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Research Paper

Assessment of the Modified O-T Advancement Flap in Reconstruction of Soft Tissue Defects

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ABSTRACT

BACKGROUND:

Round or oval defects are common in plastic and reconstructive surgery. The functional and cosmetic reconstruction of the defect in surgical process is critical for the patient. Various flaps have been introduced, each of which has its advantages and disadvantages.

OBJECTIVE:

To assess the efficacy of using modified O-T advancement flap in reconstruction of circular and oval soft tissue defects.

PATIENTS AND METHODS:

In this study, twenty five patients (15 males and 10 females), with different skin lesions in different parts of the body were enrolled during the period from September 2018 to March 2020. The most common lesion was basal cell carcinoma (7 cases) followed by melanocytic nevus (3 cases). The most common site was in the neck (5 cases) followed by arm (4 cases). All the cases were reconstructed using modified O-T advancement flap. All patients were followed up for six months.

RESULTS:

All soft tissue defects were surgically reconstructed using modified O-T advancement flap. No significant complications were noticed during 6 months follow up period except 1 case of dehiscence which was managed conservatively.

CONCLUSION:

Modified O-T advancement flap is a reliable, practical and effective reconstructive option for the closure of the circular and oval tissue defects with less scarification of normal tissue, although there are certain limitations in using this technique in some parts of the face.

KEYWORDS: Modified O-T flap, Skin defects, Advancement flap

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INTRODUCTION:

The soft tissue defect has always been a challenge for the reconstructive surgeon. The first systematic procedure using a flap for repairing a mutilated nose in an adult female was attributed to Sushruta, who lived between 6th to 7th Century BC. Four centuries ago, the Italian surgeon Gaspare Tagliacozzi described a delayed flap taken from the arm and used for reconstruction of the nose[1]. The reconstructive ladder which was introduced in 1982 continues to serve as the conceptual framework that allows plastic surgeons to decide on the appropriate reconstructive modality for any given defect, whereas healing by secondary intention and wound coverage using skin grafts rely on a well vascularized wound bed, lack thereof mandates the use of flaps for successful reconstruction [2].

Numerous choices exist for closing any wound, so the surgical challenge is that of selecting the optimal method.

It is necessary to balance multiple factors, including recipient site requirements, donor site morbidity, operative complexity, patient factors and surgeon experience and/or preference. Wounds can be divided into simple, compound, composite and complex tissue defects, for example in the facial region, resection of a large skin tumor often causes a single tissue defect (skin), whereas removal of intraoral squamous cell tumor can produce a compound defect (oral lining and bone), a composite defect (oral lining, bone and skin), or even a complex defect (oral & nasal lining, three dimensional maxillary bone loss, skin and subcutaneous tissue) [3]. Local flaps are flaps that are located adjacent to the defect site; and they maybe contiguous to the defect or small amount of tissue may separate the flap from the defect.

The surrounding tissue is transferred to repair the defect and therefore, the flap tends to be similar in color, texture and thickness and can often be tailored to the needs of the defect [4].

Most minor procedures can be performed in an outpatient basis under local anesthesia, and secondary defects can frequently be closed directly. The greatest drawback to the use of skin flaps is that they require planning and experience[5], in this study 25 patients were evaluated for using O-T advancement flap for closure of oval or circular defects in terms of efficacy & aesthetic outcomes.

PATIENTS AND METHODS:

Between September 2018 to March 2020, this prospective study was done at Al-Sadir Teaching hospital, Basra, Iraq. The total number of cases was 25 (15 males and 10 females), with their ages ranged between 15 and 84 years, mean (47 ± SD 19.56). All the patients were surgically managed by skin excision and the skin defects were reconstructed by the use of modified O-T advancement flap.

Patients with lesions less than 1.5 cm., patients who had scars surrounding the skin lesion, patients with facial lesions and patients who refused to have a T shaped scar were excluded from the study. Full medical history was taken and patients were subjected to clinical examination including the site, size of the lesion, depth, the tissue laxity around the lesion which was confirmed by pinching test and lymph node examination in case of suspected malignant lesions. Differential diagnosis was considered for every skin lesion and the final diagnosis was confirmed by histopathological examination. Pre-operative investigations were sent for all patients including complete blood count, bleeding and coagulation profile and virology screen for (Hepatitis B virus, Hepatitis C virus and Human immune deficiency virus). All the pre, intra and post-operative photos obtained after taking verbal consent from the patients or their parents for those under 18 years old. All operations were done under local anesthesia, routine pre-operative skin preparation and disinfection was done by using Povidone iodine. Marking the skin lesion following draping was done and those who were suspected to be malignant, a safety margin was taken ranging between (0.5cm-3cm) according to the type of that lesion.

