

Occlusal Analysis and Management of a Patient with Unilateral High-Frequency Hearing Impairment and Stiff Shoulder: A Case Report

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ABSTRACT

Although the relationship between low-frequency hearing loss and dental occlusion has been reported, the treatment of high-frequency hearing impairment using occlusal position correcting therapy has not yet been reported. As a result of the occlusal analysis of a woman who was pointed out as having a high-frequency hearing impairment (4000Hz: 40dB) in the right ear at the complete medical checkup, it was found that there was no occlusal contact at all except for the left premolars and molars. The occlusal force on the right side was mean 5.3 kg, and the left side was mean 14.0 kg. The statistical difference between the mean values was significant ($p < 0.01$). As a result of improving the occlusion, the left and right premolars and molars were evenly in contact. The occlusal force was improved mean 10.0 kg on the right side, mean 12.0 kg on the left side respectively (not significant). High-frequency hearing impairment disappeared (400Hz: 20dB). Since the right molars are not in occlusion, the masticatory muscles are not capable of isometric contraction and the bite force is weak. Since the tensor tympani is also innervated by the same mandibular nerve as the masticatory muscle, it is thought that the contracting force of the tensor tympani is also weakened, resulted in high-frequency hearing impairment occurred.

Key words: habitual occlusal position, bite plate-induced occlusal position, occlusal position correcting therapy

INTRODUCTION

A relationship between some ear symptoms and occlusion has been reported, but there is no report on the relationship between high-frequency hearing impairment and occlusion [1-4]. This case may help us understand the relationship between high-frequency hearing loss and occlusion.

CASE PRESENTATION

A 59-year-old woman presented with the chief complaint of detachment of the crown of the lower right second molar.

She reported that she was pointed out as having a high-frequency hearing impairment in the right ear at the complete medical checkup (4000Hz: 40dB). Her medical history was unremarkable. She reported sounds of the left temporomandibular joint (TMJ) during jaw movements, a left stiff shoulder and left tinnitus. Mouth opening was 40 mm and the opening

pass deviated laterally to the right. There was no TMJ tenderness; however, tenderness of the left trapezius, the left external and medial pterygoid muscles on palpation was observed. Dental occlusion was anatomically normal (Figure 1). The TMJs bilaterally appeared normal on the computed tomography images taken in the habitual occlusal position (HOP) at the initial consultation (Figure 2). The opening amount was 40 mm. However, an opening mouth disturbance was suspected because the right condyle was not moved when opening. The right second molar was restored at 2 appointments. At the third visit, the HOP record was obtained using a vinyl polysiloxane bite registration material (Exabite, GC, Tokyo, Japan), while the patient was seated upright with her jaw voluntarily closed. The bite force was then measured at the first molars using an occlusal force meter (MPM 3000, NIHON KOHDEN, Tokyo, Japan). Three measurements performed on each side after asking the patient to bite as strongly as possible. The statistical differences between mean values were evaluated using a t-test. The mean value was 5.3 kg on the right side and 14.0 kg on the left side, respectively. The statistical difference between the mean values was significant ($p < 0.01$). Subsequently, the upper and lower impression were obtained, and dental models were fabricated. An anterior flat biteplate was fabricated on the upper model using a self-curing acrylic resin (Ortho-fast, GC, Tokyo, Japan). At the fourth visit, the patient wore the bite plate for 5 min and the bite plate-induced occlusal position (BPOP) record obtained, using the same material as used for obtaining the HOP record (Figure 3). A BPOP wax record was obtained using registration wax material (Bite wafer, Kerr US, Romulus, MI, U.S.A) in the previously described manner. The upper and lower models were mounted on an articulator with the BPOP wax record. Premature occlusal contacts were recognized on the left first premolar and first molar (Figure 4). To examine the direction from the BPOP to HOP, three-dimensional measurements near the first molars were performed with the modified articulator using the polysiloxane records. Her HOP was deviated anterolaterally to the left from BPOP (Figure 5). The shift ranged from 0.5 mm to 2 mm. Occlusal adjustment was performed on the models mounted on the articulator according occlusal position correcting therapy [5]. Then, the adjustment site on the model was transferred to a template, and the template was adapted to the teeth in the mouth for occlusal adjustment (Figure 6). Occlusal adjustment was performed twice, but the gap in the right lower premolar and molar regions did not disappear (Figure 7), so the temporary crowns of the right premolars and molars were fabricated to fill the gap. As a result, the opening amount was improved to 47 mm. The sounds of left TMJ disappeared, and the opening path became straight. Tenderness on palpation of the left trapezius, medial and lateral pterygoid muscles also disappeared (Figure 8). The temporary restorations were then replaced with permanent restorations (Figure 9). Tinnitus of her left ear almost disappeared. The bite force on the right side improved from mean 5.3 kg before the occlusal correction to mean 10.0 kg after the occlusal correction (significant at $p < 0.05$). The bite force on the left side was mean 14.0 kg before the occlusal correction and mean 12.0 kg after the occlusal correction (no significant). The high-frequency hearing impairment disappeared (4000Hz: 20dB)*.

