

Quality of life in oncologic patients after maxillectomy operations: clinical case series on different rehabilitation protocols

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Abstract. – OBJECTIVE: The study's purpose was to compare the quality of life (QoL) in oncologic patients treated with different rehabilitation protocols following maxillary tumor resections.

PATIENTS AND METHODS: The patients were divided into three groups. Group A: 18 patients with maxillary obturator prosthesis. Group B: 17 patients with simultaneous autologous tissue reconstruction. Group C: 12 patients with prosthesis on zygomatic implants. The post-operative QoL was compared using standard questionnaires, investigating items like pain, mood, social relations, and specific functions that could potentially compromise the post-operative QoL. A secondary analysis compared reconstructed vs. non-reconstructed patients.

RESULTS: Most questionnaire items did not show significant differences among groups. Statistically significant outcomes were found in two parameters (social contact and sexuality), in which patients treated with zygomatic implants had the best satisfaction, and patients with obturator prostheses showed the lowest satisfaction. Patients belonging to the non-reconstructed group showed better moods than those in the reconstructed group, while taste problem complaints and pain were lower in the reconstructed group.

CONCLUSIONS: Although the type of reconstruction procedure depends on the type of maxillectomy to be performed and on the general health situation of each patient, the impact of the rehabilitation protocol on the patients' QoL should be accounted for when planning the treatment.

Key Words:

Maxillectomy, Maxillary tumors, Oncologic patients, Maxillary obturator prosthesis, Autologous tissue flaps, Zygomatic implants, Quality of life questionnaire.

Abbreviations

QoL: Quality of Life; TNM: Tumor-Nodes-Metastases staging; UW-QOLv4: University of Washington Quality of Life Questionnaire; EORTC QLQ-N&H35: European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Version 3.0; OHRQoL: Oral Health-related Quality of Life; MHI: Mental Health Inventory; FACE-Q: A patient-reported outcome measure that can be used to measure outcomes of aesthetic facial procedures and products from the patient's perspective; VAS: Visual Analogue Scale.

Introduction

Management of oral cancer is a challenging situation for the oncologic surgeons, and the therapeutic choice mostly depends on the histological type of the tumor and TNM (Tumor-Nodes-Metastases)¹⁻⁵. Currently, the protocols for the treatment of maxillary tumors include surgery, radiotherapy, and chemotherapy^{6,7}. Maxillectomy is the gold standard for tumors from T1-T4 (T: Tumor), N0-N3 (N: Nodes), and the type of reconstruc-

tion to be programmed obviously depends on the classification of maxillectomy to be performed⁴. In 2001, Okay et al⁸ proposed a classification that focuses on the potential residual function of the unresected maxilla from a rehabilitation point of view which is widely used today⁸. On the other hand, in 1999, Brown et al⁹ classification focused on both surgical and post-maxillectomy rehabilitation concepts, which can be used as a reference to plan the best maxillary rehabilitation for each type of maxillectomy.

In cases of small defects, the first choice is the use of local flaps. Conversely, in middle- to large-sized defects, rotation or free flaps are utilized with various types of prosthesis and dental implant placement whenever needed. Furthermore, traditional implantology provides valuable help in oncological rehabilitation, especially in small maxillectomies with sufficient maxillary alveolar bone. However, in cases of larger defects, the implants may have impaired primary stability, which might be related to the quality of the donor bone, and this can cause implant failures as a result¹⁰. Furthermore, in large defects, the cantilever forces on the prostheses that take anchorage from implants can be excessive and have a negative impact on the remaining teeth and the implants themselves¹¹.

In cases of total maxillectomy, traditional implants cannot be used for oral rehabilitation. As an alternative, zygomatic implantology was introduced in 1998 by Branemark¹² for cases of severe atrophy and large defects following resection of maxillary tumors. Today, zygomatic (and pterygoid) implantology is accepted as a valuable option in selected cases, allowing for partial or complete rehabilitation of the upper arch¹³.

The studies¹⁴⁻¹⁷ that evaluate the patients' Quality of Life (QoL) following oncologic surgery of the head and neck area use various questionnaire tests such as UW-QoLv4 (University of Washington Quality of Life Questionnaire), EORTC QLQ-H&N35 (European Organization for Research and Treatment of Cancer Quality of Life Questionnaire), OHRQoL (Oral Health-related Quality of Life), MHI (Mental Health Inventory), FACE-Q (Patient-reported outcome to measure outcomes of aesthetic facial procedures), and VAS (Visual Analogue Scale). However, there are no reports in the literature that compare the QoL outcomes of different therapeutic methods for maxillectomy among them.