Measurement of the transverse diameter of the resultant circular shape along the direction of minimum tension at the circular center was done after doing pinching test.

Then a line was drawn perpendicular to the circle with the same length of the transverse diameter along the extension of the lesion into the surrounding area of excess laxity skin. After completing the markings, local anesthesia was infiltrated (Lidocaine 1% with 1:100.000 Adrenalin), and the lesion was excised completely and an incision along the (a a`) line which is intersecting perpendicular with circle at point (a). After incising this line down to subcutaneous tissue, two flaps were elevated and undermined with adequate thickness and advanced to the center of the circle and the leading edges of these two parallel advancing flaps will be represented by point (a1 & a2) Then the two flaps were sutured with opposite site of the circle (i.e point b) after doing an undermining of the opposite site so that the defect covered completely by the two advancing flaps and the opposite site advancement (point b), which in turns give us a tension free center of closure with much tissue available. Both points (c and d) which represents the vertical axis of the diameter of the circle would shift to new location to point (c`& d`). Points a1, a2 & b were sutured together by using cross over half buried suture technique with 3/0 Polyprolene suture, the remaining of incision was closed in layers with usage of 3/0 Vicryl suture as inverted dermal suture and the skin was closed by 3/0 Polyprolene suture as simple interrupted suture so that the final appearance of wound would be T shaped, as shown in figure (1).

Patients were discharged in the same operative day with prescription of oral antibiotics and instructions about dressing changes for seven days post operatively. The sutures were removed on the 10^{th} – 14^{th} day of operation depending on the site of the lesion. All the patients were scheduled for regular follow-up visits (weekly at the first month and monthly for the subsequent 2-6 months). In each visit, the healing process was assessed along with checking for any complication or recurrence of malignant lesions. Additionally; photographic documentation was performed.

The final assessment of the scar was done using the Patient and Observer Scar Assessment Scale (POSAS) [6,7], which is a standard comprehensive tool for assessment of surgical scar, in which both the observer and the patient give scoring from 1 to 10 for a six categories, so that the score 1 presenting the normal skin and the score 10 presenting the worst imaginable scar.

