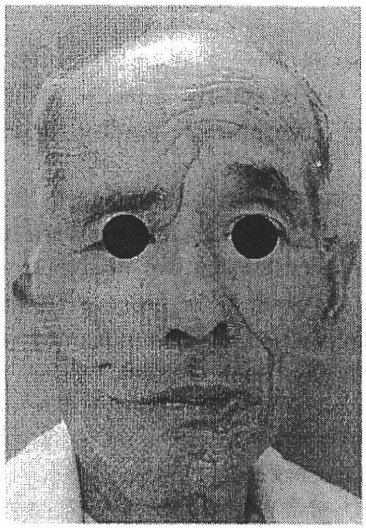
(b)



(c)

Figure 12. (a) An intraoperative photograph showing the treatment of parotid cancer with neck lymph node and skin metastasis. A wide soft tissue defect is present. (b) The photograph shows the resurfacing of the neck wound using a free rectus abdominis flap transfer. (c) The photograph of patient 6 months after surgery. Facial nerve palsy was treated by static suspension.

Pharyngocutaneous fistula is the most common complication (8.7% to 22%) during the immediate postoperative period after total laryngectomy. [15-17] Redaelli et al. reviewed the clinical course of 39 of 246 (16 %) patients who developed cervical fistulae after total laryngectomy for squamous cell carcinoma. Among these patients, spontaneous closure with local wound care was achieved within 3 weeks in 70% of cases. [18] Saki et al. examined 19 patients who developed cervical fistulae after total laryngectomy and reported that most fistulae could be successfully managed with conservative treatment. [19] These patients experienced satisfactory wound healing, without secondary surgery, because they underwent only laryngectomy; nearly all of these patients did not undergo reconstruction using free flap transfer.

Bozikiv and Arnez reported the occurrence of cervical fistulae following restoration with free flaps in 12 of 194 (6.2%) cases. [8] In the present study, among patients who underwent reconstruction with free flaps, 11 of 83 (13.2%) with cervical fistulae required salvage surgery, which suggests that the frequency of cervical fistulae after reconstruction with free flaps is similar or inferior, to that of procedures using conventional flaps. Depending on the characteristics of the severances, reconstruction using free fraps appears to cause more severe cervical fistulae, as indicated by the need for second surgeries. However, radical and wide tumor ablation, such as that required for a total laryngo-pharyngo-esophagectomy, requires free flaps to repair the extensive tissue loss. As a result, development of cervical fistulae after reconstruction with free flaps tends to be more severe because this reconstructive technique is likely to be used for the treatment of more severe cancer cases.

3. Risk Factors for Postoperative Neck Fistulae after Microsurgical Reconstruction

It is commonly believed that the development of postoperative neck fistulae after surgical reconstruction is influenced by several underlying factors, including the presence of systemic diseases, previous radiotherapy, chemotherapy, positive surgical margins, and lymph node metastases. [16-21]

However, we observed that putative several risk factors for conventional flap reconstruction, including extent of lymph node metastasis and use of chemotherapy, were not associated with fistulae when reconstruction was performed with free flaps. Furthermore, tumor size to be removed was not a risk factor, because free flaps of any size or any type of tissues, could be harvested. In addition, the ability to reconstruct larger areas permits the more radical ablation of malignant tumors, which reduces the rate of positive surgical margins-one of the risk factors for postoperative cervical fistulae.

There are many conflicting reports concerning the predisposing factors for postoperative cervical fistulae after flee flap reconstruction, but our data show that radiotherapy is the most important. The combination of endarteritis and chronic ischemia caused by radiation interrupt the normal process of wound healing, consequently, develop cervical fistulae. Pinar E et al. also reported that 12 percent of 33 free flap transfers after irradiation remained fistula formation. [20] The lack of contraction caused by delayed myofibroblast function, and repeated wound contamination are also factors of non-improvement in irradiated wound. [9, 10, 22].