To make a better decision, it would be important for the surgeons/clinicians to understand the

post-operative/post-treatment situation from the patients' point of view. At this point, it would be crucial to evaluate all the treatment options and offer patients alternative solutions that can match their situation. For this purpose, QoL tests aim to evaluate the patients' satisfaction and life quality following any kind of therapy. Especially in oncologic patients, lifetime expectations can be limited, and as a result, positive outcomes in a short time would be the most wanted solution. Furthermore, many patients cannot receive any prosthetic rehabilitation due to the anatomical restrictions following reconstructive surgery, which can result in a critical decrease in their quality of life. Due to these reasons, this study aimed to provide clinicians with information on the post-operative/post-treatment quality of life differences among these aforementioned alternative therapy solutions. For this purpose, patients who had been rehabilitated with maxillary obturator prosthesis, patients who received a simultaneous reconstruction with autologous tissue, and patients who had zygomatic implants inserted were compared in terms of QoL after surgery using EORTC QLQ-H & N35¹⁸ and UWQOLv4¹⁹ questionnaires. In each group, the specific functions that can potentially compromise the QoL after a maxillectomy surgery were investigated. The effect of reconstruction procedures on QoL was also assessed.

Patients and Methods

This multi-centric retrospective research study included three groups of patients that were collected from three Maxillofacial Surgery centers, namely the Hospital Maggiore della Carità di Novara, the AOU City of Health and Science - Molinette Hospital of Turin, and the Galeazzi Orthopedic Institute of Milan. The study followed the principles laid down in the Declaration of Helsinki on medical protocols and ethics. All participants signed an informed consent for the surgical interventions and, subsequently, agreed on the phone for the use of clinical data for research purposes. An institutional Ethics Board permission for retrospective research was obtained for this study (Institutional Scientific Review Board of IRCCS Orthopedic Institute Galeazzi, Milan, Italy. Authorization number: Prot. Dsc. 75/2019-L2057).

Patients were selected using diagnostic search criteria (tumor pathology) crossed with surgical

ones (maxillectomy) between patients treated in the clinics in the period February 2010-June 2021. All the patients that had maxillectomy operations were recruited based on the type of surgery (partial or total maxillectomy).

Inclusion Criteria

- Adult patients (older than 18 years old; no other age limit was set for age);
- Patients that had not received any medical treatments that could prevent surgery;
- Patients that had received maxillectomy (partial or total maxillectomy) operations for oncologic purposes or with conditions with potential for subsequent malignant transformation;
- Patients who agreed to participate in the study by answering quality of life surveys by mail.

Exclusion Criteria

- Patients who had been operated for non-oncologic reasons;
- Patients that had osteonecrosis of the jaws due to medications.

The null hypothesis was: No therapy was more beneficial than others in terms of improvement in QoL.

Study Groups

- Group A: Patients who were rehabilitated with maxillary obturator prosthesis (Figures 1-2 show a patient from Group A).
- Group B: Patients who received a simultaneous maxillectomy and reconstruction with autologous tissue (regional or free flaps). Five of these patients were rehabilitated with either fixed or removable prostheses. The rehabilitation of a



Figure 1. Intra-oral representative view of one of the patients from Group A who was rehabilitated with hemi-maxillary obturator prosthesis on the left side of the maxilla. **A-C**, Intra-oral view showing maxillary defect. **B-D**, Intra-oral view showing obturator prosthesis placed.



Figure 2. Obturator prosthesis of the same patient from Group A photographed from different angles.

patient from Group B can be seen in Figures 3-4.
- Group C: Patients who were rehabilitated with fixed prosthesis on zygomatic implants (Noris Medical Ltd., Nesher, Israel). Rehabilitation of one of the patients from Group C can be seen in Figures 5-7.

Outcome Measures

Data collection included demographics, medical history, and questionnaire forms. The primary outcome variables of this study were based on the questionnaire forms obtained. Patients were contacted by telephone and chose