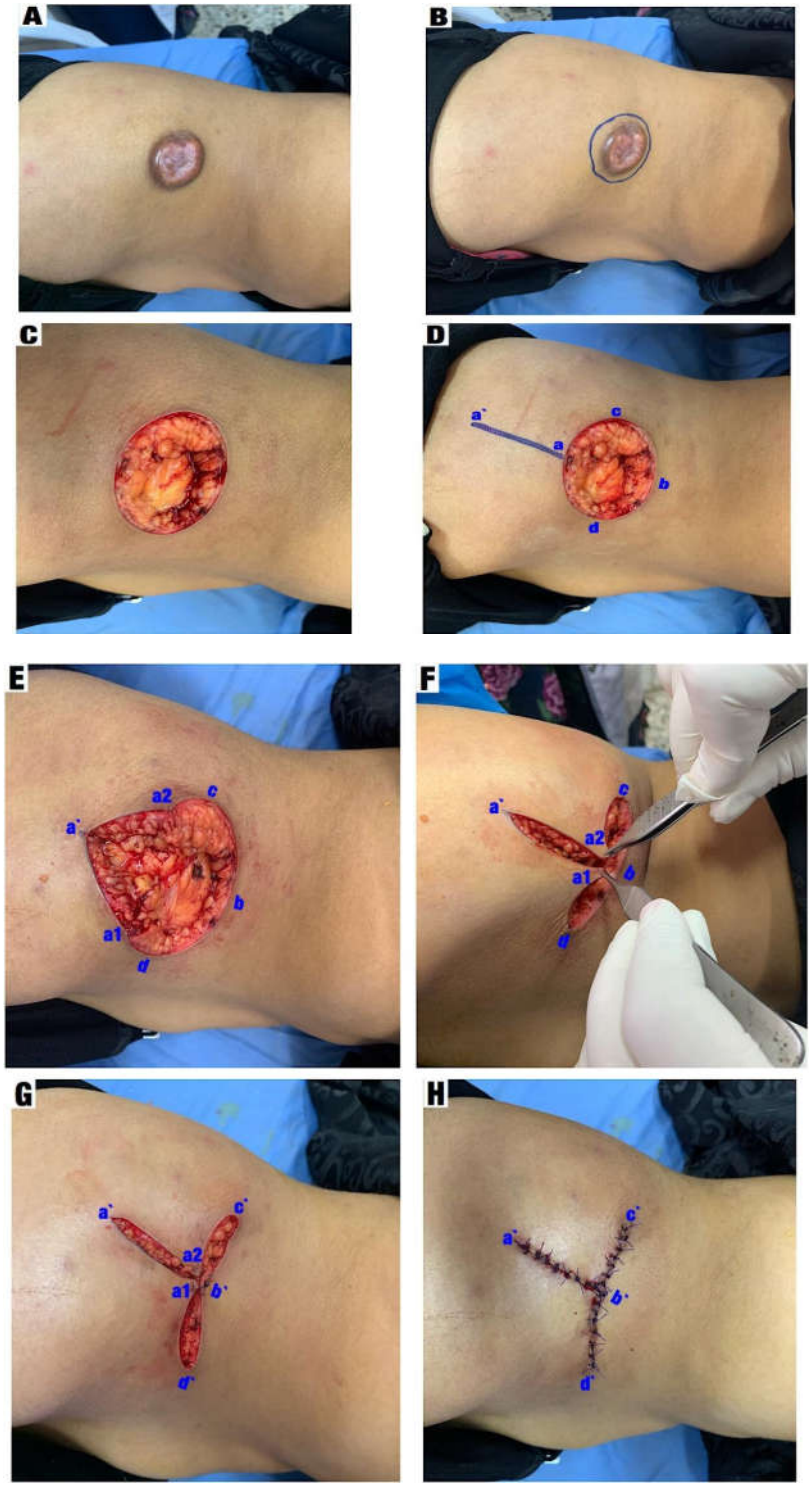

Figure 1: Steps of surgical operation of Granular cell tumor in the flank. A. Preoperative view B. Marking the lesion C. The resulted defect D. Marking the modified O-T advancement flap E F. Dissection and advancement of the flaps G. Suturing the tips of the flaps H. Final result after closure of the wound

RESULTS:

Table (1) showed the distribution of patients according to age and gender. The total number of cases was 25. Their ages ranged between 15 to 84 years with mean (47 ± SD 19.56), 10 (40%) of them were females and 15 (60%) of them were males.

Table 1: Distribution of patients according to age and gender

Age group (years)	Number	Percentage
10-20	2	8%
21-30	4	16%
31-40	2	8%
41-50	2	8%
51-60	6	24%
61-70	6	24%
71-80	2	8%
81-90	1	4%
Total	25	100%
Gender	Number	Percentage
Females	10	40%
Males	15	60%
Total	25	100%

Results in table (2) showed that the most common lesion was basal cell carcinoma 7 (28%) cases, followed by melanocytic nevus 3 (12%) cases. The most common site for lesions was the neck (5 cases) followed by arm (4 cases) and (3cases) for each of thigh and leg.

Table 2: Distribution of patients according to site of lesion

Type	No.	Percentage (%)	Site	No.
Basal cell carcinoma	7	28%	Scalp	1
			Neck	4
			Thigh	2
Melanocytic nevus	3	12%	Arm	2
			Leg	1
Squamous cell carcinoma	2	8%	Neck	1
			Arm	1
Neurofibroma	2	8%	Shoulder	1
			Knee	1
Keloid	1	4%	Chest	1
Dermatofibrosarcoma	1	4%	Back	1
Dermatofibroma	1	4%	Leg	1
Cutaneous horn	1	4%	Foot	1
Keratoacanthoma	1	4%	Forehead	1
Tatoo	1	4%	Arm	1
Sebaceous adenoma	1	4%	Scalp	1
Granular cell tumor	1	4%	Flank	1
Xanthogranuloma	1	4%	Thigh	1
Benign eruptive syringoma	1	4%	Back	1
Trichilemoma	1	4%	Leg	1
Total	25	100%		25

According to POSAS, the mean total score using the observer component of POSAS was (28.04 ± SD 6.22), while the mean total scoring using the patient component of POSAS was (27.76 ± SD 4.69) as shown in table (3).