4. Salvage Surgery for Cervical Fistulae Developing after Radiotherapy

At a minimum, flaps are required to treat cervical fistulae. Skin grafts are not indicated, because a previously irradiated wound bed does not have a sufficient oxygen and nutrient supply. [10, 23] Elevation of local flaps is also not recommended because tissue surrounding the ulcer crater has often been compromised by radiotherapy, which result in the loss of at least part of the flap. [9] With the development of axial-pattern musculocutaneous and muscle flaps, it is less difficult to deal with these ulcers. [10, 11] Surgeons can now recommend earlier debridement of the entire irradiated area, followed by immediate coverage with a well vascularized axial-pattern musculocutaneous flap or revascularized free flap. [24] When irradiated wounds increase in size, complete excision of the wound requires a well-vascularized distant flap. [25, 26] Strawberry reported that only 6 of 52 patients with cervical irradiation ulcers could be successfully treated with either local skin flaps or a free skin graft; the remaining 46 patients required the use of myocutaneous flaps and including pectoralis major musculocutaneous flaps, latissimus dorsi musculocutaneous flaps. [10] The use of a pectoralis major musculocutaneous flap remains an important reconstructive technique in head and neck cancer surgery, because it is a with low-risk procedure with acceptable morbidity. [27] In addition, this flap can be still used in a salvage procedure after free flap failure or when there facility with microsurgery is limited. [3]

The pectoralis major muscle originates from the medial part of the clavicle, the sternocostal border of the first 6 ribs, and the external oblique muscle aponeurosis. The main

functions of the muscle are adduction and medial rotation of the arm. Sacrifice of this muscle leads to only minimal functional deficit because adjunct muscles of the shoulder belt can almost completely compensate for the loss. [28] The pectoralis major muscle and its overlying skin receive their blood supply from the pectoral branch of the thoracoacromial vessels originating from beneath the midportion of the clavicle. The skin island should be centered over the pectoralis major muscle. When the flap is elevated completely as a vascularized island flap, it can reach cervical fistulae easily. This safe and reliable flap is our first choice for salvage surgery after unfavorable outcomes for free flap reconstruction, including development of cervical fistulae. Below, we describe our successful results with pectoralis major MC flaps for the treatment of complex cervical fistulae (Figure 13).

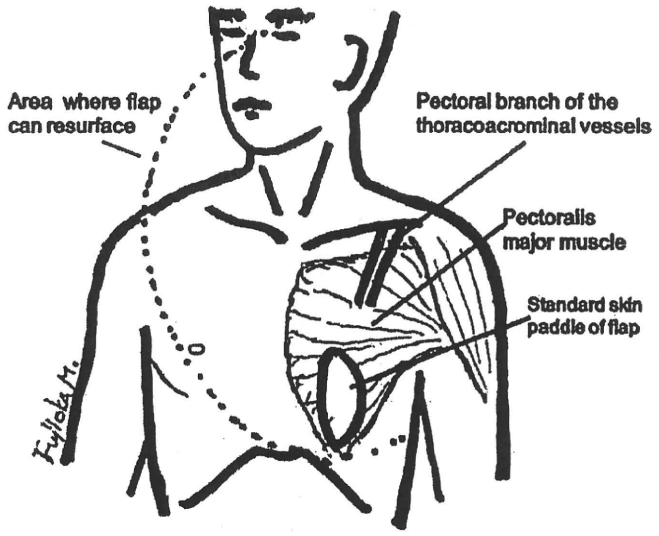


Figure 13. Schema of a pectoralis major musculocutaneous flap.

5. Representative Cases of Salvage Surgery for Cervical Fistulae after Radiation Treatment and Free Flap Reconstruction

Case 1. A 49-year-old woman received a total dose of 60 Gy during radiotherapy for epipharyngeal squamous cell carcinoma, 1 month after ablation of the tumor and reconstruction using free forearm flap transfer. A contaminated neck ulcer measuring 2×2 cm, which formed fistula that penetrated to the oral floor, occurred 3 months after surgery (Figure 14a). Chronic dermatitis and a small skin ulcer around the fistula that had been caused by radiation treatment were also observed on the neck. Oral examination showed a fistula connecting to the neck ulcer (Figure 14b). The cervical fistula and cavity involving the irradiated skin were widely debrided and the defect was reconstructed using a pectoralis major musculocutaneous flap (Figure 14c). Immediately after surgery, the patient was able to orally ingest a soft diet without backflow or leakage, and the patient was discharged, without relapse of fistula, 2 weeks after surgery.

