

# Implant-Supported Full Fixed Prosthesis with a Removable Oro-Nasal Obturator for the Edentulous Maxilla with Palatal Fistula due to Surgical Procedures for Oral Cancer

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**How to cite this paper:** Enomoto, A., Shimoide, T., Morikage, E., Matsunaga, K., Mukai, T., Uchihashi, T. and Hamada, S. (2016) Implant-Supported Full Fixed Prosthesis with a Removable Oro-Nasal Obturator for the Edentulous Maxilla with Palatal Fistula due to Surgical Procedures for Oral Cancer. *Surgical Science*, 7, 443-452. <http://dx.doi.org/10.4236/ss.2016.710060>

**Received:** June 2, 2016

**Accepted:** September 25, 2016

**Published:** September 28, 2016

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## Abstract

Open oro-nasal defects resulting after oral tumor resection need structural and functional rehabilitation using dental prostheses. Conventional removable prostheses have usually been indicated and performed for prosthodontics. When the patient has an edentulous maxilla, the unfavorable stability of the prosthesis will cause dysfunction of mastication and pronunciation. To achieve improvement of the impaired functional situation, implant-supported full fixed prostheses (IPSPs) for the edentulous maxilla with a removable obturator offer a reasonable solution. We present herein the case of a 70-year-old Japanese man who has presented with oro-nasal defect due to surgical procedures for oral cancer. He was treated with implant-supported full fixed prostheses in a conventional two-step procedure. After prosthesis treatment, a palatal obturator was set. The patient has shown no clinical or radiological evidence of failure as of 24 months after the end of treatment. Functional evaluation of mastication and pronunciation showed dramatic improvements. For a patient with an edentulous maxilla and palatal fistula, full-arch fixed prostheses supported by a combination of axially and non-axially positioned implants and a removable oro-nasal obturator, using the anterior alveolar bone, without bone transplantation or maxillary sinus elevation, could offer an effective, minimally invasive treatment alternative.

## Keywords

Implant-Supported Full Fixed Prosthesis, Oro-Nasal Obturator, Oral Tumor

## 1. Introduction

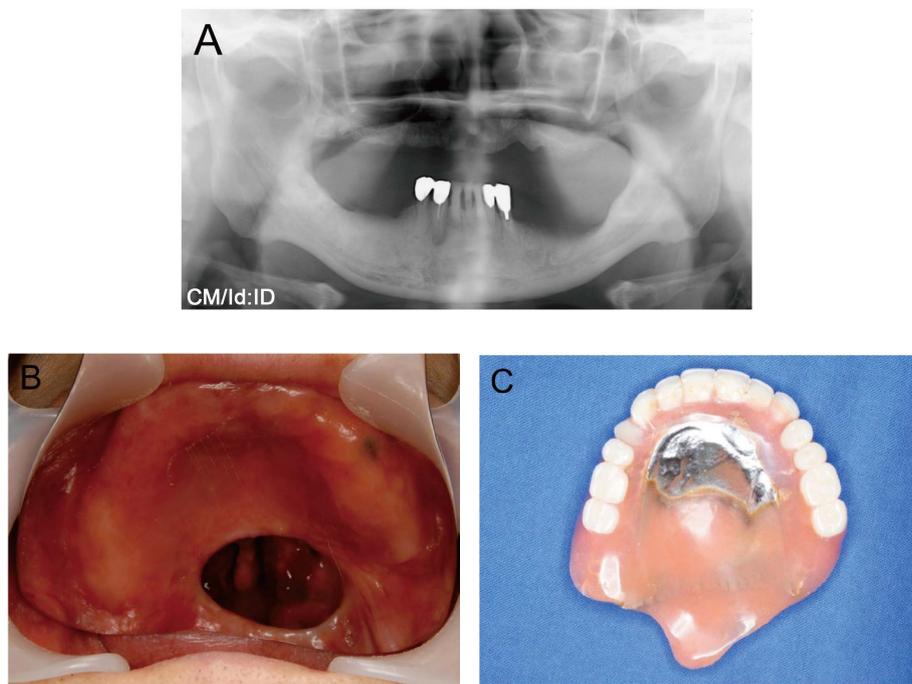
Open oro-nasal defects, resulting from the resection of oral tumors need structural and functional rehabilitation using dental prostheses. Conventional removable prostheses are usually indicated, and are applied with follow-up observations for tumor recurrence. Fabrication of a maxillary obturator is relatively easy for dentate patients. However, in patients with an edentulous maxilla, retention and stability of the prosthesis are problematic and will cause dysfunctions of mastication and pronunciation [1] [2]. Implant-supported full fixed prostheses (ISFPs) for the rehabilitation of edentulous jaws using osseointegrated implants have been getting popular among dental clinicians. An increasing number of publications on IPSPs in edentulous jaws have appeared in the literatures, and high survival rates and the technical advantages and simplification are widely reported. Recent several clinical studies have reported that tilting of the implants may represent another practical treatment option. Such technique is related to several surgical and prosthetic advantages, such as the possibility of placing long implants with improvement of bone anchorage, the reduction of the need for the maxillary sinus lifting, the improvement of the distribution of implant loading force. Furthermore, no difference in the marginal bone loss between tilted and axially placed implants has been reported. These treatment therapies showed the excellent result of implant survival rate and prosthesis survival rate [3]. Few case reports have described implant rehabilitation for edentulous patients following maxillectomy due to oral surgery [4] [5].