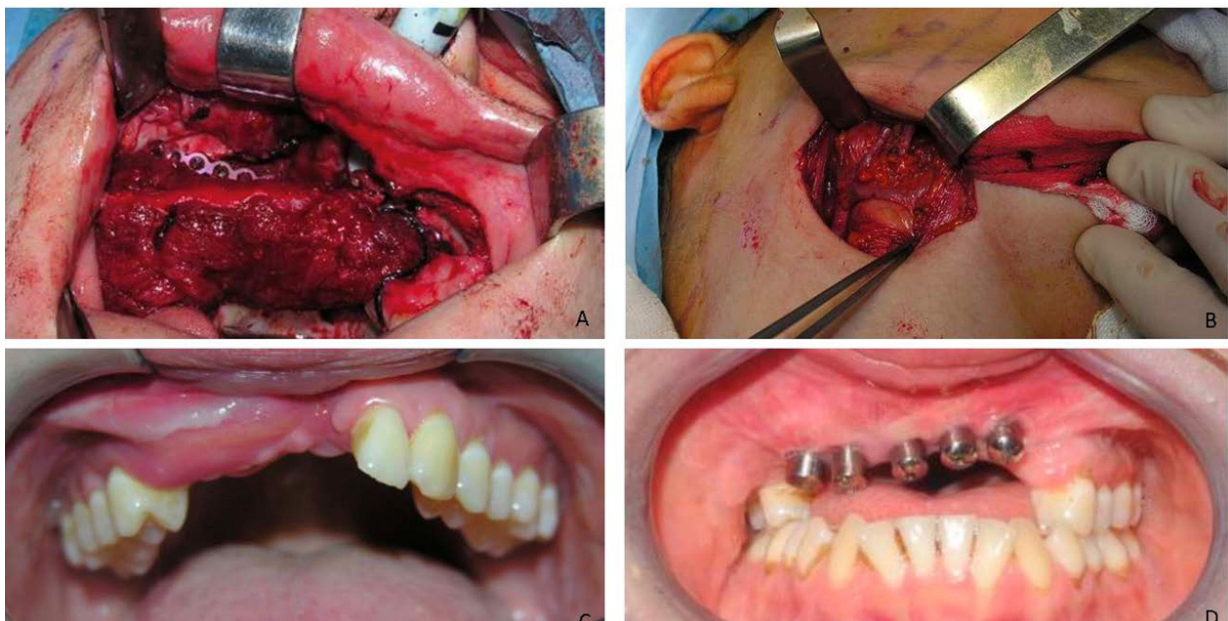


Figure 3. A-B, Intra-operative view of one of the patients from Group B showing anterior maxillectomy and reconstruction with fibula flap (in Figure B, the cervical vessels for the anastomosis of the pedicle can be seen). C, Healing after fibula flap placement. D, Five dental implant placements after healing.



Figure 4. A, The same patient from Group B showing final prosthesis fixed on implants (Occlusion with the prosthesis). B, Intra-oral occlusal view of the final prosthesis.

freely to participate in the Quality-of-Life study.

Both questionnaires were chosen according to the criteria suitable for research purposes. After agreement on the telephone, the questionnaires were sent by e-mail or, upon request of the patient, they were administered by telephone by the same operator. The answers provided by all patients were interpreted according to the specific indications of the individual questionnaires:

*EORTC QLQ-H&N35 questionnaire*¹⁸

The EORTC QLQ-N&H35 consists of 35 questions in 18 parameters. The parameters investigated were: 1- Pain, 2- Swallowing, 3- Problems with teeth, 4- Restrictions in mouth opening, 5- Dry mouth, 6- Thick, sticky saliva, 7- Questions for olfactory and gustatory senses, 8- Coughing, 9- Health status, 10- Speech, 11- Social eating, 12- Social contact, 13- Sexuality. Further questions only involved the last 7 days with respect to

the time of the interview: 14- Pain medications, 15- Nutritional supplements, 16- Feeding tube, 17- Weight loss, 18- Weight gain.

The EORTC QLQ-N&H35 questionnaire is divided into seven multi-item scales that evaluate pain, swallowing, taste and smell, speech, sociability, nutrition, social contact, and sexuality¹⁸. In addition, problems with the teeth, mouth opening restrictions, dry mouth, saliva, constant coughing, feeling sick, use of painkillers, dietary supplements, or the presence of a tube for nutrition, weight loss, or weight gain were investigated. All fields explored in the questionnaire correspond to an answer score that starts from 0 and reaches 100. For each item investigated, the highest score describes a high level of symptoms or problems.

*UW-QoLv4 questionnaire*¹⁹

The parameters investigated in UW-QoLv4 questionnaire were: 1- Pain, 2- Physical aspect, 3-

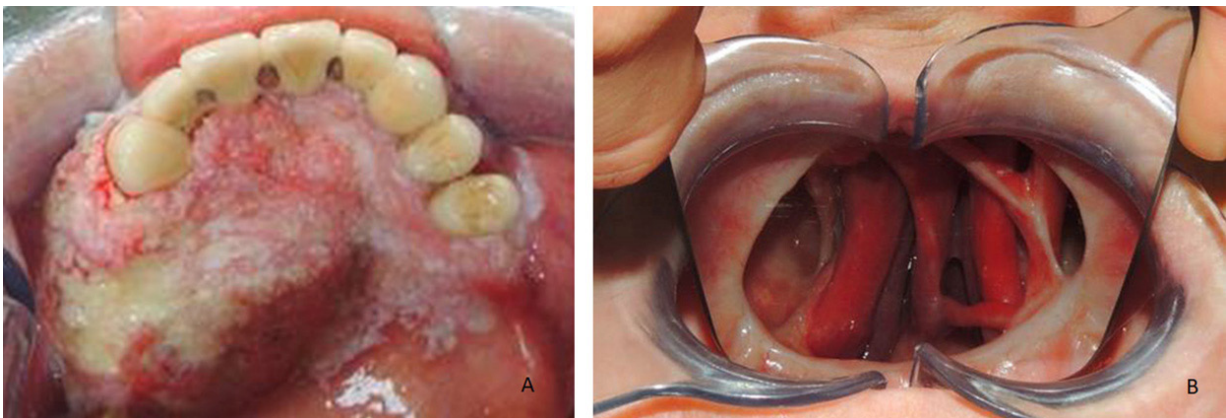


Figure 5. A, Intra-oral representative view of one of the patients from Group C showing maxillary tumor. B, Maxilla after total maxillectomy.