Table 3: The patient and observer scar assessment scale results

Case No.	Complication	POSAS* (observer score)	POSAS* (patient score)
1		33	27
2		29	23
3		30	32
4		28	26
5		35	25
6		17	24
7		28	37
8		22	28
9		34	30
10		25	33
11		32	21
12		25	27
13	Wound dehiscence	43	36
14		21	30
15		24	33
16		19	23
17		36	27
18		30	28
19		27	26
20		35	33
21		20	17
22		22	28
23		30	30
24		24	23
25		32	27
Mean		28.04	27.76

**Normal skin score 6. Worst scar imaginable 60*

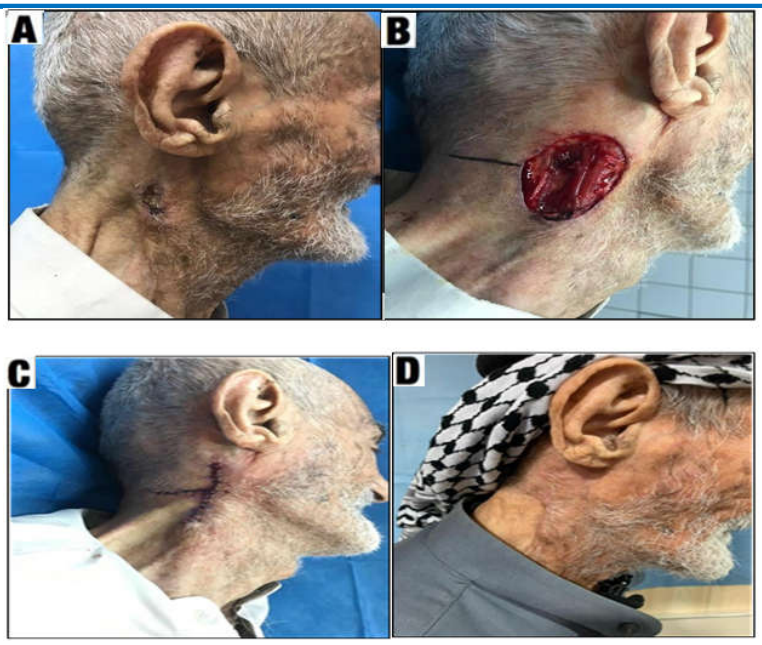

Figure 2: Case No. (1) A. Pigmented nevus in the neck preoperative view B. After excision showing the Modified O-T flap design C. After completing closure of the flap D. Photograph after 6 months of the operation

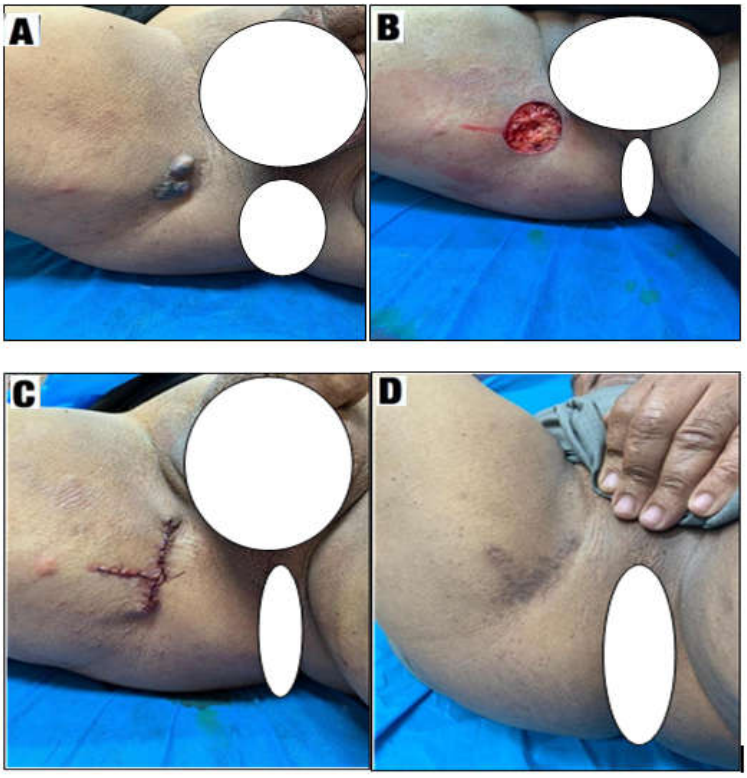

Figure 3: Case No. (2) A. Basal cell carcinoma preoperative view B. After excision of the tumor and planning of Modified O-T advancement flap C. After completing closure of the wound D. Photograph after 6 months of the operation.

