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CASE REPORT

Hoarseness evaluation and prosthetic rehabilitation after maxillofacial surgery: A clinical report

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ABSTRACT

After maxillofacial surgery, some patients have not only articulation disorder, but also voice disorder. It is important for prosthodontists to know what kind of speech disorder patients have so that they can plan and implement rehabilitation. This report describes the case of a 58-year-old man with a speech disorder that developed after mandibulectomy, maxillectomy, neck dissection, and reconstructive surgery because of tumor. Objective evaluation of voice and articulation clarified that the postoperative speech disorder was due to not hypernasality but hoarseness. Conventional postoperative prosthodontic rehabilitation was performed using a delayed surgical obturator and definitive obturator and his voice was objectively analyzed at each stage. The voice disorder improved over time and the results of the voice evaluation helped the prosthodontist to further plan and implement postoperative prosthodontic rehabilitation. (*Int J Maxillofac Prosthetics 2021;4:43-46*)

Keywords

Speech impairment, voice disorder, prosthodontic rehabilitation.

INTRODUCTION

Maxillofacial prosthetic treatment is important in postoperative rehabilitation for patients with head and neck cancer. Objective evaluation of the orofacial functions, including speech, is important in prosthetic rehabilitation. Speech disorders are divided into articulation disorder and voice disorder.[1] Some patients develop not only articulation disorder but also voice disorder after maxillofacial surgery.[2] Prosthetic treatment is often an important consideration in patients with articulation disorder because it can have either beneficial or detrimental effects. However, prosthetic treatment cannot address voice disorder. Thus, it is important for prosthodontists to know which kind of speech disorder the patient has when planning and implementing prosthetic rehabilitation in order to determine whether they can help resolve it.

Digital analysis is often used in speech evaluation. Hoarseness is one type of voice disorder and is evaluated by acoustic analysis. Previous studies have shown that the noise-to-harmonic ratio is a practical index of the degree of voice disorder in patients.[3-5] This ratio has been used to objectively quantify hoarseness due to neck dissection in maxillofacial rehabilitation.[6]

This report describes a case of hoarseness that developed after maxillofacial tumor resection, neck dissection and reconstructive surgery. The aim is to show that voice evaluation provides prosthodontists with important information for planning prosthodontic treatment.

CASE REPORT

A 58-year-old man was referred to our Clinic for Maxillofacial Prosthetics from the Department of Head and Neck Surgery at Tokyo Medical and Dental University for rehabilitation after resection of head and neck tumor. He had difficulty speaking and had to write in order to communicate. Because of a squamous cell carcinoma in the right retromolar region, he had undergone segmental resection of the mandible, partial maxillectomy, right neck dissection, and fibula flap reconstruction. He had a laterally extended Aramany Class II defect in the right maxilla perforating the sinus (Fig 1). He also had a right mandibular defect. There was severe trismus with opening of less than 20 mm between the upper and lower central incisors.

Fabrication of a delayed surgical obturator followed by a definitive obturator was planned. The surgical obturator

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was designed with cobalt-chromium wire clasps and was fabricated by a conventional process using acrylic resin (Acron clear; GC Corp., Tokyo, Japan).

Three days after the first consultation, the surgical obturator was inserted and fit with soft reline material (Fig 2). The surgical obturator was adjusted once weekly until the wound healed. During this stage, the patient continued to write in order to communicate, even though the perforation was effectively obturated by the prosthesis. Because difficulty in speech was observed, the patient's voice was evaluated by acoustic analysis. The patient was diagnosed with breathy and rough hoarseness and received speech and voice training from a speech pathologist 20 days later. The patient received training 8 times until 32 days after the surgery. He was able communicate without the need to write 40 days after the surgery.



Fig 1. Intraoral view of the maxilla after surgery.



Fig 2. Surgical obturator was fit using soft reline material.