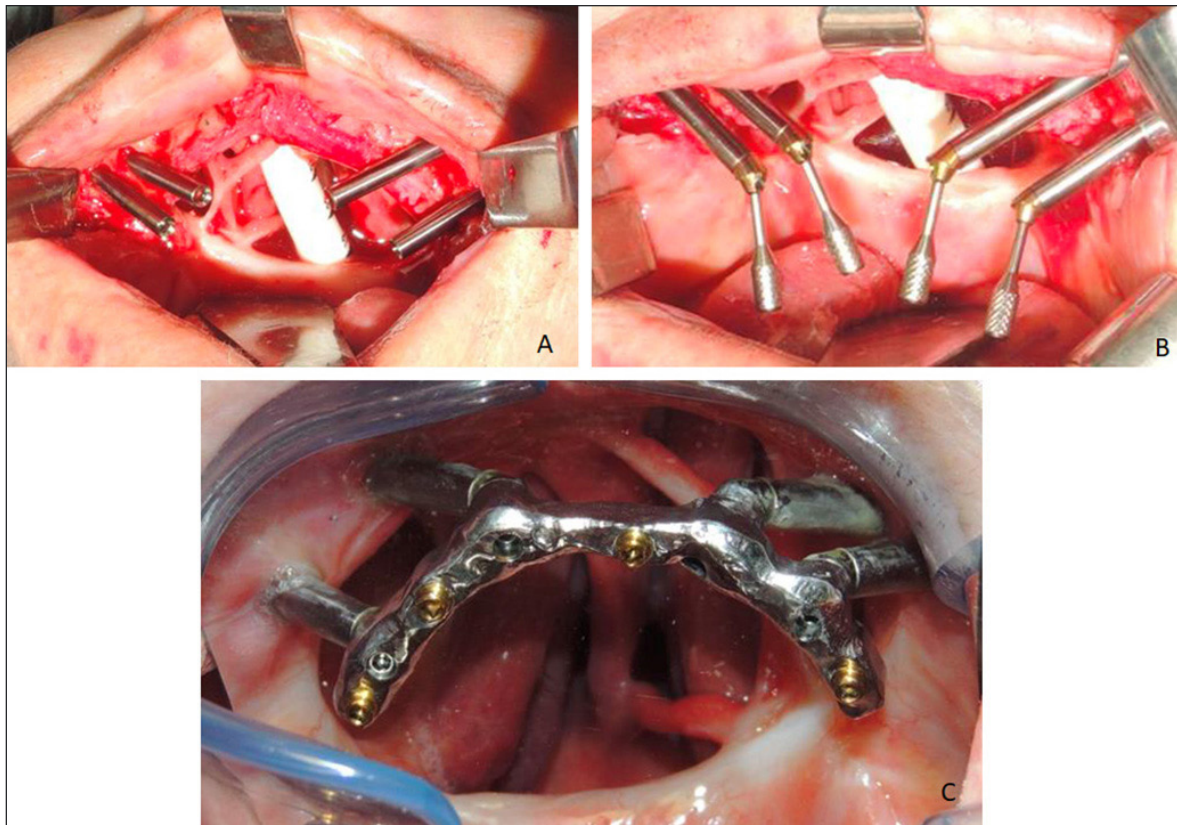


Figure 6. A, The same patient from Group C showing bilateral Quad zygomatic implant placement. B, Abutment placement. C, Intra-oral view of the patient showing metal prosthetic superstructure fixed on zygomatic implants.



Figure 7. A-C, Provisional removable prosthesis of the Group C patient from different angles. D, Intra-oral view showing prosthesis in occlusion. (As a note: The prosthesis in the photo was a provisional removable prosthesis which then was changed to a fixed prosthesis). E, Intra-oral view of the patient showing provisional prosthesis from occlusal view.

Physical activities, 4- Recreation activity, 5-De-glutination, 6- Mastication, 7- Speech, 8- Shoulder function, 9- Taste, 10- Salivation, 11- Mood, 12- Anxiety, 13- Evaluation of the 12 parameters listed above for the last 7 days, 14- Evaluation of quality of life in the last month when compared to experience during cancer, 15- Quality of life, 16- Health status in the last 7 days. For each parameter, the patient had to indicate the appropriate score (the highest score depending on the question regarding the parameter evaluated) on a Likert-type scale, where 1 corresponded to the “best” situation (e.g., no pain at all), and the highest score (3 to 6, depending on the question) corresponded to the worst situation.

The scores in the UW-QoLv4 test are divided into sections describing the severity of the functional limitation in the specific items investigated, with a minimum score of 0 representing the best possible situation to a maximum of 100 describing the worst possible condition¹⁹.

For this study, the following additional data were collected: patients’ age and gender, the histological type of the disease, the presence of residual dentition, and the application of radiotherapy/chemotherapy. Post-operative residual maxillary defects were classified according to the maxillectomy classification by Okay et al⁸.

