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Evaluation of Outcomes from Lower Lip Defect Reconstruction after Wide Excision of Squamous Cell Carcinoma

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Abstract. *Introduction.* Lip defects may occur from various etiologies, the most prevalent being invasive malignant processes. The treatment of these lesions involves their surgical removal. The reconstructed mouth, along with the functional, esthetic, and psychological outcomes of the reconstruction, profoundly affect the patient's quality of life. *Aim.* The purpose of this paper is to present our clinical experiences with the application of different methods for the reconstruction of lower lip defects, as well as to evaluate the functional, aesthetic, and psychological outcomes after surgical intervention. *Patients and methods.* This retrospective study included thirty patients who underwent surgery at the Department of Maxillofacial Surgery, Clinical Hospital, Stip, during the period from 2021 to 2024. The analysis was performed by gender, age, size of the skin incision, size of the defect, histological margins, and method of reconstruction. A functional, aesthetic and psychological assessment was performed six months after the surgery. Oral competence, speech intelligibility, and lip mobility during movement were evaluated. The esthetic assessment referred to the presence of microstomia and the evaluation of scar visibility. The psychological assessment referred to the patient's levels of depression and anxiety. *Results.* This study presents our clinical experiences in applying different techniques for lower lip reconstruction. The outcomes of the evaluation, in accordance with the specified parameters, are thoroughly discussed and presented. *Conclusion.* A combination of various techniques can be effectively applied in the reconstruction of lower lip defects that are larger than 2/3 of its width, thereby achieving optimal functional, esthetic, and psychological outcomes.

Keywords: lip reconstruction, squamous cell carcinoma, functional, aesthetic and psychological outcomes.

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Introduction

Lips occupy the lower third of the face and play an essential role in nutrition and speech, but also in body image, facial expression, and psychological well-being. For these reasons, the reconstruction of lip defects which occur as a result of congenital and acquired defects (oncological excisions, traumatic avulsions), along with the functional, aesthetic, and psychological outcomes of such reconstructions, which profoundly affect the patient's quality of life, presents a challenge for every maxillofacial surgeon. According to medical literature, squamous cell carcinoma of the lips occurs more frequently in men over 45 years of age, particularly among those who are chronically exposed to sunlight, smokers, and individuals who consume alcohol [1]. Predisposing factors for the development of this type of cancer include immunosuppressive therapy, while precursors for its manifestation encompass actinic cheilitis, systemic lupus erythematosus, and leukoplakia [1]. The most reliable method for treating lip carcinomas is their complete excision, which encompasses a margin of healthy tissue approximately 0.5 to 1 cm from the tumor's edges. Such an extensive resection markedly diminishes the likelihood of recurrence; however, it leads to a defect that necessitates reconstruction. The reconstructed lip must not be under tension and should have as natural an appearance as possible. The choice of surgical technique depends on several factors, including the size and location of the defect, the patient's comorbidities, and the surgeon's expertise [2].

It is generally accepted that full-thickness defects involving up to one-third of the width of the lip are repaired with primary sutures, accompanied by variations in incisions. This technique yields exceptional functional and esthetic outcomes [3]. On the other hand, for defects larger than one third and more, complex reconstruction is required applying reconstructive techniques such as the methods of Burow, Dieffenbach, Bernard, Fries, Abbe, Karapandzik, and others, each with its own advantages and disadvantages [4]. The selection of the reconstruction method is contingent upon the size of the tumor, and consequently, the dimensions of the post-excision defect [5]. This decision is informed by the various algorithms delineated in the international literature [6]. The reconstruction of substantial lower lip defects continues to pose a challenge, as no singular surgical technique fulfills the criteria for optimal reconstruction [7]. The primary objective of this study, which forms part of a broader research initiative, is to present our clinical institutional experiences in the reconstruction of extensive defects after the wide excision of squamous cell carcinoma of the lower lip, as well as to evaluate its functional, aesthetic, and psychological outcomes.

