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Improvement of The Method for Plasty of Post-Burn Scar Deformity of The Face and Neck with a Replaced or Rotational Neck Flap

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ABSTRACT
Plastic surgeons are constantly trying to find new ways to adequately compensate for a scar defect with tissues adjacent to the surgical intervention area. One of such promising donor zones is the anterolateral surface of the neck with the subcutaneous neck muscle (m. platysma) located here. The advantage of this method of plastic surgery is the proximity of the donor zone to the defect, the possibility of borrowing a flap that is significant in area, but small in thickness, and has high mobility. The disadvantage of this method of plastic surgery is the possibility of a violation of regional blood circulation, leading to marginal necrosis of a part of the flap. To improve the results of surgical rehabilitation of patients with post-burn scar deformity of the face and neck using displaced and rotational neck flaps. According to the applied plastic surgery methods, 87 patients were divided into two groups. In the main group – 40 patients, the proposed method of eliminating post–burn scar deformity of the face and neck was performed; in the comparison group - 47 patients, plastic surgery with a mixed or rotary neck flap was performed according to traditional methods. The developed method of surgical treatment of post-burn scar deformity with a displaced neck flap in the face and a rotational flap in the neck is characterized by the simplicity of the operation, improves the aesthetic quality of the formation of the chin-neck bend during plastic surgery of the lower facial area, and is generally characterized by a decrease in the tension of implanted tissues, improvement and acceleration of the processes of engraftment, reduction of the risk of local inflammatory and the scar-adhesive process.
Keywords: *replaced or rotational neck graft; post-burn scar deformity; surgical treatment; face and neck.*

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INTRODUCTION

In economically developed countries, thermal burns reach 380-390 cases per 100,000 population [1]. In the Republic of Uzbekistan, according to the Center for Statistics (Republican Health Center, 2019), 35-38% of the total number of patients who received thermal burns for the year were with burns of the head and neck. Despite advances in the treatment of burns and their consequences, many survivors of burns experience disabling scar deformities. Thus, more than 50% of patients with deep burns of the face and neck need to eliminate scarring defects with restoration of function and aesthetic appearance. Extensive scars not only cause functional disorders, limiting the ability of patients to perform everyday tasks and actions, but can also cause significant psychological and social disorders. In general, the head and neck area (H&N) is a highly specialized area of the body that performs key psychological and social functions. Post-burn scars can significantly affect each of these functions, as well as disrupt respiratory function, vision, speech, and even the ability to express emotions [2]. H&N burns are common and affect many people every year [3]. Heilbronn CM, et al. it was reported that more than 200,000 patients were examined in emergency departments in the United States in connection with H&N burns from 2009 to 2013 [4]. The large number of affected patients and the potential lifelong impact of H&N injuries highlight the need to develop and improve specific therapeutic strategies that can improve patient outcomes. Burns can cause extensive and devastating head and neck injuries. Preventing the initial injury should always be a priority, but once the injury has occurred, the immediate goals should be to prevent the progression of the injury along with the patient's survival. Emergency care will have a big impact on subsequent scarring, the need for

reconstruction and the long-term outcome. In most cases, reconstruction will involve restoring the shape and function of soft tissues, and the methods used will largely depend on the degree of scarring in place and in other parts of the body. In almost all cases, it is possible to achieve a significant improvement in functional and aesthetic results, which, combined with intensive psychosocial rehabilitation, can lead to high-quality patient treatment results [5, 6].

Plastic surgery of scar defects of the face with a displaced and neck rotational neck flap remains one of the most frequent operations. This technique does not require special equipment and tools, and if it is possible to replace scar tissue with healthy skin from the neck, it is the main method of choice. This study is aimed at reducing the risk of developing specific complications of plastic surgery. The introduction of the proposed methodology into clinical practice allowed us to analyze the first results of these operations.

MATERIAL AND METHODS

All patients were divided into two groups according to the applied plastic surgery methods. In the main group – 40 patients, the proposed method of eliminating post–burn scar deformity of the face and neck was performed; in the comparison group - 47 patients, plastic surgery with a mixed or rotary neck flap was performed according to traditional methods (Table 1).