Statistical Analysis

Statistical analysis was performed using GraphPad Prism 5.03 (GraphPad Software, Inc., La Jolla, CA, USA). Due to the categorical nature of the questionnaire, the between-groups comparison for all domains (parameters) of quality-of-life was made using Pearson’s Chi-square test or the Fisher exact test. The latter was used if the number of answers in one or more categories (scores) of each domain was 5 or lower. To investigate if there was a difference in outcomes between reconstructive and non-reconstructive techniques, we pooled data from groups A and C (non-reconstructive procedures) and repeated the tests (Pearson’s Chi-squared or Fisher exact test) for comparison with group B (reconstructive procedure). A probability value of $p < 0.05$ was considered as the significance threshold.

Results

From an initial pool of 72 patients, a total of 47 adult oncological patients who underwent

maxillary surgery were included in this study (Group A: 18 patients, Group B: 17, Group C: 12). Patients who refused to participate (only one patient), those who did not provide answers to the questionnaires (24 patients) and those who did not undergo any reconstruction (25 patients) were excluded. Details about patients’ demographics, type of tumor, maxillectomy classification according to Okay et al⁸, maxillary teeth status, and radiotherapy can be seen in Table I. Table II shows the type of flaps, TNM staging³, type of prostheses, radiotherapy, chemotherapy, and histo-pathological results for patients in Group B.

Furthermore, according to the maxillectomy classification used in this study, it is possible to divide the patients into two groups considering the defect size:

- < 50 (less than 50% of maxilla was resected and reconstructed) (Ib+II) – Group A: 14 patients, Group B: 14, Group C: 11 patients (Okay Ia-Ib);
- ≥ 50 (equal or more than 50% maxilla was resected and reconstructed) (III) – Group A: 4 patients, Group B: 3 patients, Group C: 1 patient (Okay II-III)⁸.

Questionnaire Results

Comparison of percentages among three groups

Questionnaire results as percentages (as higher percentages indicate better results) and p -values among groups can be seen in Table III and Table IV (showing UW-QoLv4 and EORTC QLQ-H&N35, respectively).

In brief, according to the results of the UW-QoLv4 questionnaire, none of the parameters were statistically significant. According to the results of the EORTC QLQ-H&N35 questionnaire, only 2 questions showed statistically significant results. For example, question 12, which indicated social contact, resulted in statistically significant ($p=0.0051$) results, like question 13, which indicated sexuality ($p=0.0009$). For both questions, patients treated with zygomatic implants (Group C) had significantly better results than the two other groups, while patients with obturator prosthesis (Group A) had the worst outcomes in terms of satisfaction.

Most of the study participants were over the age of 60; the number of females was lower than the number of males in Group A, higher in Group B, and the same in Group C. The most frequent

Table I. Patients' demographics and clinical data.

	Group A (n=18 patients)		Group B (n=17 patients)		Group C (n=12 patients)	
	Number	%	Number	%	Number	%
Gender						
Male	12	67%	4	24%	6	50%
Female	6	33%	13	76%	6	50%
Mean age at operation (years)						
20-29	1	6%	-	-	-	-
30-39	-	-	2	12%	-	-
40-49	1	6%	1	6%	-	-
50-59	1	6%	5	29%	1	8%
60-69	2	11%	1	6%	3	25%
≥70	13	72%	8	47%	8	67%
Tumour type						
Gingival squamous cell carcinoma	11	61%	8	73%	7	64%
Adenocarcinoma	1	6%	-	-	1	0.091%
Chordoma	1	6%	-	-	-	-
Adenoid cystic carcinoma	1	6%	2	18%	2	18%
Mucoepidermoid carcinoma	2	11%	1	9%	1	9%
Ameloblastic carcinoma	1	6%	-	-	-	-
Arteriovenous malformations	1	6%	-	-	-	-
Myoepithelial-epithelial carcinoma	-	-	1	9%	-	-
Osteoblastoma	-	-	1	9%	-	-
Leiomyoma	-	-	2	18%	-	-
Sarcoma	-	-	1	9%	-	-
Chondroblastic osteosarcoma	-	-	1	9%	-	-
Ameloblastoma	-	-	-	-	1	-
Radiotherapy						
Yes (radiotherapy)	5	28%	7	41%	3	25%
No (radiotherapy)	13	72%	10	59%	9	75%
Maxillectomy classification						
Ib (<50%)	7	39%	8	47%	7	58%
II (<50%)	7	39%	6	35%	4	33%
III (>50%)	4	22%	3	18%	1	8%
Maxillary teeth status						
Partially edentulous	15	83%	15	88%	11	92%
Fully edentulous	3	17%	2	12%	1	8%

tumor presented by the patients was squamous cell carcinoma, followed by tumors of the minor salivary glands (adenoid cystic carcinoma, mucoepidermoid carcinoma). According to the classification provided by Okay et al⁸, the number of patients with Ib was smaller, followed by II, and subsequently by III.