In addition to the functional and aesthetic outcomes of reconstruction, which are already well-researched in the literature [8–10], analyzes and scientific studies that highlight the significance of psychological outcomes are less frequently addressed. These psychological outcomes are equally important and profoundly influence the patient's quality of life. This was precisely the challenge, based on the findings of available research: to supplement the evaluation and analysis with an assessment of the patient's levels of depression and anxiety during the preoperative and postoperative periods [11, 12].

Material and methods

After receiving approval from the Institutional Ethics Committee, this retrospective analysis, which is part of a larger research project, was conducted at the Department of Maxillofacial Surgery, Clinical Hospital Stip, for the period from March 2021 to April 2024. It includes 30 patients of varying ages from both sexes. The inclusion criteria are as follows: histologically confirmed squamous cell carcinoma, characterized by full thickness and varying sizes of defects on the lower lip, resulting from acquired etiology (subsequent to the excision of advanced squamous cell carcinoma). In accordance with the Declaration of Helsinki regarding

research involving human subjects, all patients have provided informed consent for participation in this study. The exclusion criterion are as follows: the refusal to consent to participation in the research, the presence of distant metastases, previous extensive reconstructions in the same area, significant psychiatric comorbidities (which could significantly affect the PHQ-9 and GAD-7 results), active therapy for other malignant diseases, previous radiotherapy to the head and neck. The analysis of the patients was conducted according to gender, age, size of the skin incision, size of the defect, histological margins, and method of reconstruction. In 26 patients, the surgical intervention was carried out under general anesthesia, while the remaining 4 underwent the procedure under local anesthesia. After discharge from the hospital, the sutures were removed on an outpatient basis after ten days. Subsequently, follow-up check-ups were conducted for thirty-six months: every two weeks during the first two months, then periodically every three months during the first year, and every six months during the second and third year. The data that we analyzed and presented in the tables for the functional and aesthetic assessment of outcomes pertain to six months postoperatively. For the psychological analysis, the data refer to the preoperative period and the six months postoperative period. The functional assessment was conducted by evaluating oral competence, speech intelligibility, and lip mobility. Oral competence was categorized as follows: incompetent, sialorrhea at rest, sialorrhea during fluid intake, and complete competence. Lip mobility was evaluated as symmetrical or asymmetrical by observing movement during pouting, whistling, smiling, and mouth opening. The aesthetic assessment was conducted by evaluating the oral stoma (classified as noticeable microstomia, moderate microstomia, or normal stoma) and by examining the aesthetics of the scars (categorized as atrophic, normotrophic, or hypertrophic). The psychological assessment of depression and anxiety was conducted using the following instruments: the Patient Health Questionnaire (PHQ-9) to evaluate the level of depression and the Generalized Anxiety Disorder scale (GAD-7) to assess the level of anxiety. The assessment of functional and aesthetic outcomes was conducted by two independent surgeons. The psychological assessment was conducted by a psychiatrist and a clinical psychologist.

Results

Descriptive statistics were computed using the IBM SPSS Statistics 26 software. This retrospective study encompassed 30 patients who underwent surgery: 19 (63.3%) men and 11 (36.7%) women, with a median age for the entire group of 69.50 years (as detailed in Tables 1 and 2).

Table 1. Overview of operated patients by gender

		Frequency	Percent
Valid	Female	11	36.7
	Male	19	63.3
	Total	30	100.0

Table 2. Overview of operated patients by age

N	Valid	30
	Missing	0
Mean		68.4667
Std. error of the mean		1.31108
Median		69.5000

N	Valid	30
	Missing	0
Std. deviation		7.18107
Minimum		55.00
Maximum		81.00

Tables 3 and 4 present tabular overviews of the number of patients in relation to defect size and the method of defect closure concerning the patient count.