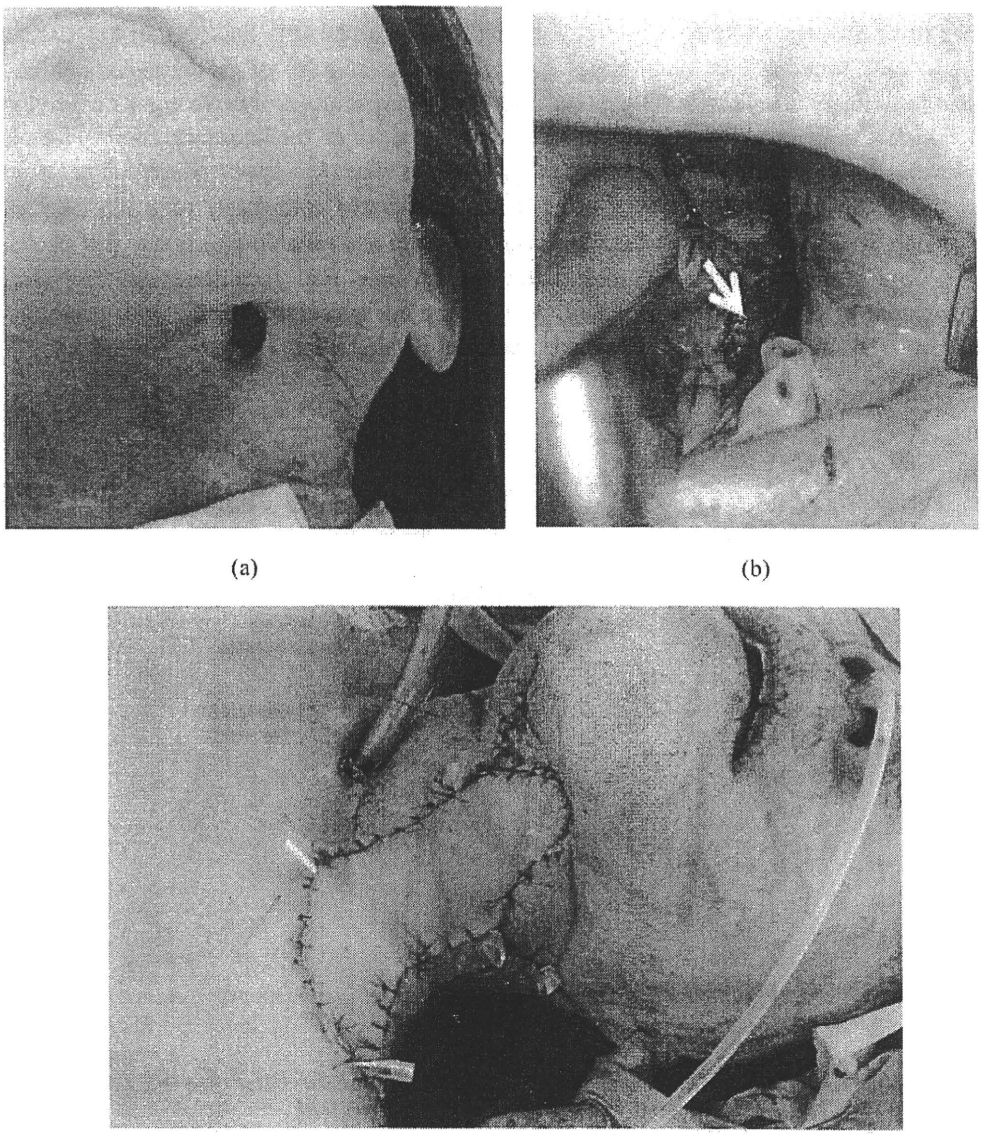