From the statistical analysis based on the percentage of the EORTC QLQ-H&N35 question-

naire, out of all three groups, few patients reported severe pain in the oral cavity, specifically in group B. Group A expressed 100% the absence of general illness. On the other hand, group A claimed to face the worst problems with respect to the functions of speech, swallowing, and chewing compared to the other two groups, although these limitations were not severe. In addition to pain, group B reported a higher percentage of

Table II. Group B patients (type of flap, TNM staging, radiotherapy/chemotherapy and histology results).

Patient No.	Prosthetic rehabilitation	Type of flap	TNM Staging	Radiotherapy/Chemotherapy (RT/CT)	Tumor type
1	Removable	Temporal flap (P)	PT1N0M0	No	Squamous cell carcinoma G1
2	Removable	Primary closure + Bichat (P)	PT1N0M0	No	Low grade mucoepidermoid carcinoma
3	Removable	Temporal flap (P)	PT1N0M0	No	Squamous cell carcinoma G1
4	Removable	Temporal flap (P)	PT1N0M0	No	Squamous cell carcinoma G1-G2
5	X	ALT (F)	PT2 PN0	No	Myoepithelial carcinoma
6	X	Temporal flap and orbital flap (P)	PT4ANX	RT	Squamous cell carcinoma G1-G2
7	X	Temporal flap (P)	PT3NXMX	No	Osteoblastoma
8	X	FAMM +Bichat (P)	PT1NXMX	No	Squamous cell carcinoma G1
9	X	Temporal flap (P)	PT2 PN0	No	Differentiated leiomyosarcoma G1
10	X	Temporal flap (P)	PT2N0MX	CT	Differentiated leiomyosarcoma G1
11	X	Temporal flap (P)	PT2N0MX	Yes	Adenoid cystic carcinoma
12	X	Buccinator flap (P)	PT1NXMX	No	Squamous cell carcinoma G1-G2
13	X	Temporal flap (P)	PT4ANX	Yes	Squamous cell carcinoma G1-G2
14	X	Temporal flap (P)	PT1N0MX	Yes	Squamous cell carcinoma G1-G2
15	X	Temporal flap (P)	PT2N0MX	Yes	Adenoid cystic carcinoma
16	X	Temporal flap + orbital flap + ALT (F+P)	PT4N0MX	RT + CT	Sarcoma
17	Fixed	Free Fibula Flap (F)	PT3NXMX	CT	Chondroblastic osteosarcoma

ALT: anterolateral thigh flap, F: free flap, FAMM: facial artery musculo-mucosal flap, P: pedicled flap, X: No prosthetic rehabilitation, RT: radiotherapy, CT: chemotherapy.

discomfort related to reduced mouth opening and masticatory function. Group B patients showed good scores for swallowing and social contacts. More than 50% of patients belonging to group C declared that they do not have any major problems (such as cough, oral opening, dry mouth, thick saliva, and weight loss).

According to the UW-QoLv4 questionnaire, group A showed a very low level of pain in the upper jaw. However, issues were present regarding mastication, swallowing, and phonation functions, which seemed to cause general dissatisfaction. For group A, the most critical difficulty encountered was in chewing, followed by difficulty in swallowing and the presence of anxiety. Group B showed better results for pain in the upper jaw (2/3 had no pain) and the absence of major problems regarding speech. Difficulty in chewing remained present also in this group, which appeared to be the first cause of the problems. In group C, the physical aspect was the problem that was most frequently indicated. Patients in this group, on average, complained less about masticatory function, swallowing, and speaking.

Comparison of reconstructed vs. non-reconstructed patients

In Table V, results from the UW-QoLv4 Italian questionnaire showing *p*-values among reconstructed (Group B) vs. non-reconstructed (Group A+C) groups can be seen. As shown in Table IV, the only statistically significant items regard mood and taste in question 13 (for the last 7 days). The mood was better for the non-reconstructed group than the reconstructed, while taste alteration complaints were lower in the reconstructed group.

In Table VI, EORTC QLQ-H&N35 questionnaire results showing the *p*-value of comparison among reconstructed (Group B) and non-reconstructed (Group A+C) groups are listed. As shown in Table V, the only statistically significant difference was for pain, which was lower for Group B than Group A+C.

Discussion

Resection of malignant disease results in defects in terms of integrity, function, and shape in

Quality of life in oncologic patients after maxillectomy

Table III. Results as percentages from UW-QoLv4 Italian questionnaire showing best scores and *p*-value among groups (Chi-squared or Fisher exact test).

