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Maxillofacial Prosthesis for Partial Edentulism with Maxillary Bone Loss

Hassan El Alaoui El Abidi, Fatima Zahra Ghazzar, Samira Bellemkhannate

Removable Prosthodontics Department, Dental Consultation and Treatment Center, Dental Medicine Faculty, University Hassan II, Casablanca, Morocco
Email: dr.elalaoui@gmail.com

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Abstract

Maxillary bone loss impairs essential functions (chewing, swallowing, speech) and gives patients a very unaesthetic appearance due to the removal of facial support tissues, leading to serious psychological consequences. Treatment is multidisciplinary and requires a resective surgery if the cause is tumor-related, or an additive surgery if the cause is traumatic. This article aims to show the role of making a prosthesis to restore function (chewing, swallowing, speech) and aesthetics following maxillary bone loss. We will eighter present a clinical case involving a right maxillary tumor that was surgically resected followed by radiotherapy, and subsequently rehabilitated with a maxillofacial prosthesis in the consultation and dental treatment center of the university hospital center of Casablanca.

Keywords

Tumor, Maxillary Bone Loss, Maxillofacial Prosthesis, Aesthetics, Function, Quality of Life

1. Introduction

Maxillofacial prosthetics is defined as the art and science of anatomic, functional or cosmetic reconstruction by means of a nonliving substitute of regions in the maxilla, mandible and face that are missing or defective due to surgical intervention, trauma, pathology, developmental malformation or congenital malformation. It is a difficult dental field dealing with disorders of speech, mastication, deglutition and esthetics, adding to this radiotherapy or even chemotherapy, that can complicate the prosthetic rehabilitation in tumor origin cases. The placement

of an immediate, semi-immediate, or temporary palatine plate after the surgery will help ensure comfort during breathing and partially improve facial aesthetics. After complete healing, the fabrication of a maxillofacial prosthesis to replace missing teeth and fill in maxillary bone loss will provide satisfactory speech and chewing function, as well as acceptable aesthetics.

2. Clinical Case

For information, the consent was obtained from the patient to report this case.

Mr. H. H., a 46-year-old man, presented for a consultation in the maxillofacial surgery department due to a localized mass in the maxillary arch (**Figure 1**).

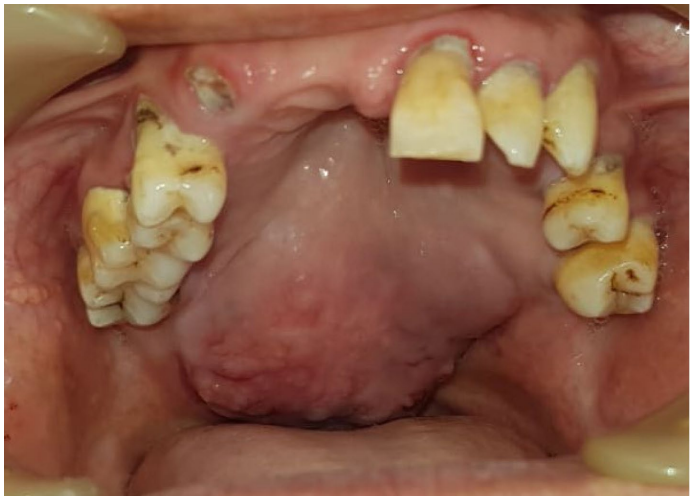

Figure 1. Maxillary arch with palatine tumor.

Figure 2. Mandibular arch.

The interview revealed nocturnal pain and difficulty in chewing, swallowing, and speech.

The clinical examination (**Figure 1** and **Figure 2**), noted a movable excrescence

compared to the adjacent bone that bled upon contact. The mass occupied the hard palate with an extension into the soft palate.

An anatomical-pathological examination was conducted and confirmed a malignant tumor of the adenoid cystic carcinoma type.

Radiological examination showed significant bone lysis in the anterior maxilla (Figure 3), proximity to the right and left sinuses, and persistence of a root of tooth 45 that was impacted (Figure 4).