We present herein the case of a patient, treated using implant-supported full fixed prostheses (ISFPs) with a removable oro-nasal obturator for an edentulous maxilla with palatal fistula due to surgical procedures for oral cancer.

## 2. Case Report

A 70-year-old Japanese man was referred to our hospital, complaining of instability of a prosthesis causing dysfunctions of mastication and pronunciation. He had undergone surgery for maxillary gingival cancer in May 2012, which had resulted in an edentulous maxilla with palatal fistula. Conventional removable prostheses were applied and post-operative follow-up observations were performed (Figure 1). Because of the edentulous maxilla, stability of the prosthesis was unfavorable, and the patient reported discomfort during mastication and pronunciation. The practical classification needs to relate the likely aesthetic and functional outcomes of a maxillectomy for the rehabilitation. According to the Brown classification, the defect was classified as 2-A [5]. To obturate the defect, a prosthesis comprising complete dentures with an obturator part was used. The obturator was attached to the posterior part of the denture. Panoramic radiography showed reduced alveolar bone volume in the left molar region. Before primary tumor excision, the denture had shown adequate suction properties without being detached. However, after surgery, the denture could not maintain adequate stability.

After evaluating maxillary bone condition on CT, to improve stability of the prosthesis and masticatory and pronunciation functions, treatment using full-arch fixed prostheses supported by a combination of axially and non-axially positioned implants and a



**Figure 1.** (A) Panoramic radiography before treatment with implant prostheses; (B) Palatal view of the anatomical defect following partial maxillectomy in the edentulous patient; (C) Prosthetic complete denture with obturator in the posterior part.

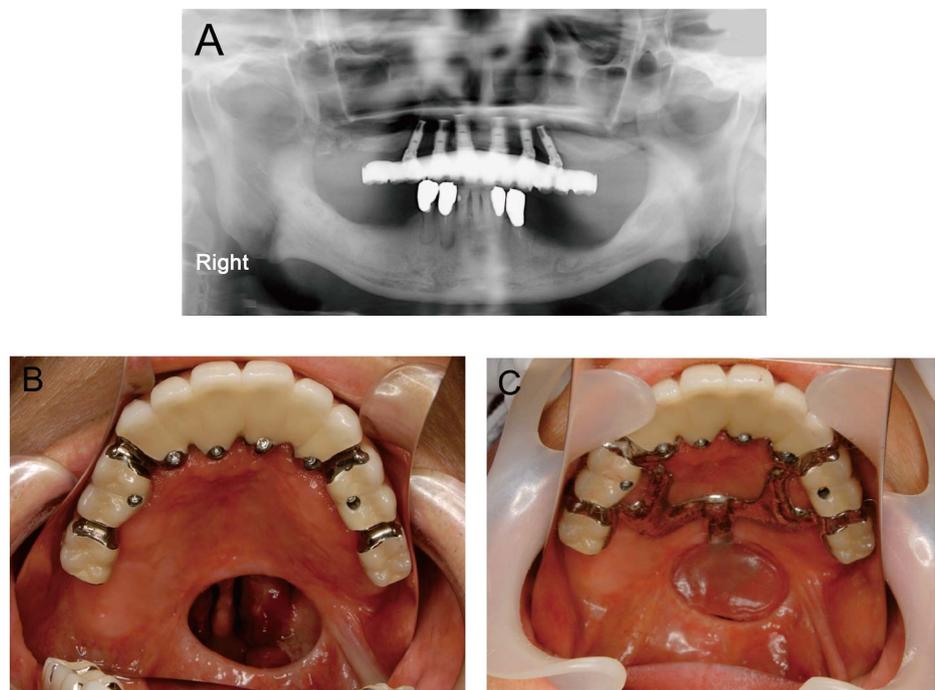
removable oro-nasal obturator was selected. A total of 6 implants were inserted into the crestal region between both sides of the first molar region without any bone transplantation. Implant surgery was performed as described by Malo *et al.* under local anesthesia [6] [7]. A crestal incision was made from the first molar region on the contralateral side. The incision started on the lingual side of the crest, and a small flap was reflected in order to preserve vascularization. The patient received six implants (Brånemark System®; Nobel Biocare AB, Göteborg, Sweden) according to previously used protocols [8]-[12]. In the maxilla, the most distal implants were placed, proximal to the anterior wall of the maxillary sinus. Implants were inserted with a maximum angulation of about 30° relative to the occlusal plane. Where perforation of the sinus membrane was considered a risk, the drilling axis was corrected using the drilling guide.