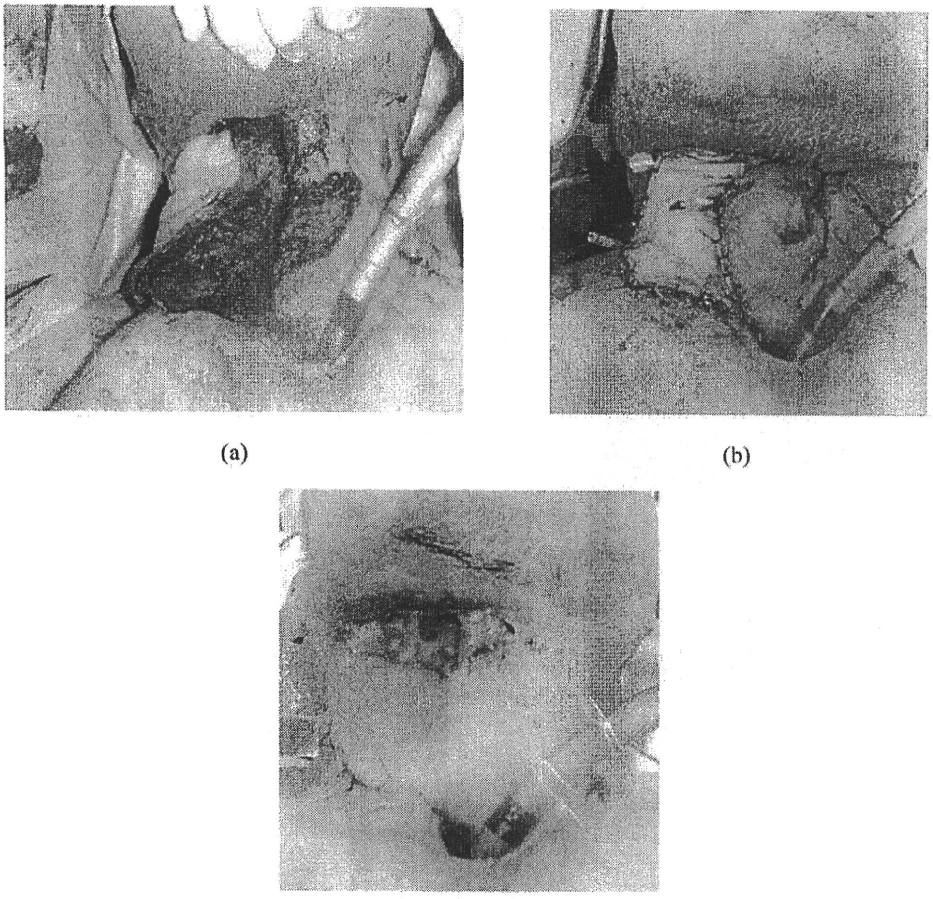