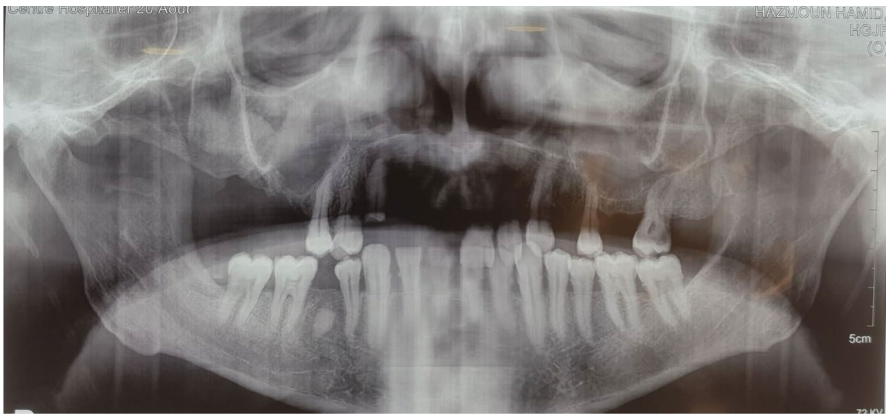

Figure 3. Panoramic X-ray (teeth 16 and 17 extracted with surgical resection).

Figure 4. Retro view of teeth 14 and 15.

2.1. Pre-Surgical Phase

Extraction of the root of tooth 13. After healing, a primary alginate impression was taken (Figure 5), and the resulting plaster model was corrected to simulate the surgical resection (Figure 6). A palatine plate was then created (Figure 7), to be placed post-surgically on the same day; however, the surgical appointment was scheduled earlier.

Figure 5. Alginate impression.

Figure 6. Corrected maxillary model (simulation of surgical resection).

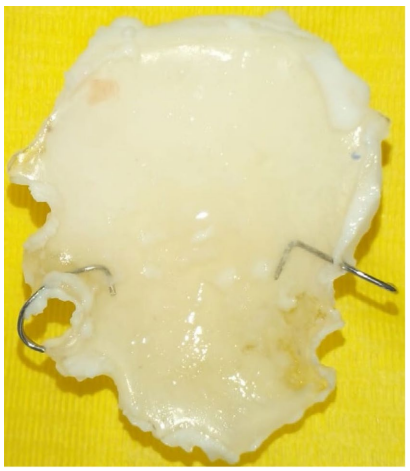

Figure 7. Palatine plate.

2.2. Surgical Phase

Surgical resection with the resection of the tumor tissue with 1cm of protection.

The radiotherapy (dosage 70 grays in 7 weeks, 5 sessions per week at 2 Grays level per session).

2.3. Post-Surgical Phase

One week after the surgery, the palatine plate was adapted by adjusting its edges in the mouth using a bur mounted on a handpiece. Subsequently, tissue conditioning was performed using slow-setting resin (Fitt by Kerr) (**Figure 8**) to provide the patient with comfort during breathing by sealing the buccal-nasal communication and ensuring correct speech while improving healing (the TC is renewed periodically).

Figure 8. Adaptation of the palatine plate and tissue conditioning using slow-setting resin (Fitt by Kerr).

2.4. Phase of Maxillofacial Prosthesis Fabrication

The prosthetic fabrication stage began with a primary mucostatic impression of the post-surgical maxillary with residual teeth, a sterile compress was placed over the area of bone loss to prevent any alginate entrance to the internal structures of the face. The plaster model was used to create an Individual Impression Tray (IIT) (**Figure 9**), which was adapted on the model and then in the mouth. A handpiece with a tungsten carbide bur was used to adjust the IIT in the mouth (edge 2 mm from the bottom of the vestibule on the left side with teeth, releasing the lateral frenum; the right side of the IIT was spaced from the inner cheek since the surgical resection affected the ridge on that side). A parallelometer study was conducted to create a tracing for the metal framework (**Figure 10**). Tooth 14 was exempt from a clasp due to its degree 1 of mobility. After preparing the teeth with a round bur and diamond flame bur, a secondary anatomical-functional impression was taken (surfacing with Polyether "Impregum") (**Figure 11**), and the area of bone loss was covered with a sterile compress to prevent Polyether entrance to the internal structures of the face. The metal framework obtained from the secondary impression was adapted in the mouth, and a flame bur mounted on a turbine was used to eliminate any over-occlusions. An occlusion record was made in

maximum intercuspation (MI) (Figure 12), and the patient's vertical dimension (VD) was confirmed to be correct. The choice of prosthetic teeth was made based on the shape and shade of the remaining teeth. The try-in of teeth arrangement (Figure 13), and the maxillofacial prosthesis mouth-insertion were conducted (Figure 14). Occlusal equilibration and tissue conditioning were performed using slow-setting resin (Soft Liner) on the prosthetic intrados to enhance the support of the maxillofacial prosthesis and promote tissue healing.

Figure 9. Creation of an Individual Impression Tray (IIT).