	Questions in groups	Group A	Group B	Group C	<i>p</i> -value
1	Pain	66.67%	70.59%	58.33%	0.1808
2	Physical aspect	27.78%	11.76%	25.00%	0.7325
3	Physical activity	38.89%	29.41%	41.67%	0.7424
4	Recreational activity	27.78%	47.06%	33.33%	0.7211
5	Deglutition	50.00%	47.06%	50.00%	0.2221
6	Mastication	11.11%	23.53%	8.33%	0.1946
7	Speech	27.78%	58.82%	41.67%	0.3584
8	Shoulder function	83.33%	76.47%	75.00%	0.5685
9	Taste	72.22%	47.06%	58.33%	0.4957
10	Salivation	77.78%	41.18%	58.33%	0.2215
11	Mood	38.89%	23.53%	33.33%	0.1870
12	Anxiety	38.89%	58.82%	41.67%	0.0737
Evaluation of 12 parameters for the last seven days					
13	Pain	5.56%	5.88%	33.33%	0.1284
	Physical aspect	16.67%	23.53%	41.67%	
	Physical activity	11.11%	0.00%	16.67%	
	Recreational activity	5.56%	0.00%	8.33%	
	Deglutition	27.78%	11.76%	25.00%	
	Mastication	55.56%	70.59%	33.33%	
	Speech	22.22%	17.65%	8.33%	
	Shoulder function	0.00%	11.76%	8.33%	
	Taste	5.56%	23.53%	0.00%	
	Salivation	11.11%	35.29%	16.67%	
	Mood	16.67%	0.00%	33.33%	
	Anxiety	22.22%	5.88%	33.33%	
14	Quality of life in the last month when compared to experience during cancer	5.56%	11.76%	0.00%	0.5554
15	Quality of life in the last 7 days	0.00%	5.88%	0.00%	0.0731
16	Health status in the last 7 days	0.00%	11.76%	8.33%	0.6989

**p*-value <0.05 statistically significant.

the head and neck region²⁰. Patients undergoing maxillectomy mostly suffer from increased emotional stress, and a good level of psychological health and physical activity emerge as impacting elements of great importance on QoL²¹. The QoL is an indicator often measured in clinical studies²² to evaluate the factors that contribute to patients' well-being. In literature²³, many studies have assessed the Quality of Life of the patients following maxillectomy rehabilitations using different evaluation methods.

According to previous reports^{24,25}, the final rehabilitation of the maxilla can be obtained with different techniques and each rehabilitation has its own advantages and disadvantages. The studies conducted to date have mostly investigated the patients' QoL after rehabilitation of the upper jaw using the obturator plate or autologous flaps^{23,26-28}. Some studies²⁹⁻³¹ de-

scribe better QoL in patients rehabilitated with obturator prosthesis since this allows faster rehabilitation than flaps. Other studies^{32,33} report a superiority of the flaps with respect to the obturator plate for their stability and fundamental function of separation between the nasal sinus and buccal compartments (which avoids the discomfort caused by the passage of food and liquids from the oral cavity to the nose). The stability of the separation can be achieved both with traditional implants and prostheses on the residual jaw or on free flaps with bone content³⁴. However, for very large defects, such as in Okay et al⁸ Class III, free flaps are not sufficient to achieve rehabilitative solutions, and additional techniques are needed to restore an adequate level of QoL³⁵. In literature, the first line treatment seems to be the use of the obturator plate with the help of local/re-

Table IV. Results as percentages from EORTC QLQ-H&N35 questionnaire showing *p*-value among groups (Chi-squared or Fisher exact test).

	Questions in groups	Group A	Group B	Group C	<i>p</i> -value
1	Pain	73.6%	77.9%	54.2%	0.0543
2	Swallowing	66.7%	80.9%	62.5%	0.1951
3	Teeth	61.1%	47.1%	75.0%	0.5823
4	Opening mouth	50.0%	41.2%	50.0%	0.9123
5	Dry mouth	50.0%	41.2%	58.3%	0.5787
6	Sticky saliva	50.0%	52.9%	50.0%	0.4969
7	Senses	80.6%	55.9%	66.7%	0.1632
8	Coughing	83.3%	88.2%	91.7%	0.6092
9	Felt ill	100.0%	94.1%	83.3%	0.3459
10	Speech	46.3%	72.5%	60.0%	0.0850
11	Social eating	51.4%	58.8%	50.0%	0.0656
12	Social contact	73.3%	76.5%	51.7%	0.0051*
13	Sexuality	88.9%	70.6%	37.5%	0.0009*
Evaluation for the last seven days					
14	Pain killers	72.2%	82.4%	50.0%	0.1672
15	Nutritional supplements	72.2%	70.6%	58.3%	0.6991
16	Feeding tube	94.4%	94.1%	83.3%	0.5021
17	Weight loss	77.8%	70.6%	83.3%	0.7189
18	Weight gain	88.9%	94.1%	66.7%	0.1048

**p*-value <0.05 statistically significant.

Table V. Results from UW-QoLv4 Italian questionnaire showing *p*-value among reconstructed (Group B) vs. non-reconstructed (Group A+C) groups.

Group A+C vs. Group B	<i>p</i> -value
1 Pain	0.37
2 Physical aspect	0.69
3 Physical activity	0.54
4 Recreational activity	0.46
5 Deglutition	0.46
6 Mastication	0.06
7 Speech	0.15
8 Shoulder function	0.86
9 Taste	0.43
10 Salivation	0.11
11 Mood	0.20
12 Anxiety	0.57
13** Pain	0.07
Physical aspect	0.27
Physical activity	0.15
Recreational activity	0.4
Deglutition	0.15
Mastication	0.07
Speech	0.31
Shoulder function	0.25
Taste	0.046*
Salivation	0.07
Mood	0.03*
Anxiety	0.23
14 Quality of life in the last month when compared to experience during cancer	0.71
15 Quality of life in the last seven days	0.51
16 Health status in the last seven days	0.62

**p*-value <0.05 statistically significant; **Evaluation of 12 parameters for the last seven days.

gional flaps. However, more recently, with the development of microsurgical techniques and implantology, there have been increasing numbers of reports^{11,36-38} of alternative techniques.