DISCUSSION

The relationship between some ear symptoms and occlusion has been reported [1]. Rubinstein reported that 46 % of the patients who had received stomatognathic treatment reported no tinnitus or reduced tinnitus a few months after treatment [2]. Torii described that tinnitus related to occlusion may be caused by the spasmodic synkinesis of the tensor tympani muscle

with muscle spasm of the masticatory muscles [3]. In the present case, the patient's left tinnitus was thought to be caused by the muscle spasm of the left medial and lateral pterygoid muscles. The patient's left shoulder stiffness was thought to be due to spasm of the left trapezius muscle due to the habitual occlusal position being displaced to the left.

Myrhaug described that contractions of the tensor tympani could be watched directly under the operating microscope when stimulated voluntarily by clenching movements of the jaw [4]. The tensor tympani, which pulls the tympanic membrane inward and maintains constant tension, is the mandibular nerve innervation of the trigeminal nerve, which controls the movement of the masticatory muscles. In the present case, since the right premolars and molars were not in occlusion, the right masticatory muscles were not capable of isometric contraction, and the contracting force of the muscles were weak. The contracting force of the right tensor tympani, which receives the same innervation, is thought to be weakened. Therefore, it is thought that the tension of the right tympanic membrane was weak and high frequency sounds were difficult to transmit.

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References

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FIGURE LEGENDS



Figure 1. Upper and lower dental arches



Figure 2. Bilateral tomographic images of temporomandibular joint in habitual occlusal position