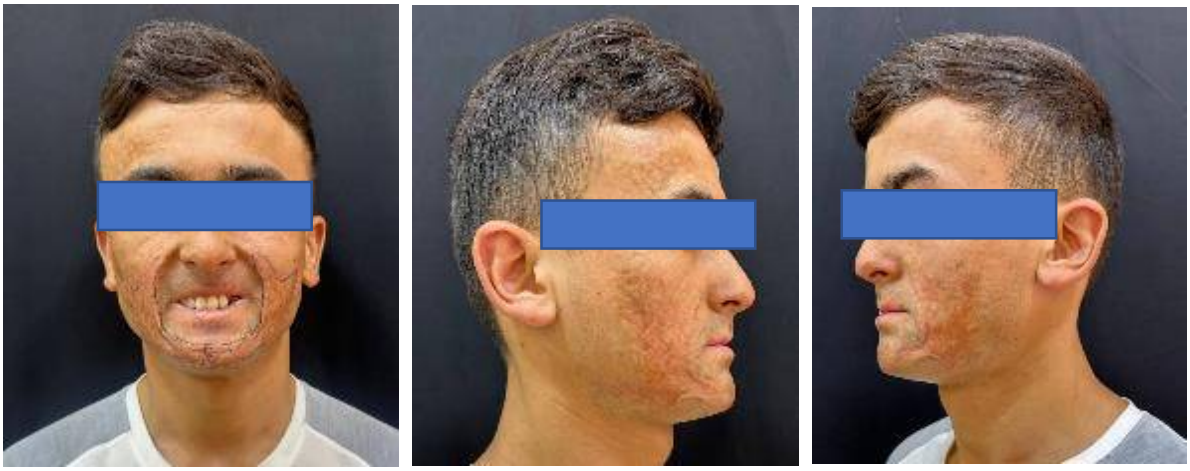
Table 1: Distribution of patients by type of plastic defects of the face and neck

Type of operation	Comparison Group		Main group		Total	
	abs.	%	abs.	%	abs.	%
Facial defect plastic surgery with a displaced neck flap	26	55,3%	22	55,0%	48	55,2%
Neck defect plastic surgery with a rotary neck flap	21	44,7%	18	45,0%	39	44,8%
Total	47	100,0%	40	100,0%	87	100,0%

Plastic surgery with a displaced or rotational neck flap was performed in 47 patients in the comparison group, of which 26 in the lower third of the face and 21 in the neck. In the main group, this operation was performed in 40 patients, of which 18 patients in 22 cases in the face and neck area.

Both groups were dominated by women. About half of the patients were aged 20 to 44 years, about a third were 45-59 years old. The timing of burns ranged from 1 year to 5 years. In all cases, only finally formed scar deformations without elements of the inflammatory process were subjected to plastic surgery. Taking into account the fact that in this work we consider the results of only one stage of plastic surgery, the sizes of scar defects among patients were different, while the analysis included only patients with an average defect area that was within 50-120 cm^2, as well as large defects that exceeded an area of 120 cm^2. In the comparison group, there were 28 patients with average defects (59.6%), of which 11 (23.4%) were in the lower/3 area of the face, 5 (10.6%) were defects involving 2 or 3 areas of the face, and 12 (25.5%) were in the neck. There were 19 patients with large defects in this group: lower/3 persons – 7 (14.9%), defects involving 2 or 3 areas of the face – 3 (6.4%), on the neck - 9 (19.1%). In the main group of patients with average defects there were 22 (55%), of which there were 7 (17.5%) in the lower/3 area of the face, 4 (10%) defects involving 2 or 3 areas of the face, 11 (27.5%) on the neck. There were 18 patients with large defects in this group: n/3 persons – 6 (15%), defects involving 2 or 3 areas of the face – 5 (12.5%), on the neck - 7 (17.5%).