Figure 14. (a) Case 1. A photograph of a cervical fistula in patient who underwent treatment with 60 Gy of radiation and ablation of tumor for epipharyngeal SCC. Reconstruction surgery utilizes a free forearm flap. (b) The photograph shows a fistula connecting to the neck ulcer (arrow). (c) An intraoperative photograph. The radiation ulcer and cavity were debrided and reconstructed using a pectoralis major musculocutaneous flap.

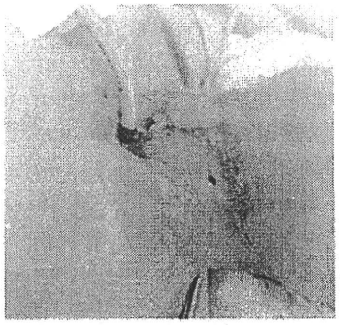


(a) (b)

(c)

Figure 15. (a) Case 2. A photograph of a cervical fistula in a patient who underwent treatment with 65 Gy of radiation, ablation of tumor, and reconstruction using a free jejunum flap for hypopharyngeal SCC. (b) An intraoperative photograph of the secondary surgery shows insertion of the transported pectoralis major muscle into the fistula to occupy the dead space. (c) The photograph shoes the reconstruction of cervical fistula.

Case 2. A 65-year-old man received a total dose of 65 Gy during radiotherapy for hypopharyngeal squamous cell carcinoma. Eleven months later, a recurrent tumor developed, and the patient underwent ablation of the tumor and reconstruction using a free jejunum flap transfer. However, a contaminated cervical fistula measuring 5×4 cm occurred 1 month after surgery (Figure 15a). Chronic dermatitis around the fistula due to radiation treatment was also observed on the neck. The cervical fistula and cavity involving the irradiated skin were widely debrided and the defect was reconstructed using a pectoralis major musculocutaneous flap. The transported muscle body was inserted into the fistula to occupy the dead space (Figure 15b, 15c). The patient was able to orally ingest a soft diet without backflow or leakage immediately after surgery, and was discharged without a relapse of the fistula, 3 weeks after surgery.



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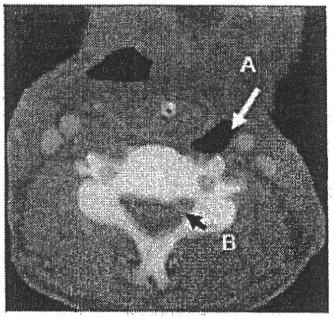

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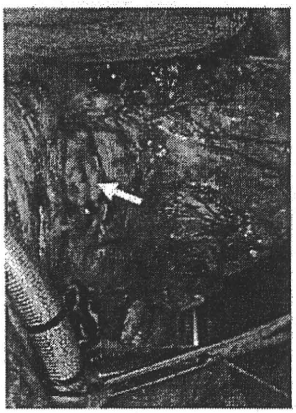

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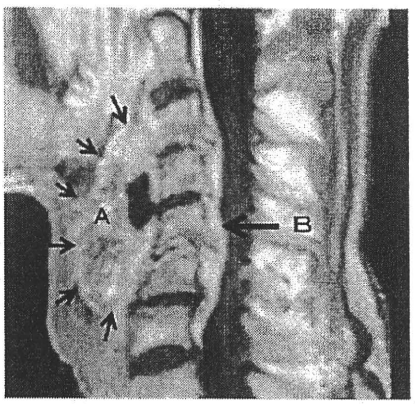

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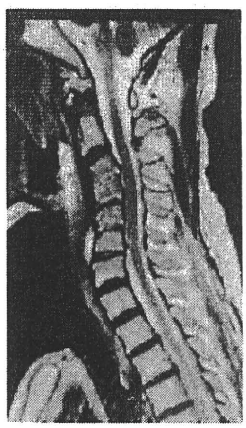

(e)

Figure 16. (a) Case 3. A photograph of a patient who had received 68 Gy of radiation for the treatment of hypopharyngeal SCC 14 years before. The chronic cervical fistula is visible. (b) A CT image shows the dead space between the vertebrae and transported jejunum flap (A) and an abscess in the cervical spinal canal (B). (c) An intraoperative photograph shoes a fistula leading to the anterior surface of the cervical spine; a contaminated, infected anterior longitudinal ligament is exposed. (arrow). (d) An MRI 7 days after surgery shows the pectoralis major muscle flap placed over the surface of the vertebral bodies (A), as well as inflammatory granulation in the spinal canal (B). (e) An MRI 5 months after surgery confirms that the disappearance of the epidural abscess.

Case 3. A 64-year-old man who had undergone radiation therapy for treatment of pharyngeal cancer 14 years before, underwent total laryngo-pharyngo-esophagotomy for the treatment of a recurrence. After ablation of the malignant tumor, a free jejunum flap was transferred. Three days later, the patient developed a fever with purulent discharge from the neck wound, even though the circulation in the transferred jejunum flap was satisfactory (Figure 16a). Magnetic resonance imaging (MRI) revealed an abscess in the spinal canal and a deformity of the vertebral bone, which suggested cervical osteomyelitis (Figure 16b). Radical excision of the infectious tissues was performed. The anterior surfaces of the contaminated vertebral bone bodies between C4 and C6 were osteotomized, and a vascularized pectoralis major muscle flap was placed over the surface of the vertebral bodies (Figure 16c, 16d). The patient was discharged without tetraplegia, neck instability, or relapse of infection, 8 weeks after surgery. An MRI 5 months after surgery confirmed the disappearance of the epidural abscess and favorable vertebral alignment (Figure 16e).