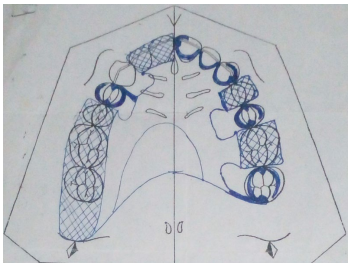

Figure 10. Framework tracing.

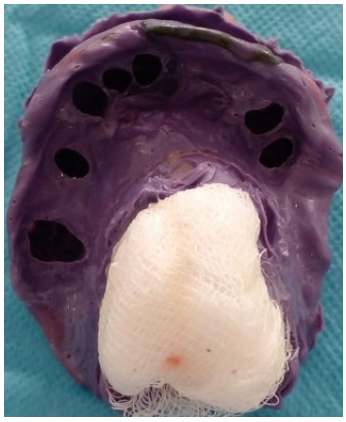

Figure 11. Secondary anatomical-functional impression.

Figure 12. Intermaxillary relationship.

Figure 13. Try-in of the tooth arrangement.

Figure 14. Insertion of the prosthesis.

The follow-up of the patient didn't show any complication with this prosthetic rehabilitation, and the patient was satisfied with his prosthesis (both in function and esthetic).

3. Discussion

Post-surgical maxillary bone loss due to malignant tumors causes severe defects, leading to difficulties in chewing, swallowing, speech, olfaction, and taste, as well as nasal secretions leaking into the oral cavity and aesthetic and psychological issues [1] [2]. Treatment with a semi-immediate (temporary) obturator, followed later by a definitive obturator, can correct these defects, allowing for comfortable breathing, good chewing [3], correct speech, and satisfactory aesthetics, ultimately resulting in patient satisfaction [4].

For therapeutic purposes, several authors have classified these maxillary bone losses [5]. Devauchelle's classification is the most interesting:

Type I: Bone loss affecting the hard palate while preserving the alveolar dental arch:

(a): Anterior location;

(b): Posterior location.

Type II: Bone loss involving the alveolar dental arch:

(a): At the incisor-canine block;

(b): Laterally.

Type III: Bone loss of one hemi-palate.

Type IV: Total bone loss.

Several types of obturators are available [6]:

The immediate obturator, created before surgery and placed right after the resective surgery, which helps the healing of the tissues surrounding the maxillary substance loss, and reduces the psychological impact [7];

The temporary obturator, which allows the patient to restore proper eating and speech during the fabrication of their definitive prosthesis [8]-[10];

The definitive obturator, which is better suited to the extent of the bone loss and the remaining maxillary structures.

These obturators can be full or hollow, with the choice depending on the clinical situation.

The hollow obturators are indicated to help ensure retention in the maxilla in case of heavy prosthesis.

The full obturators are indicated in small maxilla bone loss [11].

The maxillofacial prosthetic rehabilitation is a challenge due to the specific anatomical characteristics of the remaining bones and mucous tissues. The treatment is individual [11].

The therapeutic prognosis will depend on several parameters:

- The volume of the bone loss and its location [12];
- The presence of remaining teeth [13];
- The use of an immediate prosthesis [2] [7];
- The prompt management of maxillary bone loss cases due to the severe impairment of essential functions (eating and speech) [14];
- A multidisciplinary approach for the care of these patients (collaboration between the dentist, maxillofacial surgeon, and oncologist) [15];
- Collaboration between the dentist and the prosthetist to achieve quality work [16];
- Maintenance of the prosthesis by the patient (daily hygiene) [15];
- Periodic adjustments through tissue conditioning [17].

Digital technologies "computer aid design and manufacturing CAD-CAM" can improve maxillofacial prosthesis with:

Camera's scanning the maxilla defects with a precision (resolution 30 microns) [13];

3D camara's and software's (modjaw) helping in the acquisition and reconducting the static and dynamic occlusion;

Print software's and 3D printers to produce the prosthetic pieces.

Digital technologies can highly improve the making of orthosis if the maxilla defects touch the face with:

Perfect symmetric facial structures reconducted;

A large panel of silicone colors and shades.

4. Conclusion

After loss of the maxilla following tumor surgery, a maxillofacial prosthesis will allow patients to maintain their facial aesthetics, self-esteem, and comfort during functions such as eating and speaking correctly. Currently, there is a notable contribution from implantology through the development of prosthetic retention methods, implants, the advancement of digital imaging providing a very high level of prosthetic precision, and the introduction of new materials like silicones that offer colors and textures very close to that of the skin.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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