Conventionally, the non-loading healing period was used to protect implants from undesirable loading stress, which could cause inappropriate micromotion in the implant resulting in a loss of osseointegration [13] [14]. During the healing period after surgery, the patient often wore a transitional removable prosthesis. On October 2013, abutments were connected to the implants. Standard abutments were placed over the anterior implants. On distal implants, abutments angled several degrees with respect to the long axis of the fixture were positioned to obtain an optimal orientation for prosthetic screw access. These abutments emerged in the second premolar position.

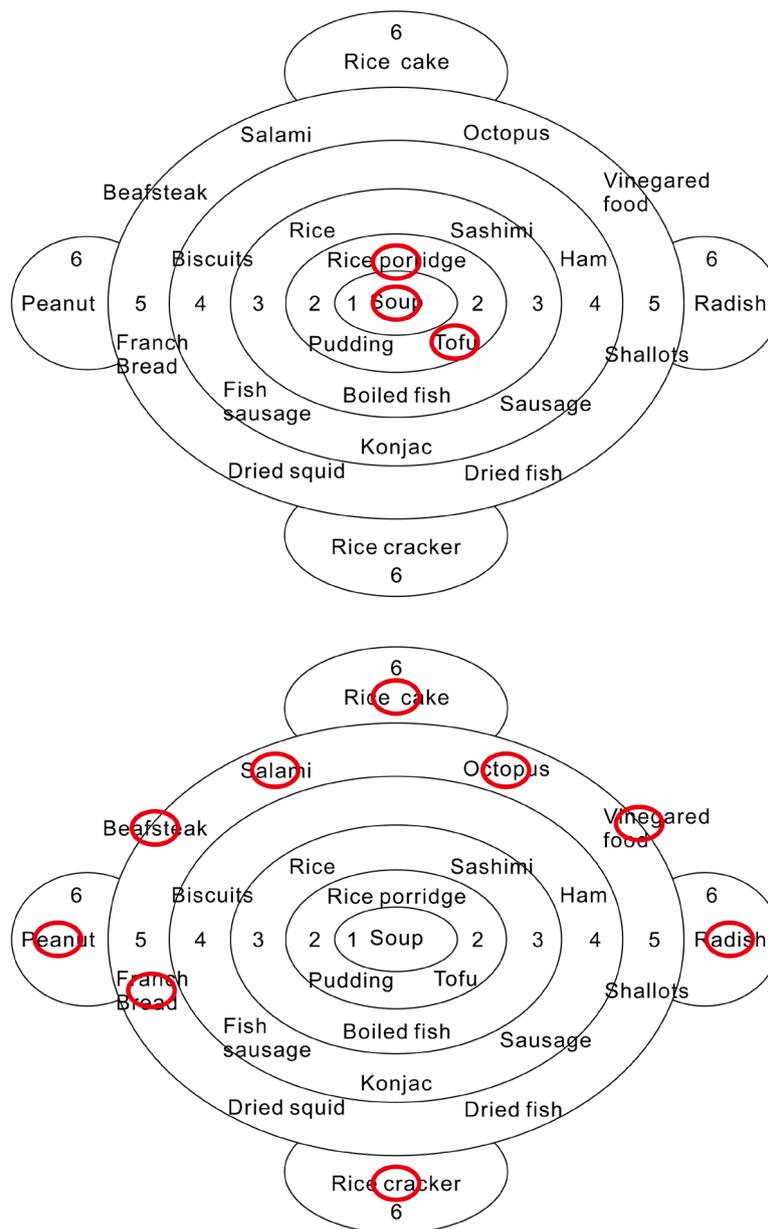
The temporary ISFPs were made of auto-polymerizing acrylic resin with a cast metallic-frame. On February 2014, in the absence of pain and inflammation, the patient