Conclusion

With increased experience in microsurgical reconstruction, free tissue transfer has become a standard technique in head and neck reconstruction after tumor ablation. However, patients receiving radiation treatment are more likely to develop cervical fistulae when they undergo reconstructive surgery with free flaps after tumor ablation, because the combination of endarteritis and chronic ischemia caused by radiation interrupts the normal process of wound healing. These wounds will not heal spontaneously despite aggressive medical wound management. Skin grafts and local cutaneous flaps located within the radiation field are unreliable and rarely provide adequate and stable coverage. Thus, salvage surgery with a vascularized pectoralis major musculocutaneous flap is recommended as a first-line therapy for these complex wounds.

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CASE REPORT

Extra-Oral Fistula Caused by a Dental Implant

Masaki Fujioka, MD, PhD[1]*
Kiyoshi Oka, MD[1]
Riko Kitamura, MD[1]
Aya Yakabe, MD[1]
Hidehiko Endoh, MD[2]

Dental implantation has become an important procedure for both dental treatment and head and neck reconstructive surgery. However, this useful technique sometimes results in peri-implantitis. We describe a rare complication of peri-implantitis in the maxilla which extended to the soft tissue and caused an extra-oral fistula above the alar region. The patient underwent the placement of dental implants in the maxilla 8 years earlier. Radiography showed osteolysis of the maxilla and implant exposure. After the implants were removed, the patient was fitted with a conventional fixed partial denture. Such unfavorable outcomes are caused by failed endodontic and apicoectomy procedures.

Key Words: extra-oral fistulae, dental implant, implant-associated periapical lesions, peri-implantitis

INTRODUCTION

Dental implantation has become an important procedure for both dental treatment and head and neck reconstructive surgery.[1] However, this useful technique sometimes results in peri-implantitis, of which chronic inflammation usually causes osteolysis around the implant.[2] Many investigators have evaluated clinical and microscopic features of implant-associated periapical lesions, and the types of complication assessed were as follows: implant loss, sensory disturbance, soft tissue complications, peri-implantitis, bone loss, and implant fracture.[3–4]

We present a rare case of peri-implantitis due to implant-associated periapical lesions of the maxilla, which extended to the soft tissue and resulted in an extra-oral fistula.

CASE REPORT

A 72-year-old woman consulted the Department of Plastic and Reconstructive Surgery of our hospital complaining of a facial fistula of 6 months' duration. On examination, a 2.0 × 1.5-cm skin fistula was found in the maxilla above the alar region. The skin around the fistula was contracted and irregular, causing a depressed deformity (Figure 1). No pain, skin inflammation, or discharge from the fistula was present. The patient had undergone the placement of 3

[1] Department of Plastic and Reconstructive Surgery, National Organization Nagasaki Medical Center, Nagasaki, Japan.
[2] Department of Dentistry, National Organization Nagasaki Medical Center, Nagasaki, Japan.
* *Corresponding author*, e-mail: mfujioka@nmc.hosp.go.jp
The authors herewith certify that they have no financial, academic, or personal relationships with any companies that produce or market products or services relevant to the topic of this manuscript.
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FIGURE 1. View of the fistula. A 2.0 × 1.5-cm skin fistula was found in the maxilla above the alar region.

screw-shaped titanium dental implants in the frontal region of the maxilla 8 years previously. Radiographs showed a maxillary bone defect around the implants (Figure 2). CT scans showed radiolucency of the maxillary bone and implant exposure (Figure 3). The implants were removed, and intraoperative examination revealed chronic inflammation in both the bone and soft tissue around the implants. After implant removal, the patient was fitted with a conventional 3-unit fixed partial denture.