Nasalance measurement and noise-to-harmonic ratio measurement were used to analyze the patient's speech. Nasalance was measured to evaluate his voice from the viewpoint of nasal leakage. The headset of a nasometer (Nasometer II Model 6450; Pentax Medical, Montvale, NJ) was fitted to the patient's head and he was asked to speak a sentence consisting of non-nasal sounds.[7] Mean nasalance score was recorded and analyzed by the software as the nasal voice energy divided by the addition of nasal and oral voice energy, and the average of speaking three times was calculated.

Noise-to-harmonic ratio was measured to evaluate his voice in terms of hoarseness.[8] A microphone (SM58; Shure Inc., Niles, IL) was positioned 10 cm away from the lips. The patient was asked to vocalize a prolonged /a/ as a test sound at a comfortable volume and constant pitch.[6] The voice was recorded for 5 s on a computer through a sound interface using a speech analysis system (Computerized Speech Lab model 4400; Pentax Medical). Voice analysis software (Multi-Dimensional Voice Program; Pentax Medical) was used to calculate the noise-to-harmonic ratio. The 1-s middle portion of the voice was extracted for analysis and the noise-to-harmonic ratio was automatically calculated by the software as inharmonic spectral energy in the 1500 Hz to 4500 Hz range divided by harmonic spectral energy in the 70 Hz to 4500 Hz range. The evaluation was performed on days 26, 40, 61, and 128 after surgery.

Eight months after surgery, the head and neck surgeon and the prosthodontist agreed that wound healing was sufficient to commence fabrication of a new prosthesis. The trismus was in remission with the interincisal opening greater than 30 mm. A definitive obturator with cobalt-chromium wire clasps was designed and fabricated in a conventional manner (Fig 3A, B). Because the right mandibular molars were missing and there was no space for prosthetic treatment in that area due to the surgery, no occlusal contact was added to the artificial teeth.

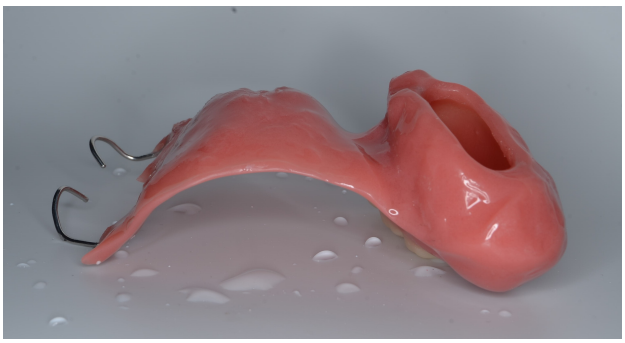


Fig 3A. Definitive obturator.



Fig 3B. Intraoral view of the patient wearing the definitive obturator.

RESULTS

The surgical obturator fit well. The patient could eat and swallow well with it. Nasalance after surgery was 21.0% and a normal value was obtained even without the surgical obturator. Noise-to-harmonic ratio of the voice after surgery was 0.649 and was higher than the threshold of 0.2 that indicates hoarseness. Noise-to-harmonic ratio quickly decreased to less than 0.2 in 40 days (Figs 4, 5). It continued to decrease and became comparable to the average value of patients after mandibulectomy in 3 months.

The results of voice analysis indicated the speech disorder was not due to misfit of the obturator, but due to temporary hoarseness that developed after surgery. The prosthodontist did not change the design of the surgical obturator and continued to adjust it as usual until the wound healing became sufficient to commence fabrication of the definitive prosthesis.