underwent the final prosthetic protocol. The final prosthesis was laboratory-processed using the CAD-CAM Procera® System (Nobel Biocare AB, Göteborg, Sweden). In addition, the removable oro-nasal obturator was set for the palatal defect as planned. After setting the final prosthesis (**Figure 2**), the patient was seen at 3- to 6-month intervals. Orthopantomographs and periapical radiographs were taken to assess the marginal bone loss and overall bone level throughout the study. At the 2-year review visit, stability of the implants and prostheses as well as proper occlusion had been obtained.

Mastication and pronunciation were evaluated, using the modified Yamamoto classification system and speech articulation test [15]. Masticatory function improved to levels 5 and 6 after prosthesis application from levels 1 and 2 before prosthodontic implant treatment. The levels of the classification system are shown in **Figure 3**. Pronunciation function was also improved. Single character pronunciation improved to 18% from 8%, and single word pronunciation improved to 93% from 57%. In sentence pronunciation, an improvement from level 2 to level 4 was obtained. A 70-year-old Japanese man was referred to our hospital, complaining of instability of a prosthesis causing dysfunctions of mastication and pronunciation. He had undergone surgery for maxillary gingival cancer in May 2012, which had resulted in an edentulous maxilla with palatal fistula. Conventional removable prostheses were applied and postoperative follow-up observations were performed (**Figure 1**). Because of the edentulous maxilla, stability of the prosthesis was unfavorable, and the patient reported discomfort during mastication and pronunciation. According to the Brown classification, the defect



**Figure 2.** (A) Panoramic radiograph after treatment with implant prostheses; (B) Palatal view after treatment with implant prostheses without removable obturator; (C) Palatal view after treatment with implant prostheses with removable obturator.



**Figure 3.** Modified Yamamoto classification system. The figure shows the level of masticatory ability (level 1 to 6). Classification depends on the kind of meals that the patient can eat. Red circle indicates food that the patient can eat. Masticatory efficiency is at level 1 to 2 before prosthodontic treatment (top), improving to level 5 and 6 after implant prosthodontic treatment (bottom).

was classified as 2-A [6]. To obturate the defect, a prosthesis comprising complete dentures with an obturator part was used. The obturator was attached to the posterior part of the denture. Panoramic radiography showed reduced alveolar bone volume in the left molar region. Before primary tumor excision, the denture had shown adequate suction properties without being detached. However, after surgery, the denture could not maintain adequate stability.

After evaluating maxillary bone condition on CT, to improve stability of the prosthesis and masticatory and pronunciation functions, treatment using full-arch fixed prostheses supported by a combination of axially and non-axially positioned implants and a removable oro-nasal obturator was selected. A total of 6 implants were inserted into the crestal region between both sides of the first molar region without any bone transplantation. Implant surgery was performed as described by Malo *et al.* under local anesthesia [7] [8]. A crestal incision was made from the first molar region on the contralateral side. The incision started on the lingual side of the crest, and a small flap was reflected in order to preserve vascularization. The patient received six implants (Brånemark System®; Nobel Biocare AB, Göteborg, Sweden) according to previously used protocols [3] [9]-[12]. In the maxilla, the most distal implants were placed, proximal to the anterior wall of the maxillary sinus. Implants were inserted with a maximum angulation of about 30° relative to the occlusal plane. Where perforation of the sinus membrane was considered a risk, the drilling axis was corrected using the drilling guide.