Table 3. Number of patients in relation to defect size

Size of the defect	Total number of patients (n = 30)
Less than 1/3	13
In the range of 1/3–2/3	9
Exceeding 2/3	8

Table 4. The method of defect closure concerning the patient count

Direct flap/reconstruction (technique for defect closure)	Total number of patients (n = 30)
Direct suture of the defect, i.e., direct suturing	4
Unilateral Von Bruns nasolabial flap	8
Bilateral sliding V–Y lip advancement	9
Bilateral Von Bruns	1
Unilateral Von Bruns and contralateral Dieffenbach	4
Unilateral Fries flap and contralateral Dieffenbach flap	2
Unilateral Fries flap and contralateral lip advancement (V–Y)	2

According to Table 3, among the 30 patients, 13 exhibited a lower lip defect measuring less than one-third, 9 patients had a defect ranging from one-third to two-thirds, and 8 patients presented with a defect exceeding two-thirds of the lip's width. Table 4 presents the method of defect closure in relation to the patient count; out of a total of 30 patients, primary closure of the defect was achieved through direct suture in 4 patients. In 9 patients, bilateral sliding V–Y lip advancement flaps were utilized. In 8 patients, the defect was closed with a unilateral Von Bruns nasolabial flap, while in 9 patients, the defects were addressed using a combination of other transposition flaps, as follows: Bilateral Von Bruns was performed in 1 patient, while a combination of unilateral Von Bruns and contralateral Dieffenbach was executed in 4 patients. In 2 patients, a combination of unilateral Fries flap and contralateral Dieffenbach flap was utilized, and in another 2 patients, the defect was closed using a combination of unilateral Fries flap and contralateral lip advancement (V–Y).

Table 5 presents detailed data for each individual patient, including an overview of the gender and age of the patients, the dimensions of the lip incision, the resection margins, the method of reconstruction, and the size of the defect across all 30 patients. In addition to the previously explained data, Table 5 reveals

that in a group of 30 patients, of 28 patients achieved successful tumor removal with a “clean” margin of several millimeters, while in two cases, the tumor reached the resection edge.

Table 5. The gender and age of the patients, the dimensions of the lip incision, the resection margins, the method of reconstruction, and the size of the defect

Num. of patient	Sex	Age	Resection of a part of the lip (mm)	Resection of the margin	Direct flap/reconstruction (method of defect closure)	Size of the defect
1.	f	64	2.5×2.0	2 mm	Unilateral Von Bruns	1/3–2/3
2.	f	62	2.0×2.0×1.6	2 mm	V–Y flap – lip advancement	<1/3
3.	f	64	2.4×1.5×1.5	1.5 mm	Unilateral Von Bruns	1/3–2/3
4.	m	55	1.4×1.0×1.1	2 mm	V–Y flap – lip advancement	<1/3
5.	m	74	7×1.5	0.3 mm	Combination of unilateral Von Bruns and contralateral Dieffenbach	>2/3
6.	f	71	4×1.5×1.5	0.4 mm	Combination of Fricke unilateral and contralateral Dieffenbach	>2/3
7.	m	78	4×2×1.5	0.3 mm	Combination of Fricke unilateral and V–Y flap – contralateral lip advancement	>2/3
8.	f	80	4.5×3×2	2 mm	Combination of Fricke unilateral and contralateral Dieffenbach	>2/3
9.	m	72	1.5×1.4×1	1.5 mm	V–Y flap – lip advancement	<1/3
10.	m	68	4.5×2.5×1.5	2 mm	Combination of unilateral Von Bruns and contralateral Dieffenbach	>2/3
11.	f	75	1.3×1×1	0.2 mm	V–Y flap – lip advancement	<1/3
12.	m	67	2.5×1.5×1.5	0.5 mm	Unilateral Von Bruns	1/3–2/3
13.	m	62	1.5×3×1.5	1 mm	V–Y flap – lip advancement	<1/3
14.	m	73	1.5×1.4×1.4	1.5 mm	V–Y flap – lip advancement	<1/3
15.	m	59	1.4×1	0.1 mm	Direct suture	<1/3
16.	m	74	0.5×2.5×2	To the resection of the margin	Bilateral Von Bruns	1/3–2/3
17.	f	81	2.5×2.5×1	0.5 mm	Unilateral Von Bruns	1/3–2/3
18.	m	73	5×2×1	0.3 mm	Combination of unilateral Von Bruns and contralateral Dieffenbach	>2/3