The method of surgical treatment of post-burn scar deformity of the lower facial area with a displaced neck flap included a skin incision at the border with scar deformity along the anterior-lateral surface of the neck, isolation of a neck flap with subcutaneous muscle to the level of the collarbones, excision of a post-burn scar, treatment of the donor surface with autoplasm, closure of a wound defect with a displaced neck flap, layered suturing with the formation of chin-neck bending and final fixation of the neck flap to the edges of the tissues remaining after excision of scar deformation, nodular sutures, after isolation of the neck flap (recipient zone) and excision of the post-burn scar (donor zone), a powdered composition "HEMOBEN" containing Na-carboxymethyl cellulose, oxidized viscose, oxidized cellulose, calcium chloride in the ratio, mass fraction%, respectively, is applied to the wound surfaces of the recipient and donor zones: 46,5%, 10,5%, 19,0%, 24.0%, in an amount of 60 mg for every 4 cm2 of the treated surface, after 5-10 minutes, autoplasm diluted with saline solution in a ratio of 1:1, applied with a syringe to the treated donor and recipient surfaces in an amount of 10 ml per 10 cm^2 of the surface, to form a chin-neck bend for every 1.5-2.0 cm of the stitched surfaces, fixing nodal sutures are applied with atraumatic braided absorbable suture material 3/0 with maximum lifting of the neck flap upwards, after which the neck flap is additionally fixed to soft tissues from the angle of the lower jaw from both sides to the chin protrusion with a distance between the seams equal to 1.5-2.0 cm (Fig. 1).



Patient's appearance before surgery

Excision of a scar defect on the right and left

Mobilization of the neck flap on the left

The stages of tightening sutures for the formation of the neck furrow and unloading of the flap after applying the Hemoben powder

View after the end of plastic surgery

The nearest and distant result of plastic surgery

Fig. 1. Post-burn scar defect of the lower third of the face. Plastic surgery with a displaced neck flap

It should be noted that this method refers to the plastic of post-burn scar defects of the lower third of the face. At the same time, a similar technology can be applied to defects in the neck, when the flap is also cut out on the neck and moved to the area of the excised scar. The exception in the technique of performing this technique is the absence of the need for additional fixation of the flap to the zygomatic arch (Fig. 2).

Before the operation

After the operation

Fig. 2. Patient A., 32 old years. Post-burn median scar deformity of the neck. Contracture of the II degree. Moderate cosmetic defect. Plastic scarring of the neck with rotary flaps

All patients in both groups underwent a standard complex of preoperative examination. In the postoperative period, all variants of local complications were taken into account, both in the near and long-term period.

RESULTS AND DISCUSSION

The most problematic issue when using a displaced flap from the neck is the possibility of tension of the latter during fixation, which increases the risk of partial divergence of sutures and marginal necrosis. In our observations with facial plastic surgery in the comparison group, marginal necrosis of the flap (usually within 1 cm from the edge) developed in 3 (11.5%) patients, and partial divergence (without necrotic changes) due to the eruption of sutures due to tension was noted in 2 (7.7%) cases (Table 2).

Table 2: The frequency of immediate complications after facial defect plastic surgery with a displaced neck flap

Complication	Comparison Group		Main group	
	abs.	%	abs.	%
Marginal necrosis of the flap	3	11,5%	1	4,5%
Partial divergence of seams	2	7,7%	0	0,0%
Suppuration	2	7,7%	0	0,0%
Hematoma under the flap	3	11,5%	0	0,0%
Patients with complications	6	23,1%	1	4,5%
Patients without complications	20	76,9%	21	95,5%
$\chi 2$ between groups	3,285; df=1; p=0,070			

Plastic surgery with a rotary flap of the scarring zone of the neck refers to a simpler operation, but it is also accompanied by the development of specific complications. Marginal necrosis of the flap in the comparison group developed in 2 (9.5%) patients, partial divergence due to tension was noted in another 1 (4.8%) case, subcutaneous suppuration and hematoma under the flap were noted in 2 (9.5%) cases. In the main group, marginal necrosis developed in 1 (5.6%) case, no suture divergence was observed. In total, in the

comparison group after neck surgery with a rotary flap, various complications were noted in 4 (19.0%) patients, while in the main group in 1 (5.6%). Accordingly, the postoperative period proceeded without complications in 17 (81.0%) and 17 (94.4%) patients (χ2=1.579; df=1; p=0.209) (Table 3).