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For this presentation, the written consent to publish from the patient was obtained and our research was approved by the review board of Kindai University School of Medicine.

### 3. Discussion

This represents the first report of a case with full-arch fixed prostheses supported by a combination of axially and non-axially positioned implants and a removable oro-nasal obturator for an edentulous maxilla with palatal fistula due to surgical procedures for oral cancer.

Maxillary tumor resection often causes oro-nasal defects. Primary closure can be achieved by means of immediate reconstruction with a forearm or any other flap. Such structural recovery can produce functional rehabilitation. However, such immediate closure would result in longer surgical and recovery times with increased potential for complications. In addition, discovery and diagnosis of recurrent cancer risks being delayed after immediate closure, and the optimal strategy remains contentious [16] [17]. As a result, immediate closure of the maxillary defect is not performed in many cases. After sufficient observation, secondary closure can be performed with the reconstructive surgery.

In order to address the dysfunction resulting from maxillectomy, conventional removable obturating prostheses are usually indicated and applied with observation for tumor recurrence. When the case involves an edentulous maxilla, retention and stability of the prosthesis is unfavorable and causes dysfunctions of mastication and pronunciation for a long time after surgery.

ISFPs with a removable obturator seem to provide a powerful solution for these patients. The operation was performed with local anesthesia in our case. The application of full-arch fixed prostheses supported by a combination of axially and non-axially positioned implants using the anterior alveolar bone, without any bone transplantation or maxillary sinus elevation, is a minimally invasive surgery. The removable oro-nasal obturator was useful for improving velopharyngeal speech functions and oral cleanliness.

In the present case, the tumor involved the left maxilla and palate. Implant placement was performed in the anterior crestal area from the first molar region to the contralateral side. Six implants were placed as reported in previous studies, using tilted implants, referred to as “all on six”. Although immediate loading could be considered, undesirable loading stress causing inappropriate micromotions in the implant results in loss of osseointegration [13] [14]. The treatment used a two-step method, using the conventional non-loading healing period to protect implants from undesirable loading stress. Once provisional restoration was completed, an oro-nasal obturator made with a plastic splint was set temporarily. Masticatory and pronunciation functions recovered with the provisional prosthesis and temporal obturator. However, for structural reasons, the obturator often broke, and was repaired. In addition, the temporary obturator covered the whole palate, and oral hygiene was not consistently maintained.

For the final prosthesis, these problems of the temporary obturator were addressed. In the final obturator, the palatal bar was made of cobalt-chromium cast metal, and the oral environment was able to be kept clean (**Figure 2**). In addition, the obturator was removable, decreasing the risk of delaying the visual discovery and diagnosis of recurrent cancer.

As for medical costs, ISFPs have been adopted in Japanese hospitals for patients with a maxillary or mandibular defect due to oral surgery, since ISFPs were included in the revision of medical services for fiscal year 2012. Before then, high medical fees had represented a major burden on patients seeking this treatment, which had been performed as a highly advanced medical treatment in limited hospitals because of the medical insurance system in Japan. After the 2012 revision of medical services started, these patients have begun receiving ISFPs as a general medical service covered by insurance.

Obviously, treatment with a fixed restoration on implants gives the patient a high degree of satisfaction, compared with removable dentures. In general, the acceptance of such treatment by patients is extremely favorable [18]. To obtain evidence, we quantitatively evaluated masticatory and pronunciation functions, using the modified Yamamoto classification system and speech articulation test [15]. Mastication improved to level 5 and 6 after prosthesis, compared to level 1 and 2 before implantation according to the classification system. Good improvement of function was obtained in the pronunciation of single characters, word, and sentences with the speech articulation test.

The present treatment produced rigid stability of the prosthesis and obturator, good oral hygiene, and longitudinal observation of the resected area. For a patient with an edentulous maxilla and palatal fistula due to the surgical procedures for oral cancer, full-arch fixed prostheses supported by a combination of axially and non-axially positioned implants and removable oro-nasal obturator could offer an effective treatment alternative.

#### 4. Conclusion

We present herein the case of a patient, treated using implant-supported full fixed prostheses (ISFPs) with a removable oro-nasal obturator for an edentulous maxilla with palatal fistula due to surgical procedures for oral cancer. ISFPs with a removable obturator provide a powerful solution for the patient, and the application of this treatment is a minimally invasive surgery.

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