxilla. The infraversional denture caused by atrophy of the alveolar bone had intensified the bite force at the remaining cuspid, so the splint was removed to disperse the occlusal stress on the molars and premolars.

4) Chewing instruction: Chewing instruction was given so that the patient could chew with the splint.

5) Profile of audiogram after dental treatment and chewing instruction: Figure 5b shows the audiogram while the splint was in place. Improvement in hearing ability between 250 and 8,000 Hz and equalization of the profile of the audiogram were observed. This case indicates that equilibration of the occlusal stress at the front and rear as well as bilaterally is associated with equalization of audibility from lower to higher frequencies.

5. Case #5: Sixty-four-year-old female

Table 2 lists the oral conditions of the patient.

The mandibular denture and prostheses on the upper and lower jaws had already been treated, but the denture was infraversional on the left. An initial audiometric test was conducted with this set of dentures after the chewing instruction of chewing 30 times on each side. The dentures were replaced by a new set with the vertical dimension elevated on the left side. A second test was done 20 minutes after the first one after the same chewing instruction. Figure 5a shows the audiometry using the former dentures; Figure 5b represents the one with the new set.

The improvement in the left ear is significant, especially at 4,000 and 8,000 Hz. The bilateral differences were reduced, with the pattern being horizontal.

DISCUSSION

The five cases here demonstrate that hearing loss may occur as a result of unilateral chewing caused by dental treatment and oral disease. Chewing instruction and dental treatment focusing mainly on occlusal equalization can lead to an improved and equalized audiogram, as shown in our previous study. It is important to emphasize that such an improvement and equalization only occur for an extremely short time.

Unilateral chewing in adults is caused mainly by tooth loss, oral disease, and the condition of a prosthesis. It is also affected by many factors such as a disorder at the growth stage, poor chewing habits, and malocclusion and pathomorphism.

We have already reported a case in whom unilateral chewing was caused by tooth loss. The unilateral chewing in Case #1 here was caused by pain, while that in Cases #2 to #5 was caused by the condition of the prosthesis.

Malocclusion and unilateral chewing will affect hearing. Dental treatment and chewing instruction can induce not only an improvement in hearing ability but also a fall depending on oral conditions. We think that the vertical dimension of occlusion as shown in the accompanying denture preparation of Case #5, is a significant determinant of changes in hearing ability.

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