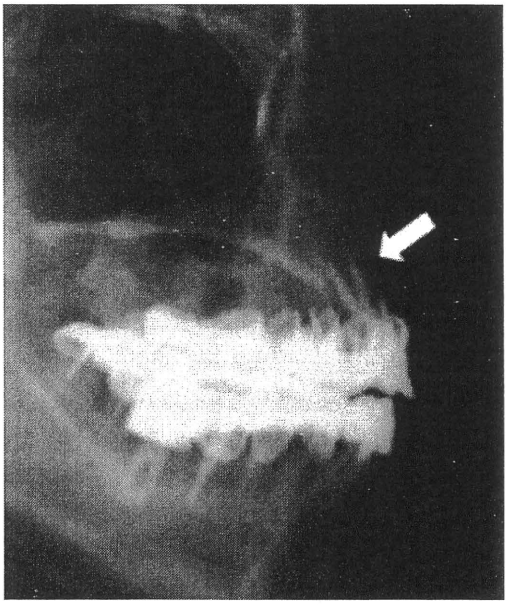

FIGURE 2. Radiography showed a maxillary bone defect around the implants (arrow).

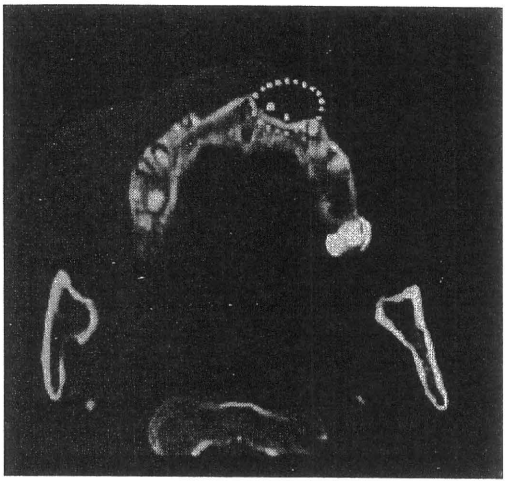

FIGURE 3. CT scan showed osteolysis of the maxillary bone and implant root exposure.

DISCUSSION

Osseointegrated implants provide restorative support for crowns, prosthesis abutments, and removable dentures. Implants are also required for patients who have undergone palatomaxillary reconstruction with vascularized bone-containing free flaps.[1] For these reasons, plastic and craniofacial surgeons are familiar with dental implants. However, dental implantation sometimes results in peri-implantitis. This chronic inflammatory reaction causes peri-implant apical radiolucencies around long implants placed in dense bone, and have been called implant-associated periapical lesions.[5,6] These unfavorable outcomes are thought to be caused by failed endodontic and apicoectomy procedures, including bone overheating, instability, overloading, contamination, residual root particles, and maxillary sinus infection.[5,6]

Many cases of peri-implant bone loss have been reported, and patients' complaints have included swelling of the maxilla, pain, tenderness, and a fistulous tract in the gingival mucosa.[3–5,7] Our patient presented with a depressed deformity and irregularity of the facial skin as a result of an extra-oral fistula caused by a severe implant-associated

periapical lesion, which was thought to be rare based on previous literature.

Concerning treatment, some investigators have recommended only the removal of inflamed granulation tissue and cleansing of the implant surface to remove bacteria.[7,8] However, a chronic infection will not heal as long as foreign bodies are present. Piattelli et al[5] reported a patient with peri-implantitis in whom a chronic infection did not heal until the implant was eventually removed. They also suggested the necessity of removing part of the implant to perform a complete toilette of the affected tissue.[9] On the other hand, Aydinli et al[7] investigated infections occurring with 174 spinal operations and found that 3 late reactions were not bacterial infections but rather foreign body reactions around implants.[7] They concluded that metallic debris may cause a foreign body reaction, which resolves after debridement and implant removal. We also believe that total implant removal and the aggressive debridement of necrotic tissue, including nonviable bone, are essential for the early healing of implant-associated periapical lesions.

Conclusion

We presented a rare complication of peri-implantitis in the maxilla which caused an extra-oral fistula. Such unfavorable outcomes are thought to be caused by failed endodontic and apicoectomy procedures. Total implant removal is desirable for the treatment of implant-associated periapical lesions.

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