

Original Research Article

Oral rehabilitation after squamous cell carcinoma mandibular resection

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Abstract – Introduction: Squamous cell carcinoma of the oral cavity is the most common cause of mandibular defect. The functional and aesthetic impacts of this surgery must be considered. The number of mandibular resections depends on the TNM classification of the tumor. Mandibular reconstruction by a fibula free flap has become the gold standard. Unfortunately, not all mandibular resections are rehabilitated. The purpose of this study is to evaluate oral rehabilitation after mandibular resection in patients with squamous cell carcinoma. **Materials and methods:** A retrospective study was conducted to evaluate oral rehabilitations according to the type of surgical resection and reconstruction. The secondary evaluation criteria were type of rehabilitation, implant success rate, post-radiotherapy delay, rehabilitation success rate, and causes of non-rehabilitation. **Results:** The study included 157 patients with mandibular resection. Of the patients, 26.7 percent received oral rehabilitation. All rehabilitation with implants was functional. The main causes of non-rehabilitation were death or recurrences related to the progression of the disease, postoperative anatomical difficulties, and cost of oral rehabilitation. **Conclusion:** Oral rehabilitation after mandibular resection surgery is insufficient. A rehabilitation unit including a maxillofacial surgeon, oral surgeon, and dentist is essential. Implementation of the unit should be considered as soon as possible. The cost of rehabilitation should not be a limiting factor.

Introduction

Squamous cell carcinomas of the oral cavity are the most common cause of mandibular defect [1]. Surgical reconstruction treatment for mandibular defect has many consequences. Functional consequences include alteration of chewing, swallowing, and phonation. Aesthetic damages can be perceived by patients as mutilation. However, every mandibular defect should receive adequate oral rehabilitation.

Since Hidalgo first described the procedure in 1989 [2], reconstruction of a total mandibular defect with a microvascular fibula free flap has become the gold standard [3,4]. It enables oral rehabilitation using intraosseous implants and has an excellent survival rate ranging from 85 to 98 percent [5–7].

However, when conditions do not allow for the free-flap procedure, reconstruction with a titanium plate is possible [8]. This technique is particularly useful in lateral mandibular

resections. The mandibular defect may also be incomplete after a partial mandibulectomy when the tumor is localized.

Oral rehabilitation in squamous cell carcinoma patients poses a challenge in treatment plans [9]. Several difficulties must be considered; for example, the postoperative anatomical changes are directly related to surgery or secondary to radiotherapy, and the financial aspect has a significant impact because the treatment currently depends on strict indications.

Oral rehabilitation is based on one of two axes: implant or simple prosthesis rehabilitation. Implant rehabilitation is the most innovative. The prosthesis is called an “implant-supported prosthesis” for the replacement of single teeth or the support of a bridge. The prosthesis can also be removable from the implants, which allows the prosthesis to be retained by an attachment system on a minimum of two implants. This creates a push-button mechanism; for example, locators are supported with supraconstruction for removable dentures. Simple prosthesis rehabilitation is performed with a partial or full removable denture; however, this rehabilitation keeps all its place.

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Table I. Patient distribution.

<i>N</i>	Partial mandibulectomy <i>n</i> = 62 (%)	Total mandibulectomy reconstructed with a titanium plate <i>n</i> = 36 (%)	Total mandibulectomy reconstructed with a fibula flap <i>n</i> = 59 (%)
		Sex	
Female	23 (37)	12 (38)	13 (22)
Male	39 (63)	24 (64)	46 (78)
		Age	
<50 years	4 (6)	2 (6)	5 (9)
50–60 years	11 (18)	9 (11)	16 (27)
60–70 years	23 (37)	11 (30)	22 (37)
70–90 years	18 (29)	14 (39)	16 (27)
>90 years	6 (10)	0 (0)	0 (0)
		T	
T0	0 (0)	0 (0)	2 (4)
T1	16 (26)	0 (0)	0 (0)
T2	16 (26)	5 (14)	3 (6)
T3	6 (10)	0 (0)	1 (2)
T4	24 (38)	29 (80)	53 (88)
		N	
NX	2 (3)	0 (0)	0 (0)
N0	41 (66)	11 (30)	21 (35)
N1	7 (11)	8 (23)	7 (12)
N2	8 (14)	11 (30)	24 (41)
N3	4 (16)	6 (17)	7 (12)
		RADIOTHERAPY	
RADIOTHERAPY +	31 (50)	28 (77)	55 (94)
RADIOTHERAPY –	31 (50)	8 (23)	3 (6)

A retrospective study was conducted involving 157 patients over five years. The main objective of this work was to evaluate the rate of oral rehabilitation following a partial or total mandibulectomy as part of the surgical treatment of cancer of the oral cavity. The type of mandibular reconstruction was also considered in the main criteria.