Table 3: The frequency of immediate complications after plastic surgery of a neck defect with a rotary neck flap

Complication	Comparison Group		Main group	
	abs.	%	abs.	%
Marginal necrosis of the flap	2	9,5%	1	5,6%
Partial divergence of seams	1	4,8%	0	0,0%
Suppuration	2	9,5%	0	0,0%
Hematoma under the flap	2	9,5%	0	0,0%
Patients with complications	4	19,0%	1	5,6%
Patients without complications	17	81,0%	17	94,4%
χ2 between groups	1,579; df=1; p=0,209			

In general, the analysis of the frequency of the development of immediate complications showed that in the comparison group there were only 10 (21.3%) patients with various complications, of which 5 (10.6%) had partial necrosis of the flap, in the main group complications developed in 2 (5.0%) (χ2=4,815; df=1; p=0.029) (fig. 3).

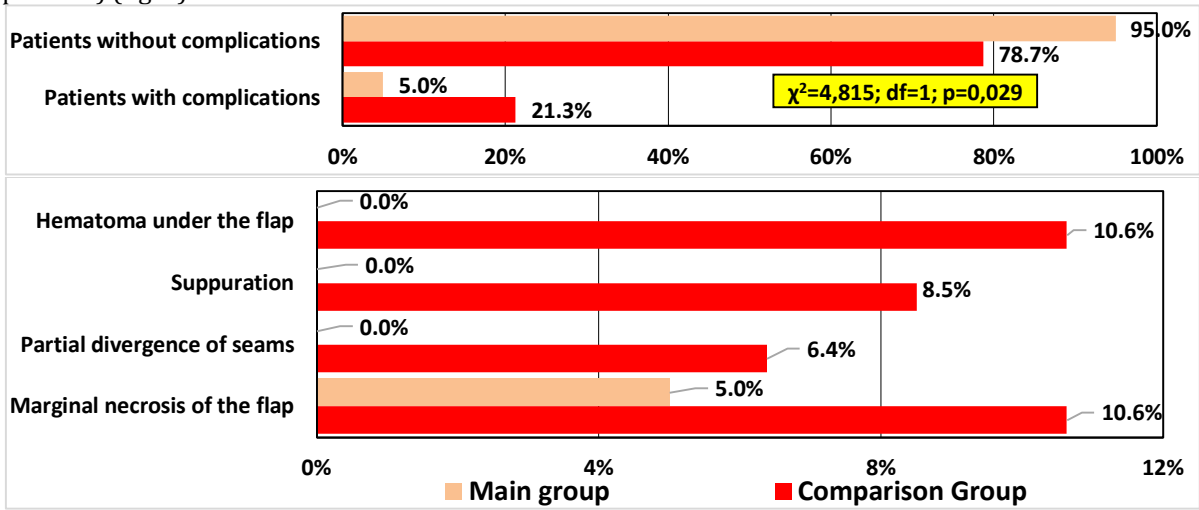


Fig. 3. The frequency of immediate complications after plastic surgery of all defects with a neck flap

The development of complications influenced the further tactics of postoperative rehabilitation. When the sutures diverged, secondary sutures were applied, which was performed in 3 (6.4%) patients in the comparison group. Marginal excision of necrotic tissues was performed in 5 (10.6%) patients in the comparison group and 2 (5.0%) in the main group, respectively. The accumulation of hematoma under the flap, provided that the volume detected by ultrasound was 5.0 ml or more, required percutaneous puncture (under ultrasound control), which was performed in 5 (10.6%) patients in the comparison group. In the main group, thanks to the use of hemostatic agent Hemoben, this complication was avoided. In total, 13 (27.7%) additional interventions were performed in 10 patients in the comparison group, and in the main group in 2 (5.0%) (χ2=7,776; df=1; p=0.006).

The duration of the hospital stage after the plastic surgery of scar defects of various localization depends on many factors, among which special importance is given to the need to resolve the complications that have developed. So, in the comparison group, this indicator after facial plastic surgery was 9.8±2.2 days, in the main group – 8.4±1.6 days (t=2.53; p<0.05). After plastic surgery with a rotary flap, this indicator was 9.1±1.6 versus 8.0±1.5 days (t=2.26; p<0.05). Among all patients after plastic surgery, the duration of the hospital stage was 9.5±2.0 days, whereas in the main group - 8.2±1.6 days (t=3.38; p<0,05).