Figure 3. Wearing an anterior bite plate

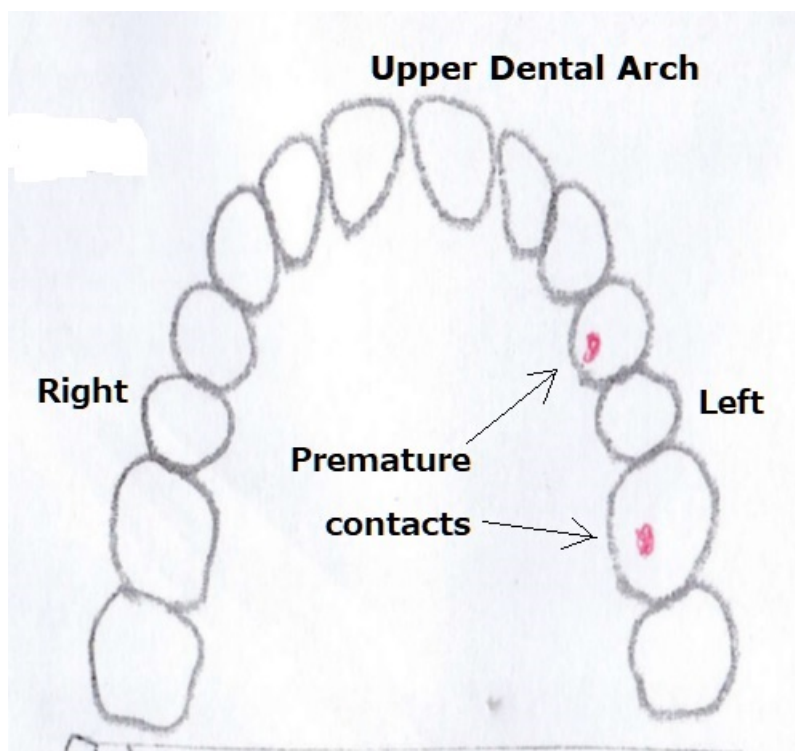


Figure 4. Recorded premature occlusal contacts

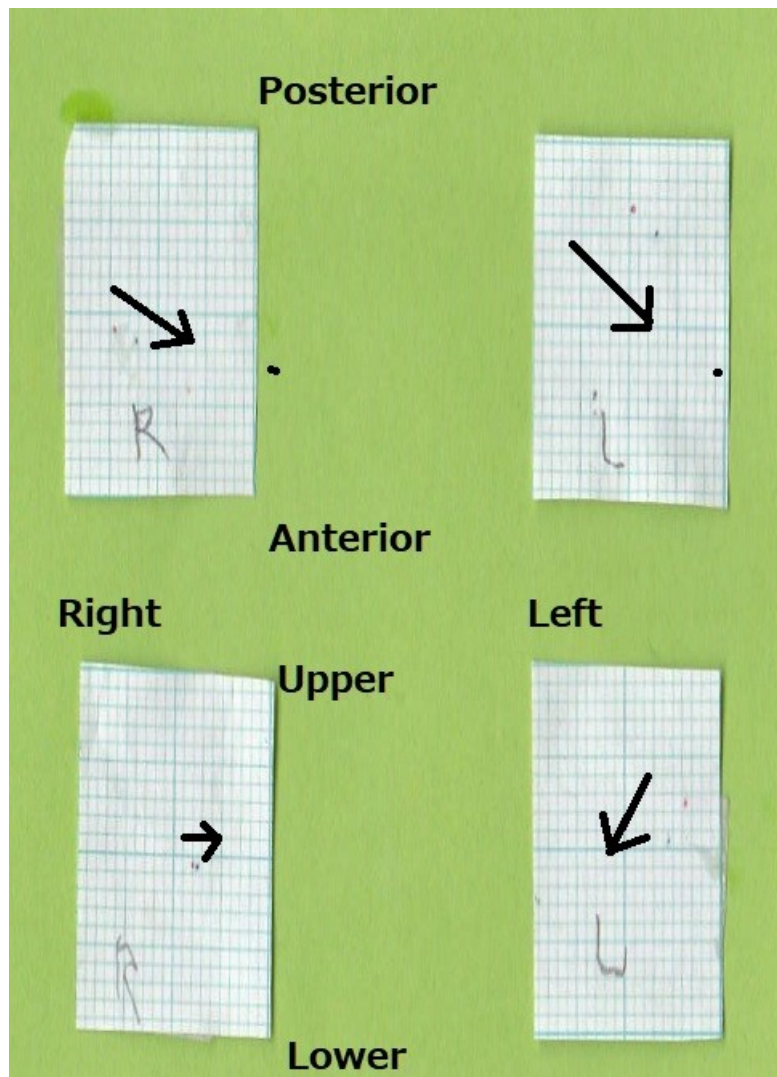


Figure 5. Three-dimensional records. The arrows indicate the shift from the bite plate-induced occlusal position (BPOP) to The habitual occlusal position (HOP).

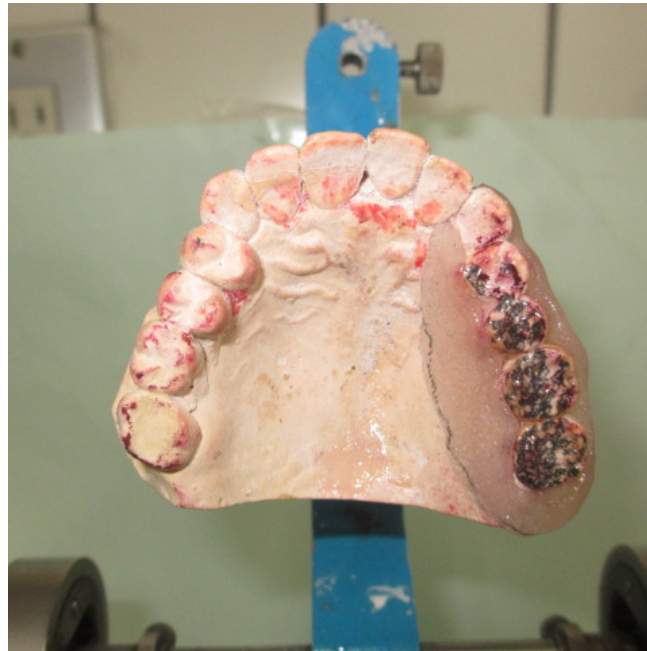


Figure 6. Template to be used for transferring the ground spots on the model to the mouth



Figure 7. Gap between upper and lower teeth on the right side

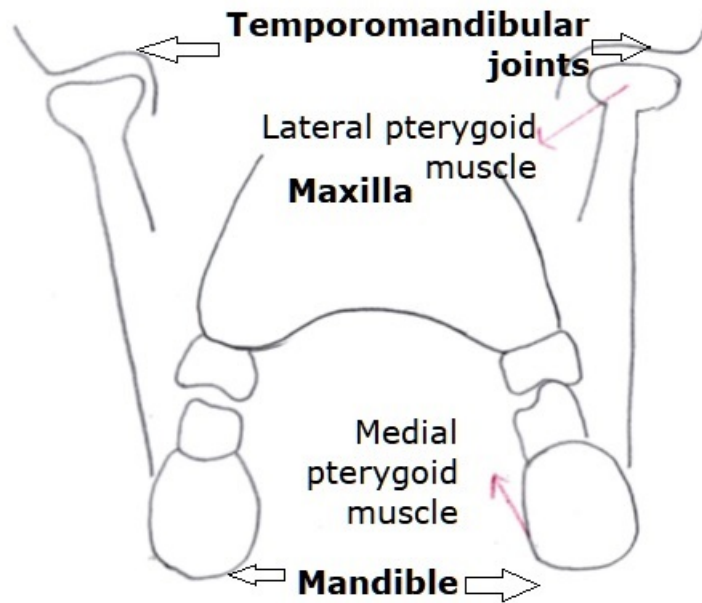


Figure 8. The muscles that the patient complained of tenderness to palpation at the first visit are illustrated.



Figure 9. Confirmation of bilateral occlusal contacts