Materials and methods

A retrospective study including 157 patients was carried out in the Maxillofacial Surgery Department of Purpan Hospital in Toulouse, France from January 2014 to December 2019. All the patient files included in the study were discussed during a multidisciplinary meeting on cancers of the upper aerodigestive tract.

Inclusion criteria were surgical management of the department and mandibular resection for squamous cell carcinoma. The TNM stage was defined according to the TNM AJCC classifications of the 7th edition for certain cases and the 8th edition for cases since 2017.

Exclusion criteria were patients operated on in another hospital, absence of mandibular resection surgery, and

different histological types of squamous cell carcinoma (sarcoma, keratocyst, or ameloblastoma).

All patients who underwent oral rehabilitation were evaluated, and the type of oral rehabilitation was recorded. Patients were classified into three groups according to the type of surgery and reconstruction (Tab. I):

- Partial mandibulectomy.
- Total mandibulectomy reconstructed with a titanium plate.
- Total mandibulectomy reconstructed with a fibula flap.

The main criterion was the percentage of oral rehabilitation in patients with mandibular resection for squamous cell carcinoma.

The secondary criteria were as follows:

- The rate of oral rehabilitation according to the resection surgery.
- The type of oral rehabilitation according to the resection surgery.
- The implant success rate.
- The success of implant rehabilitation.
- The success of prosthetic rehabilitation.



Fig. 1. Distribution of oral rehabilitations according to the resection surgery.

- The delay between the end of radiotherapy and implantation.
- The delay between surgery and the end of rehabilitation.
- The causes of non-rehabilitation.

The implant success rate was calculated according to Albrektsson *et al.*'s criteria and by prosthetic loading of the implant [10].

Results

From January 1, 2014, to December 31, 2019, 805 patients were considered in multidisciplinary meetings; 157 of those patients were included in the study. Data were collected from April to September 2020. Of the 157 cases in this study, 27 percent (42 patients) were eligible to receive oral rehabilitation.

The rate of oral rehabilitation according to the resection surgery was divided as follows (Fig. 1):

- Partial mandibulectomy: 20 patients (32%).
- Total mandibulectomy reconstructed with a titanium plate: 7 patients (19%).

- Total mandibulectomy reconstructed with a fibula flap: 15 patients (25%).

The type of oral rehabilitation according to the resection surgery was as follows:

- Implant rehabilitations (11 patients): fibula flap (6 patients; 10%), titanium plate (3 patients; 8%), partial mandibulectomy (2 patients; 3%).
- Prosthesis rehabilitations with full or partial dentures (30 patients): fibula flap (8 patients; 13%), titanium plate (4 patients; 11%), partial mandibulectomy (18 patients; 29%).

Eleven patients received implant rehabilitation. A total of 22 implants were placed with the purpose of implant rehabilitation stabilized by two symphysis implants. The implant success rate was 91 percent. One implant rehabilitation was not successful; the patient's cancer had evolved to the point of death.

All patients who received implant rehabilitation wear the aesthetic and functional prosthesis daily. The cost of the implants was fully covered by social security. Patients with an implant-stabilized prosthesis benefitted from partial or total