Num. of patient	Sex	Age	Resection of a part of the lip (mm)	Resection of the margin	Direct flap/reconstruction (method of defect closure)	Size of the defect
19.	m	58	4×2×1.5	0.5 mm	Combination of Fricce unilateral and V-Y flap – contralateral lip advancement	>2/3
20.	f	72	2.1×1.5×0.6	0.4 mm	V-Y flap – lip advancement	<1/3
21.	m	63	2.1×1.5×1.5	0.3 mm	V-Y flap – lip advancement	<1/3
22.	f	62	2×2×1.6	0.4 mm	Direct suture	<1/3
23.	f	57	1.4×1×1.1	5 mm	V-Y flap – lip advancement	<1/3
24.	f	64	2.4×1.5×1.5	0.5 mm	Unilateral Von Bruns	1/3–2/3
25.	m	68	1.5×1.4×1.4	0.4 mm	Direct suture	<1/3
26.	m	71	1.5×2×1.3	1 mm	Direct suture	<1/3
27.	m	75	2.4×2.2×0.1	0.2 mm	Unilateral Von Bruns	1/3–2/3
28.	m	61	2.5×1.1×0.6	0.2 mm	Unilateral Von Bruns	1/3–2/3
29.	m	74	2.2×1.4×1.2	0.2 mm	Unilateral Von Bruns	1/3–2/3
30.	m	77	5×2×1	To the resection of the margin	Combination of unilateral Von Bruns and contralateral Dieffenbach	>2/3

Table 6. The functional, aesthetic, and psychological postoperative outcomes

Num. of patient	Sex	Age	Microstomia	Scar	Speech intelligibility	Oral competency	Lip mobility	Pre- and postoperative scores PHQ-9	Pre- and postoperative scores GAD7
1.	f	64	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 8 post 4	pre 6 post 3
2.	f	62	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 6 post 3	pre 4 post 2
3.	f	64	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 8 post 3	pre 7 post 3
4.	m	55	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 7 post 4	pre 6 post 3
5.	m	74	Moderate microstomia	Atrophic	Moderately comprehensible	Sialorrhea upon fluid intake	Yes	pre 12 post 6	pre 8 post 5

Num. of patient	Sex	Age	Microstomia	Scar	Speech intelligibility	Oral competency	Lip mobility	Pre- and postoperative scores PHQ-9	Pre- and postoperative scores GAD7
6.	f	71	Moderate microstomia	Atrophic	Moderately comprehensible	Sialorrhea upon fluid intake	Yes	pre 10 post 4	pre 7 post 4
7.	m	78	Moderate microstomia	Atrophic	Intelligible	Sialorrhea upon fluid intake	Yes	pre 9 post 4	pre 4 post 3
8.	f	80	Moderate microstomia	Hypertrophic	Moderately comprehensible	Sialorrhea upon fluid intake	Yes	pre 9 post 5	pre 6 post 4
9.	m	72	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 6 post 3	pre 5 post 3
10.	m	68	Moderate microstomia	Atrophic	Intelligible	Complete competence	Yes	pre 9 post 4	pre 7 post 4
11.	f	75	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 4 post 2	pre 3 post 2
12.	m	67	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 9 post 3	pre 5 post 2
13.	m	62	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 6 post 3	pre 4 post 2
14.	m	73	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 5 post 2	pre 2 post 2
15.	m	59	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 6 post 3	pre 5 post 3
16.	m	74	Moderate microstomia	Hypertrophic	Intelligible	Complete competence	Yes	pre 9 post 4	pre 8 post 4
17.	f	81	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 10 post 4	pre 6 post
18.	m	73	Moderate microstomia	Atrophic	Difficult to comprehend	Sialorrhea upon fluid intake	Yes	pre 12 post 6	pre 6 post 5
19.	m	58	Moderate microstomia	Atrophic	Intelligible	Sialorrhea upon fluid intake	Yes	pre 10 post 5	pre 8 post 3
20.	f	72	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 6 post 2	pre 4 post 2