Table VI. Results from EORTC QLQ-H&N35 questionnaire showing *p*-value among reconstructed (Group B) vs. un-reconstructed (Group A+C) groups.

Group A+C vs. Group B	<i>p</i> -value
1 Pain	0.04*
2 Swallowing	0.13
3 Teeth	0.21
4 Opening mouth	0.98
5 Dry mouth	0.96
6 Sticky saliva	0.98
7 Senses	0.11
8 Coughing	1.00
9 Felt ill	0.50
10 Speech	0.09
11 Social eating	0.50
12 Social contact	0.16
13 Sexuality	0.89
Evaluation for the last seven days	
14 Pain killers	0.87
15 Nutritional supplements	0.87
16 Feeding tube	0.77
17 Weight loss	0.86
18 Weight gain	0.83

**p*-value <0.05 statistically significant.

Despite the large number of studies, there are no reports that compare the results of these options on the QoL of patients rehabilitated.

The three groups studied in this work showed different advantages and disadvantages due to the various characteristics investigated (Tables III and IV). The ideal treatment option is the reconstruction by a surgical flap. However, for the patients who cannot undergo long-duration reconstructive operating sessions (due to restrictive reasons for long periods of anesthesia), the placement of an obturator prosthesis remained the most adequate solution.

According to the results of this study, patients reconstructed with flaps and patients with fixed prostheses on zygomatic implants showed better post-operative satisfaction scores in terms of QoL. However, statistically significant results were found in just two parameters for social contact and sexuality, in which patients who were treated with zygomatic implants had the best, and patients with obturator prostheses had the worst satisfaction. An additional comparison for post-operative QoL was made among patients who had received maxillary reconstructions with flaps (Group B) and non-reconstructed patients (Group A+C) (obturator and zygomatic implant patients) (Tables V and VI). According to the results, pain and gustatory problems were statistically significantly less for Group B than for Group A+C. However, the general mood was better for Group A+C than for reconstructed Group B patients.

Regardless of the type of rehabilitation performed, the psychological status of the patients slightly worsened after surgery for mood and anxiety. The main cause can be due to the psychological trauma from the diagnosis of oncological disease. The shock of the news, the surgical procedure, accompanied by post-operative pain, uncertainty of survival, and fear of relapse of the disease were elements found in all three groups. In addition, the difficulties of adapting to new physical conditions and new daily habits (such as prosthesis management, tissue modifications, physical changes, and obligatory stressful check-ups) could have played a role.

Limitations

The limitations of this preliminary study included the restrictions of a retrospective study with a small number of maxillectomy patients. The results mostly relied on the perspectives of the patients, which might be subjective and provided a snapshot of the situation at a specific time. Some

of the information was missing due to the retrospective nature of the work. Future studies should be prospective, based on a wide sample size, and include a comparison among pre-operative and post-operative QoL questionnaires outcomes.

Conclusions

The choice of therapy and type of reconstruction for oncologic patients mostly depends on the type of maxillectomy and the general health situation of each patient. However, during planning, post-operative/post-treatment QoL outcomes are highly important. Alternative therapy options should be evaluated and discussed with the patients to provide better results. This study aimed to help clinicians understand this important aspect and offer surgeons and oncologic patients a better understanding of the QoL outcomes of different rehabilitation options.

Conflict of Interest

The authors declare no potential conflicts of interest regarding the authorship and/or publication of this article.

Ethics Approval

The study followed the principles laid down in the Declaration of Helsinki on medical protocol and ethics. An institutional Board permission was obtained from the IRB (Institutional Scientific Review Board) of IRCCS Orthopedic Institute Galeazzi, Milan, Italy (authorization number: Prot. Dsc. 75/2019-L2057) for this research study protocol.

Informed Consent

All participating patients have signed an informed consent.

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Authors' Contributions

F.G., M.B., E.G., Fa.Gr., G.D., R.K., M.D.F., and Fr.Gr. conceived and designed the analysis. F.G., M.B., E.G., Fa.Gr., M.D.F., and Fr.Gr. searched databases and collected data. All authors F.G., M.B., E.G., Fa.Gr., G.D., R.K., M.D.F., and Fr.Gr. contributed to the analysis and interpretation of data for the work. F.G. drafted the work and wrote the manuscript

with input from all authors. F.G., M.B., E.G., Fa.Gr., G.D., R.K., M.D.F., and Fr.Gr. revised the work critically for intellectual content. All authors appropriately investigated and resolved the integrity of the work. All authors contributed and approved equally to the final version of the manuscript.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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