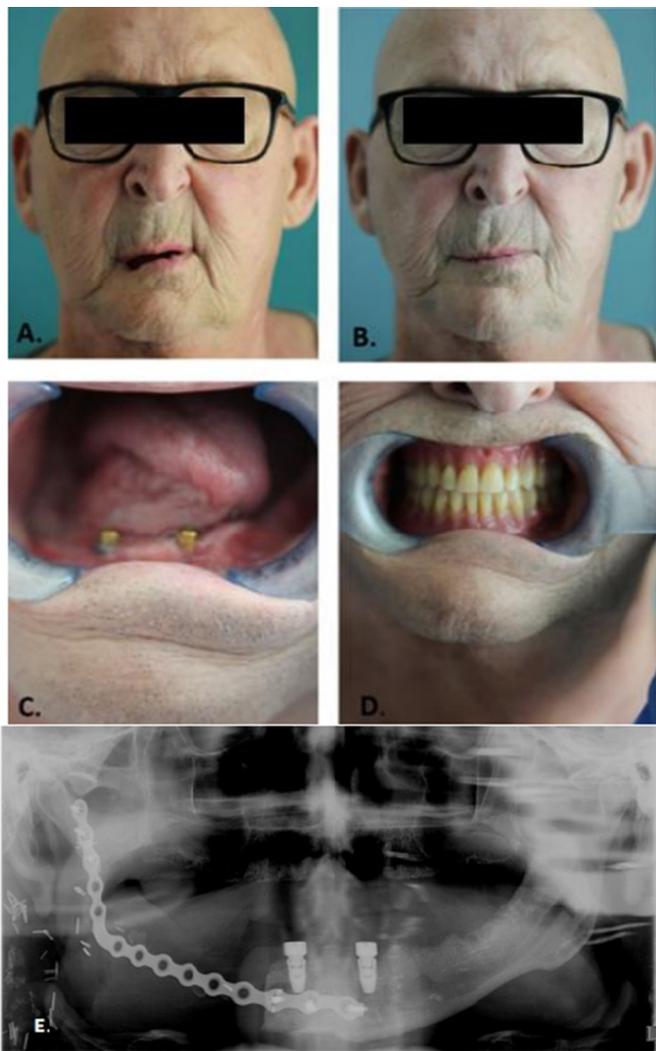


Fig. 2. (a) CASE 1: No endo-oral prosthesis, lower right lip gap. (b) Placement of maxillary and mandibular prostheses, correction of the gap. (c) Locator on 2 implants in symphysis position. (d) Occlusion after fitting the prostheses. (e) Orthopantomogram: Reconstruction with a titanium plate from the right mandibular angle to the symphysis, 2 symphysis implants on the native bone.

care by a special health service (Action Sanitaire et Santé) (Figs. 2 and 3).

Rehabilitation by removable prosthesis was carried out in 71 percent of cases (30 patients). The prosthesis was made by the department dentist or a private dentist. Less than half of the patients wear the removable prosthesis daily. Half of the patients did not receive full financial support for the removable prosthesis (Fig. 4).

External radiotherapy was performed on 74 percent of rehabilitated patients, including 82 percent of those who received implant rehabilitations. The average time between the end of the radiotherapy and the implantation was 22.1 months (ranging from 8 to 37 months). The average time for loading



Fig. 3. (a) CASE 2: No endo-oral prosthesis. (b) Placement of maxillary and mandibular prosthesis, projection of upper and lower lip. (c) Orthopantomogram: Fibula flap reconstruction from the right mandibular angle to the left para symphysis with two implants on the fibula. (d) Locator on two implants in the symphysis position.

implants was 9.7 months (ranging from 3 to 21 months). All implant rehabilitations were performed by the same dentist in the Maxillofacial Surgery Department.

The average delay between reconstructive surgery and exclusive prosthetic rehabilitation was 17.6 months (ranging from 10 to 40 months) for half of the patients. The delay for the other half of the patients could not be determined, as some of the rehabilitations were performed by a private dentist (Tab. II).

Of the patients in the study, 73 percent (115 patients) were not able to be rehabilitated (Fig. 5). The main cause (48%) was related to carcinological evolution through locoregional recurrence or death (15% and 33%, respectively). In addition, 19 percent of patients experienced postoperative difficulties that complicated rehabilitation. These difficulties were directly related to surgery (vertical bone defect, soft tissue remodeling) or secondary to radiotherapy (xerostomia, mucositis, oedema, and osteonecrosis). Finally, 14 percent of patients were suggested for rehabilitation that was not realized due to financial constraints, rejection of further surgery for implant rehabilitation, and lack of motivation.

Discussion

Surgery to remove squamous cell carcinomas from the mandible is perceived as mutilating surgery. Much progress has been made in recent decades to reconstruct the mandible as fully as possible. Oral rehabilitation using dental implants has been the goal of mandibular reconstruction since 1994; its ultimate aim is to restore both oral and aesthetic functions [11].

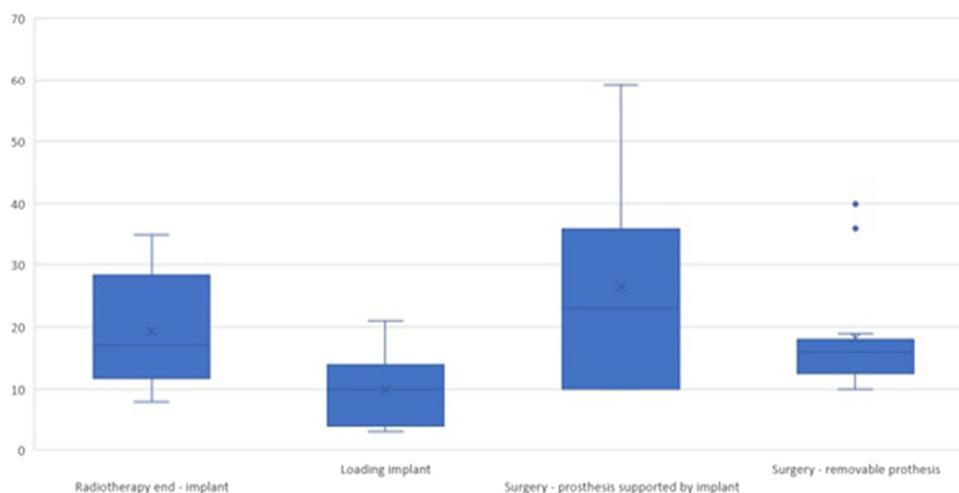
Table II. Delay between different rehabilitation steps.