Num. of patient	Sex	Age	Microstomia	Scar	Speech intelligibility	Oral competency	Lip mobility	Pre- and postoperative scores PHQ-9	Pre- and postoperative scores GAD7
21.	m	63	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 5 post 2	pre 6 post 4
22.	f	62	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 3 post 2	pre 6 post 3
23.	f	57	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 4 post 2	pre 5 post 3
24.	f	64	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 7 post 4	pre 5 post 4
25.	m	68	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 4 post 2	pre 4 post 3
26.	m	71	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 4 post 3	pre 3 post 2
27.	m	75	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 9 post 4	pre 6 post 4
28.	m	61	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 6 post 2	pre 4 post 2
29.	m	74	Normal microstomia	Normotrophic	Intelligible	Complete competence	Yes	pre 4 post 2	pre 5 post 2
30.	m	77	Moderate microstomia	Atrophic	Moderately comprehensible	Sialorrhea upon fluid intake	Yes	pre 10 post 6	pre 5 post 3

Table 6 shows the functional, aesthetic, and psychological postoperative outcomes of all 30 patients. When assessing the functional outcome, it was found that out of 30 patients, 23 had lip competence, while 7 experienced sialorrhea when consuming liquids.

In 24 patients, a normal stoma was observed, and in 6, there was a moderate microstomia. In 4 patients, speech was moderately intelligible, in 1 it was difficult to understand, and in the remaining 25, the speech was intelligible. In all 30 patients, normal lip mobility when opening the mouth was noted, meaning there was no asymmetry.

The analysis of the psychological assessment encompassed the estimated levels of depression and anxiety among the patients, both prior to surgery and six months postoperatively (see Tables 7a, 7b, 8a, and 8b).

Table 7a. Preoperative scores on PHQ-9

N	Valid	30
	Missing	0
Mean		7.2333
Std. error of mean		0.46159
Median		7.0000
Std. deviation		2.52823
Minimum		3.00
Maximum		12.00
Sum		217.00

Table 7b. Postoperative scores on PHQ-9

N	Valid	30
	Missing	0
Mean		3.4333
Std. error of mean		0.23333
Median		3.0000
Std. deviation		1.27802
Minimum		2.00
Maximum		6.00
Sum		103.00

Table 8a. Preoperative scores on GAD-7

N	Valid	30
	Missing	0
Mean		5.3667
Std. error of mean		0.28960
Median		5.5000
Std. deviation		1.58622
Minimum		2.00
Maximum		8.00
Sum		161.00

Table 8b. Postoperative scores on GAD-7

N	Valid	30
	Missing	0
Mean		3.0667
Std. error of mean		0.16563
Median		3.0000
Std. deviation		0.90719
Minimum		2.00
Maximum		5.00
Sum		92.00

The following results were obtained: the level of depression, as indicated by preoperative PHQ-9 scores, was $M = 7.23$ (minimal depression), $SD = 2.53$, $Mdn = 7.00$, with a range of 3–12 (from none to moderate depression). In contrast, the postoperative PHQ-9 scores revealed $M = 3.43$ (no depression), $SD = 1.28$, $Mdn = 3$, with a range of 2–6 (non-existent to minimal depression).