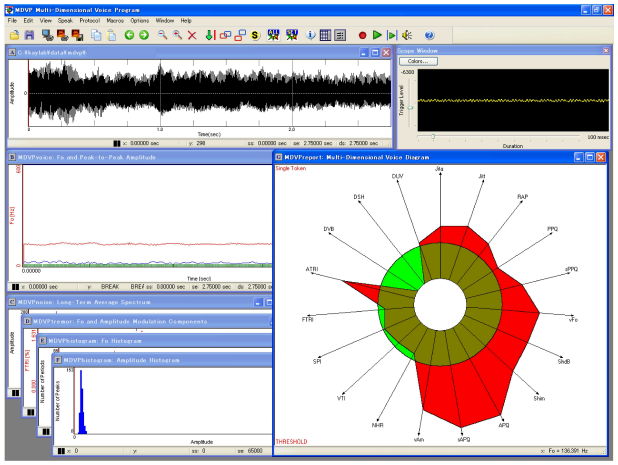


Fig 4. Example voice analysis view using the noise-to-harmonic ratio.

The definitive obturator also fit well. The patient could insert and remove it easily. He could speak, eat, and swallow with it well. He was satisfied with the prosthesis and continued to visit the clinic regularly for maintenance. He has been using the prosthesis for 7 years without problems.

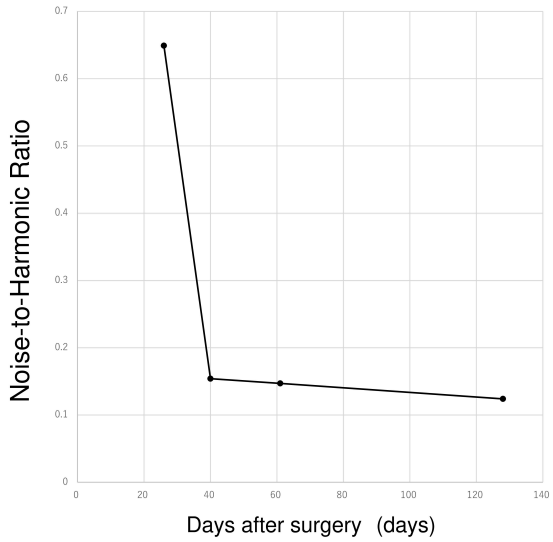


Fig 5. Noise-to-harmonic ratio of the voice after surgery.

DISCUSSION

The patient in this case had a speech disorder even while wearing the surgical obturator. Objective speech evaluation revealed not hypernasality but hoarseness. Voice evaluation also showed that the severity of the hoarseness decreased over time. Voice quality was considered to have been temporarily influenced by the maxillofacial surgery that involved neck dissection, even though the vocal folds and laryngeal structures were not operated on. Results of the voice analysis showed that voice quality recovered over time.

If hoarseness had not been measured, the speech disorder could have been misdiagnosed as being due to misfit of the obturator. The obturator then would have undergone repeated modification in an attempt to resolve the speech disorder. Because hoarseness cannot be resolved by prosthetic treatment, we simply waited for postoperative recovery and the effect of speech training by the speech pathologist while continuing regular adjustment of the surgical obturator to fit it in accord with postoperative tissue changes. Proper voice evaluation allowed us to avoid unnecessary adjustment or refabrication of the surgical obturator and to help the patient and the prosthodontist in devising the rehabilitation plan.

Although hypernasality was not observed even without the surgical obturator, the obturator helped the patient to eat and swallow by preventing food from becoming impacted into the defect. It also helped in wound healing.

The definitive obturator also functioned well. Because the right mandibular molars were missing and there was no space for a prosthesis in that area, the existing prosthesis was designed not for mastication but for obturation of the defect to prevent food impaction. The angle of the defect made it difficult for the prosthodontist to design the insertion pathway of the definitive obturator, but the design with wire clasps made rotated insertion possible. Regular consultation for maintenance made it possible to ensure a stable intraoral condition and facilitated long-term use of the prosthesis.

CONCLUSION

Objective evaluation of voice and articulation clarified that the speech disorder that developed after head and neck resection was due to not hypernasality but hoarseness. The voice disorder improved over time and the results of the voice evaluation helped the prosthodontist to plan and implement effective postoperative prosthodontic rehabilitation.

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