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LETTER TO THE EDITOR

The use of psychoacoustic evaluation in denture adjustment: The tapping sound of an obturator prosthesis

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Dear Editor,

Acoustic analysis is often used in maxillofacial prosthodontic treatment, particularly for the speech evaluation of prosthesis wearers.[1] Results derived from precise sound analysis assist prosthodontists in assessing detailed problems and monitoring recovery of speech related to treatment.[2] However, patients' sound-related complaints are not always limited to speech. They sometimes report bothersome tapping noises caused by tooth contact, especially when a removable prosthesis is in use. In the literature, some devices have been applied to evaluate dental tapping sounds,[3] but no recent studies have focused on this aspect. The purpose of this report is to present an acoustic analysis of occlusal sounds generated by tooth tapping, which may contribute to the functional diagnosis of occlusion.

Psychoacoustics refers to sound analysis based on human auditory perception and is commonly used in industrial applications.[4] In dentistry, psychoacoustic methods have been applied, for example, to describe environmental noise in dental clinics[5] and to evaluate patients' speech, particularly consonant production.[6,7] This report describes our experience using psychoacoustic analysis to identify occlusal interferences during adjustment of an obturator prosthesis.

A 73-year-old woman who had undergone maxillectomy visited our clinic after the repair of her obturator prosthesis. The defect was classified as Aramany class I,[8] perforating into the nasal cavity (Fig 1), and she was wearing an obturator prosthesis with a platinum and gold alloy base (Fig 2). The obturator fit well, and no problems were noted with speech, swallowing, or mastication (Fig 3). Examination with articulating paper revealed even occlusal contacts. Nevertheless, the patient complained of an unpleasant tooth-contacting sound. For analysis, she was seated in a soundproof room, and the microphone



Fig 1. Maxillectomy defect with extended perforation into the nasal cavity.



Fig 2. Obturator prosthesis with a platinum and gold alloy base.

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Fig 3. Obturator well fitting inside the patient's mouth.

of a sound level meter (LA-5120, Onosokki, Tokyo, Japan) was positioned 10 cm in front of her lips. The sound produced by tapping the teeth ten times was recorded with dedicated software (Osreco, Onosokki) via an external sound converter (Sound Blaster Extigy 4500, Creative, Tokyo, Japan) and stored on a computer. The recordings were analyzed using psychoacoustic software (Oscope 2, Onosokki), focusing on two parameters: loudness and sharpness.[4,9]

The results demonstrated that, with the obturator in place, the tapping sound had higher loudness (Fig. 4) and lower sharpness (Fig. 5) compared with the sound without the obturator. This suggested that the lower-frequency harmonic components were enhanced due to resonance within the defect area, propagated by the prosthesis. As both tooth-to-tooth and tooth-to-rest contacts were observed on the non-defect side of the jaw, the prosthesis was adjusted to reduce tooth–rest contact. After adjustment, the tapping sound was evaluated again, and it was confirmed that the sound had similar loudness (Fig. 4) and sharpness (Fig. 5) to the sounds recorded without the prosthesis. The patient's perception of the sound improved, and she was satisfied with the adjustment. As shown in this case, acoustic analysis may provide a useful approach to address complaints about tapping sounds in patients with obturator prostheses. Further investigations are needed to validate this method.

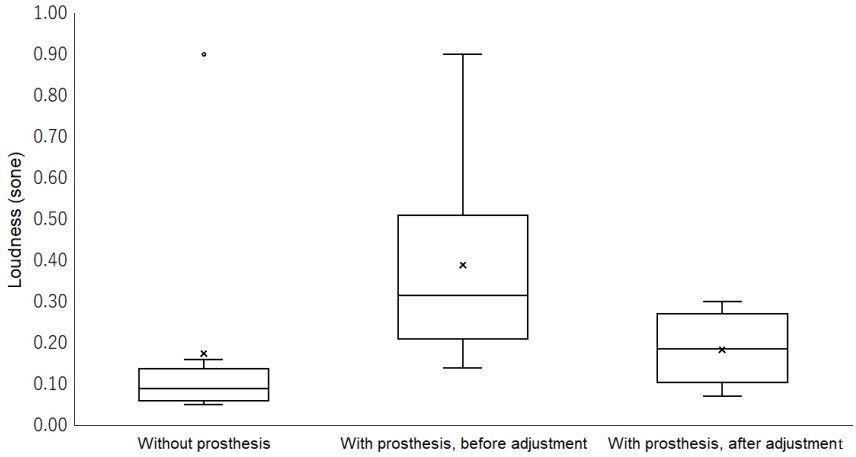


Fig 4. Box plots of the loudness (sone) of the tapping sound under three conditions: without the prosthesis, with the prosthesis before adjustment, and with the prosthesis after adjustment.

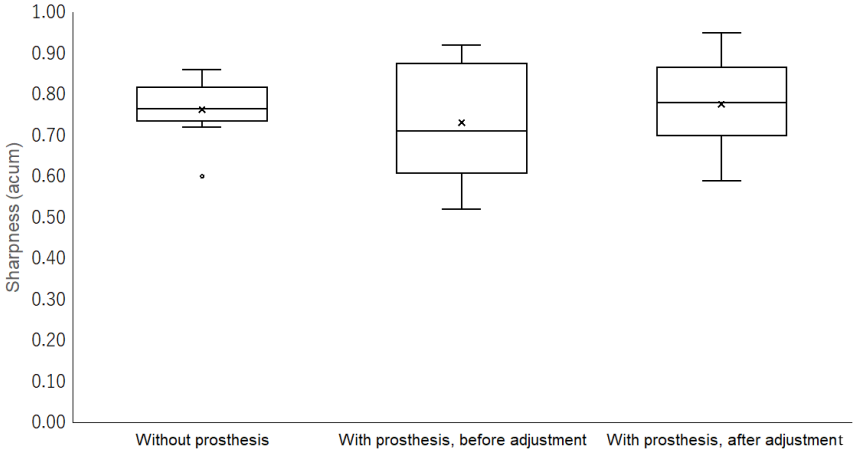


Fig 5. Box plots of the sharpness (acum) of the tapping sound under three conditions: without the prosthesis, with the prosthesis before adjustment, and with the prosthesis after adjustment.

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