After discharge, all patients applied for a follow-up examination, which made it possible to assess the long-term complications and the actual result of plastic scar deformities in the face and neck. The evaluation of the effectiveness of plastic surgery with a displaced or rotary neck flap was carried out within a period of 3 to 12 months. To assess the quality of plastic surgery in the long-term period, the following complications were taken into account: the most frequent complication was the formation of hypertrophic scars, which were usually formed in the area of suture divergence. The frequency of this complication in the comparison

group after facial plastic surgery was 46.2% (in 12 patients), in the main group 27.3% (in 6 patients). The recurrence of scar deformity due to the development of marginal necrosis in the near period was noted in 3 (11.5%) cases in the comparison group. In total, there were 15 (57.7%) different complications in the comparison group, and 6 (27.3%) in the main group (χ2=4.481; df=1; p=0.035) (Table 4).

Table 4: The frequency of long-term complications after facial defect plastic surgery with a free skin graft

Complication	Comparison Group		Main group	
	abs.	%	abs.	%
Hypertrophic scar	12	46,2%	6	27,3%
Recurrence of scarring	3	11,5%	0	0,0%
Total	15	57,7%	6	27,3%
Patients without complications	11	42,3%	16	72,7%
χ2 between groups	4,481; df=1; p=0,035			

The incidence of hypertrophic scars in the comparison group after neck surgery was 19.0% (in 4 patients), in the main group 5.6% (in 1 patient). Recurrence of scarring was noted in 1 (4.8%) case in the comparison group. In total, there were 5 (23.8%) different complications in the comparison group after neck surgery, and 1 (5.6%) in the main group (χ2=2.481; df=1; p=0.116) (Table 5).

Table 5: The frequency of long-term complications after plastic surgery of a neck defect with a free skin graft

Complication	Comparison Group		Main group	
	abs.	%	abs.	%
Hypertrophic scar	4	19,0%	1	5,6%
Recurrence of scarring	1	4,8%	0	0,0%
Total	5	23,8%	1	5,6%
Patients without complications	16	76,2%	17	94,4%
χ2 between groups	2,481; df=1; p=0,116			

In general, there were 20 (42.6%) different complications among all patients with plastic surgery with a displaced or rotational neck flap in the comparison group, and 7 (17.5%) in the main group (χ2=6,337; df=1; p=0.012) (Fig. 4).

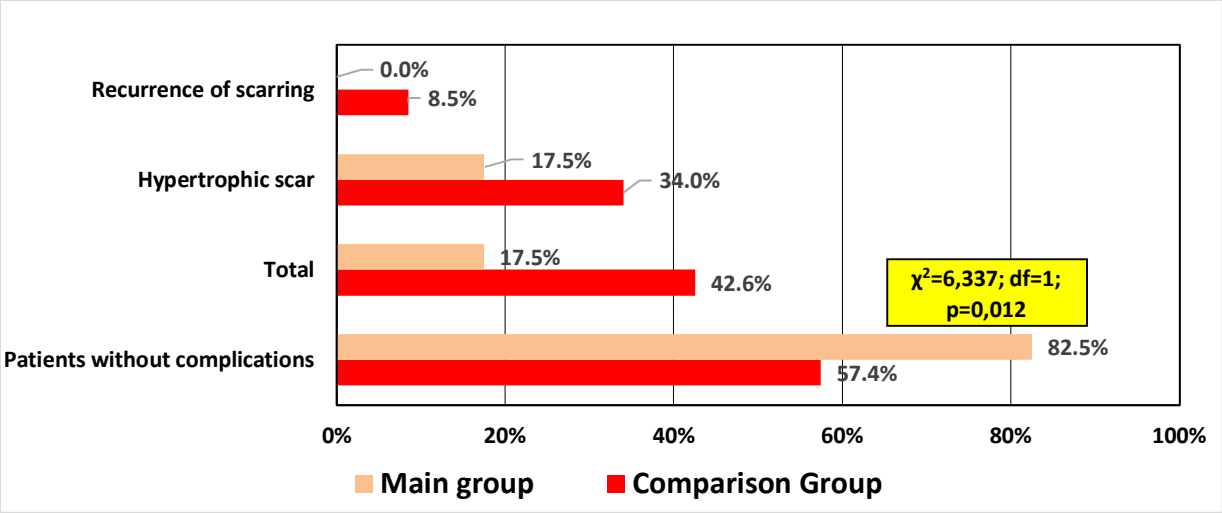


Fig. 4. The frequency of long-term complications after plastic surgery of all defects with a neck flap