For anxiety levels, the preoperative results indicated a GAD-7 score of $M = 5.37$ (moderate anxiety), $SD = 1.59$, $Mdn = 5.50$, reflecting a score range of 2–8 (from none to moderate anxiety). In contrast, the postoperative results revealed a GAD-7 score of $M = 3.07$ (nonexistent or minimal anxiety), $SD = 0.90$, $Mdn = 3.00$, within a score range of 2–5 (from none to moderate anxiety).

Discussion

The most reliable method for treating lower lip cancers is wide surgical excision. The primary aim of the procedure is to eradicate the cancer entirely, while the secondary aim is to restore both the function and aesthetic appearance of the newly formed lip, ensuring it closely resembles a healthy lip. Larger defects, irrespective of their location, are reconstructed utilizing one or more flaps. Optimal results in reconstruction are attained by employing the remaining and surrounding tissues.

Such a principle of “like for like” replacement, along with the notion that “the next best tissue is the next best tissue”, reflects the reconstructive design principles known as the Gillies principle. This principle should be employed whenever feasible, as it minimizes donor site morbidity and ensures a favorable match in texture and color of the tissue [13, 14]. To date, no singular surgical technique fulfills all the criteria for the ideal reconstruction of lip defects that encompass more than one-third of the lip. Consequently, variations of traditional techniques, whether through minor or major modifications, or a combination of various standard methods, are frequently employed [15]. Incisions are consistently made along the borders of the aesthetic subunits, thereby achieving a superior aesthetic result.

In the reconstruction methods employed, we adhered to this principle, utilizing the depressor of the corner of the mouth and the lower lip as a muscular foundation, which aligns with the established techniques delineated by Tobin and O’Daniel [16] and Bayramicili et al. [17]. We used unilateral or bilateral flaps in the mentolabial sulcus from the edge of the defect.

The absence of complications such as flap necrosis and inflammation is a result of the intact vascularization of the tissue, specifically the branches of the facial and mental arteries and veins. In older patients, enhanced skin elasticity permits greater flexibility in the application of various reconstructive techniques, leading to a reduction in the duration of surgery and a decrease in surgical risks, as substantiated by the scientific literature [18].

Postoperative photographs were captured at a period of six months following surgery, during which the patients underwent a comprehensive re-evaluation that included neck ultrasonography, assessment of aesthetic outcomes, and evaluation of both static and dynamic lip functionality. Furthermore, a psychological assessment of the patients’ levels of depression and anxiety was conducted prior to surgery and again six months postoperatively. The significance of mental health, along with the prevalence of depression and anxiety among these patients, is increasingly underscored and examined in contemporary research [19]. Our findings indicate that the levels of depression and anxiety are higher during the preoperative treatment, yet remain minimally present in the postoperative period, aligning with the latest research [19, 20].

Conclusion

Lips play a pivotal role in facial esthetics, body image, and consequently, quality of life. To attain optimal esthetic, functional, and psychological outcomes, it is imperative for the surgeon to select the most suitable method of reconstruction. During the treatment planning process, the surgeon should consider the characteristics of the defect, such as: the remaining tissue after tumor ablation, the elasticity of the skin, and most importantly, the patient's decision. It is essential to involve the patient in the process, providing a comprehensive explanation of the particulars of the procedure and its potential outcomes, as the results of the reconstruction may not meet the patient's expectations. Consequently, the size of the defect, its location, the surgeon's proficiency, and the patient's anticipations are pivotal factors in selecting the appropriate reconstruction technique. This paper has demonstrated that a combination of various local flaps serves as an outstanding alternative for the reconstruction of extensive lower lip defects, and that a multidisciplinary approach and team are necessary to attain optimal outcomes.

Declarations

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Author contributions

Vladimir Milosev – conceptualization, data curation, investigation, methodology, resources, validation, visualization, writing – original draft, review and editing.

Dijana Miloseva – formal analysis, project administration, resources, software, visualization, writing – original draft, review and editing.

Vladimir Popovski – supervision, validation, writing – original draft, review and editing.

Lence Miloseva – formal analysis, software, writing – original draft, review and editing.

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