Fig. 4. (a) CASE 3: No intraoral prosthesis. (b) Fitting of the removable prosthesis. (c) Anteriorly edentulous. (d) Occlusion after partial denture insertion. (e) Orthopantomogram: Right anterolateral partial mandibulectomy.

Our study showed oral rehabilitation in 27 percent of patients. Eleven patients (7%) had functional implant rehabilitation with a removable prosthesis stabilized by two implants; in the literature, functional implant rehabilitation has been reported for 22 percent [12,13], 34 percent [6] and 24 percent [5], of the patients.

On average, two implants were placed for each patient, which is fewer than the average recorded in other literature [2,5,12–14]. This likely has a functional explanation: social security in France reimburses a maximum of two mandibular implants.

The delay in loading the implants was longer in our study (9.7 months) than in that of Bodart *et al.* (7.6 months) (ranging from 6 to 10 months) [14]. Implant loading was earlier in patients who did not receive radiotherapy (three months). Of the implants, 82 percent were placed in irradiated territory, which is higher than described in previous literature; for example, in Bodart *et al.*'s work, 60 percent of implants received radiotherapy.

Every loaded implant was used for the prostheses; the study recorded no loss of implants. Only one patient was unable to complete implant rehabilitation due to death following the progression of the disease. This rate of success is higher than that found in previous literature, in which four to thirty-eight percent of implants were nonfunctional and not used during loading [6,13–15].

Conclusion

We believe that oral rehabilitation should be proposed to all patients. The procedure must be adapted according to the local anatomy, the risk of recurrence, comorbidities, and the wishes of each patient. This rehabilitation should be carried out in an oral rehabilitation unit including a maxillofacial surgeon, an oral surgeon, and a dentist. Mandibular reconstruction can

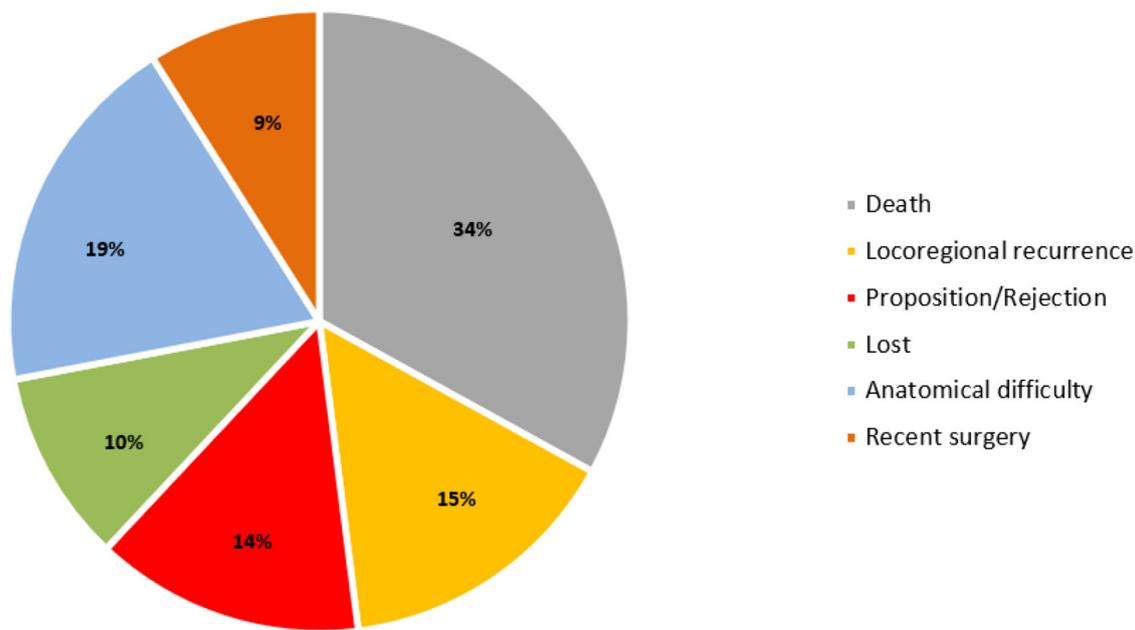


Fig. 5. Distribution of causes of non-rehabilitations.

bring comfort and improve the quality of life of each patient due to its functional and aesthetic advantages. The financial aspect of the procedure should not be a barrier to the rehabilitation. Prostheses on implants and simple removable prostheses must completely take care of the sequelae of tumors in the oral cavity, as well as the two mandibular implants.

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Informed consent: The author declare that informed consent not required.

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