The methods of eliminating the developed complications were distributed to hardware cosmetology, that is, laser dermabrasion with the development of hypertrophic scars, as well as their excision, with the formation of extensive scars, as well as repeated plastic surgery with relapses of scar deformation. Excision of hypertrophic scars was performed in 5 (10.6%) in the comparison group and in 2 (5.0%) patients in the main group, repeated plastic surgery with a neck displaced flap was required in 4 (8.5%) patients in the comparison group. Hardware cosmetology was applied in 11 (23.4%) and 5 (12.5%) patients, respectively. In general, 9 (19.1%) patients in the comparison group and 2 (5.0%) in the main group required surgical removal of complications after plastic surgery of scar defects of the face and neck with a displaced or

rotational flap. Accordingly, there were 27 (57.4%) and 33 (82.5%) patients without complications (χ2=6,785; df=2; p=0,034).
The evaluation of long-term results was carried out according to the following criteria.
An excellent result is all cases of grafting of the flap without the development of immediate (affecting the quality of engraftment) and long–term complications.
A good result is cases when there was a development of aesthetic complications that were subjected to various variants of hardware cosmetological treatment.
A satisfactory result is cases when patients with long–term complications in the form of partial cicatricial deformity required surgical removal in the form of excision of scars or secondary corrective interventions.
An unsatisfactory result is a situation when, after plastic surgery, a recurrence of scarring has occurred in the face or neck area, requiring a full–fledged repeat operation to eliminate the defect.
After plastic surgery with a displaced neck flap in the facial area, an excellent result was obtained in 11 (42.3%) patients in the comparison group and 16 (72.7%) patients in the main group. Good results were found in 5 (19.2%) and 4 (18.2%) patients, respectively, satisfactory in 7 (26.9%) and 2 (9.1%) patients. An unsatisfactory result was observed in 3 (11.5%) patients in the comparison group (χ2= 6,527; df=3; p=0.089).
After plastic surgery with a rotary flap in the neck, an excellent result was obtained in 16 (76.2%) patients in the comparison group and 17 (94.4%) patients in the main group. Good results were found in 2 (9.5%) and 1 (5.6%) patients, respectively, satisfactory in 2 (9.5%) and unsatisfactory results were noted in 1 (4.8%) patient in the comparison group (χ2=3,152; df=3; p=0.369).
Summarizing the results of plastic surgery with a displaced or rotational neck flap, it can be noted that an excellent result was obtained in 27 (57.4%) patients in the comparison group and 33 (82.5%) patients in the main group. Good results were found in 7 (14.9%) and 5 (12.5%) patients, respectively, satisfactory in 9 (19.1%) and 2 (5.0%) patients. An unsatisfactory result requiring repeated full-fledged plastic surgery was noted in 4 (8.5%) patients in the comparison group (χ2=8,882; df=3; p=0.031) (Fig. 5).

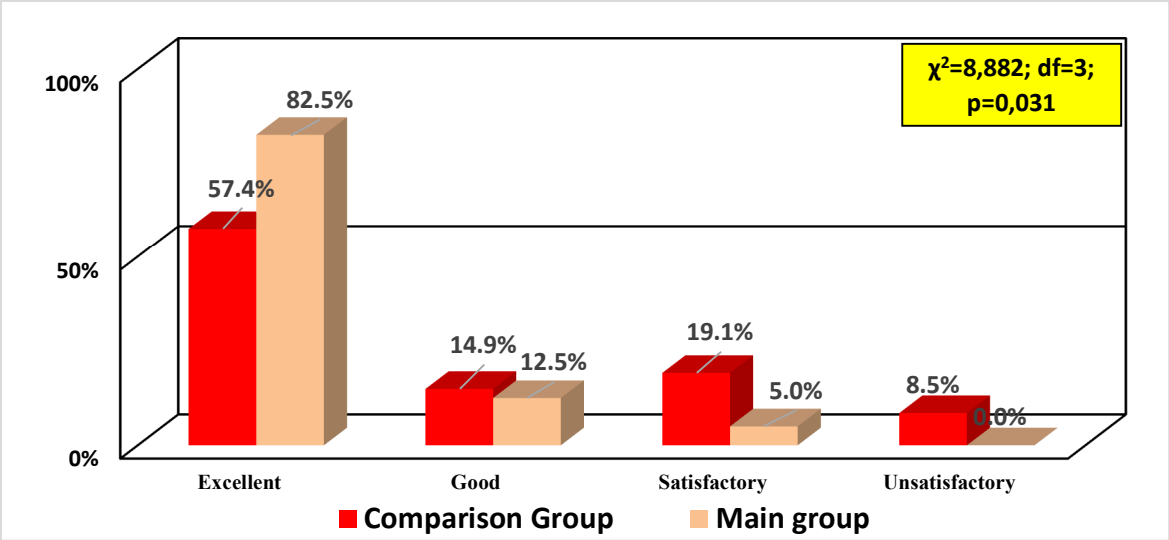


Fig. 5. Summary of long-term functional and aesthetic results of plastic surgery of facial and neck defects with a free skin graft

Thus, the introduction of an improved method of plastic surgery with a displaced neck flap of post-burn scar deformity of the face and a rotational flap in the neck area has reduced the frequency of immediate postoperative complications, respectively, the need for invasive methods to eliminate immediate complications and the duration of the hospital stage after surgery has been reduced. The use of the proposed method affected the improvement of the quality of grafting of the flaps, which ensured a decrease in the frequency of long-term complications and the need for repeated plastic surgery against the background of recurrence of scar deformation. The overall effectiveness of plastic surgery with a displaced neck flap of post-burn scarring of the face and a rotational flap in the neck area when using the improved method was characterized by an increase in excellent results of operations and leveling the risk of developing unsatisfactory outcomes.

CONCLUSION

The obtained first clinical results of the use of a displaced neck flap in the plastic of post-burn scarring of the face and a rotational flap in the neck area according to the proposed method allowed us to draw the following conclusion:

Improved technical aspects of plastic surgery of post-burn scar deformity in the n/3 region of the face with a displaced neck flap and a rotational flap in the neck allowed to reduce the frequency of immediate postoperative complications from 21.3% to 5.0% ($\chi2=4.815$; df=1; p=0.029) (with facial plastic surgery from 23.1% to 4.5%, with plastic surgery neck from 19.0% to 5.6%), respectively, the need for performing invasive methods to eliminate immediate complications decreased from 27.7% to 5.0% ($\chi2=7.776$; df=1; p=0.006) and the duration of the hospital stage after surgery from 9.5±2.0 to 8.2±1.6 days (t=3.38; p<0.05). The use of the proposed method affected the improvement of the quality of grafting of flaps and aesthetic results of operations, which ensured a decrease in the incidence of long-term complications from 42.6% to 17.5% ($\chi2=6,337$; df=1; p=0.012) (with facial plastic surgery from 57.7% to 27.3%, with neck plastic surgery from 23.8% to 5.6%), with the elimination of which hardware cosmetology was successful in 23.4% and 12.5% of patients, respectively, excision of hypertrophic scar was performed in 10.6% and 5.0%, and repeated plastic surgery against the background of recurrent scar deformation was required in 8.5% only in the comparison group.

The overall aesthetic and functional effectiveness of plastic surgery with a displaced neck flap of post-burn scarring of the face and a rotational flap in the neck using the improved method was characterized by an increase in excellent results of operations from 54.7% to 82.5% (with facial plastic surgery from 42.3% to 72.7%, with neck plastic surgery from 76.2% to 94.4%) and leveling the risk of unsatisfactory outcomes (with 8.5% in the comparison group) ($\chi2=8,882$; df=3; p=0.031).

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