DISCUSSION:

One of the most common defects that maybe encountered after excision of skin lesion whether benign or malignant lesions are circular defects. One of the simplest methods is to include the lesion into elliptical skin excision with direct closure, however, such method can be used for small size defects. For larger defects, local skin should be used such as rotational, trans-positional and advancement flaps [8,9].

The advancement flap can be configured in many different ways and not confined to two parallel lines, like the O-T & V-Y advancement flaps. Both of these flaps represent an alternative method to close the circular defects by non-linear advancement flaps [10,11].

In standard O-T advancement flap, the dimension of the triangle which guides the formation of the flap varies according to size of the defect, and proximity of nearby adjacent structures. Many studies suggested that the length of central limb of the incision should be twice the diameter of the defect and the base extension of one defect diameter on each side [11,13].

Also standard O-T advancement flap may have a risk of tension and necrosis of the leading edge adjacent to defect rather than the center of the defect . Also there will be loss of normal tissue when converting it from circular to triangular shaped defect and also burrow triangles may be needed to be excised to ease the advancement of the flaps and that means more of normal tissue excision which in turn leads to longer scar length of standard O-T advancement flap So, to overcome the problems of the standard O-T advancement flap, a modified O-T advancement flap is constructed.

The modified O-T flap distributes the circular defect equally, makes the long axis as the transverse incision of T shaped flap, and makes the defect center as tension center, which effectively distributes the tension to relieve the tension of each advancement flap, while the standard O-T flap sets the incision as the tangent of circular defect, and the center of the tension is localized in the edge of adjacent circular defect. In this study, the modified O-T advancement flap was used for treatment of variety of benign and malignant skin lesions in different sites of the body and it was successful in all patients. All the flaps completely survived with no reported case of partial or complete flap failure. The defect was closed completely without tension with no residual dog ear deformity and the post-operative scar was acceptable as shown in the results obtained from POSAS which had a mean of (28.04) and (27.76) for the observer and the patient components respectively.

In this study the size of the defect was ranging between (1.5–8cm) in length.

There are many suturing methods to avoid flap tip necrosis at the junction of the advancement flap with opposite side of the defect including tip-stitch technique (half buried suture) and its modification crossover tip-stitch [14].

We easily sutured the junction area of advancement flap by crossover half buried suture and we did not notice any tip flap necrosis with using such type of suturing, also there is no more normal tissue is excised with smaller scar length result.

In addition, the modified O-T advancing flaps covering half of the defect, so they do not traverse a long distance and there is no risk of developing a dog ear redundant skin which needs to be excised and then longer scar length result.

Although the standard O-T advancement flap was used especially for reconstruction of the defect in facial area, we avoided to use modified O-T advancement flap in face due to visible resultant scar which is difficult to hide within relaxing skin tension line of the face, except for hair bearing area adjacent to temple area and defect adjacent to the vermilion. The transverse limb of T shaped flaps within the junction area of aesthetic unit can be easily hidden, but the vertical limb is difficult to be hidden.

Regarding the comparison of modified O-T advancement flap with other flaps like Rotational flap and Limberg flap, the Rotational flap can be used to close circular defect, however, because of its design, the size of the rotational arc may need to be three to four folds the size of the defect in order to obtain free flap mobility and tension free closure, and this will increase the scar length and reduce the aesthetic outcome of rotational flap. In addition, a burrow triangle or back cut maybe needed to free up the distal end of the arc to increase the mobility and rotation, these will increase the normal tissue excision incase of burrow triangle and jeopardize its blood supply in case of using a back cut [12].

Limberg flap (Rhomboid flap) had been also used to close circular defects but it needs considerable amount of healthy tissue excision in order to convert the defect into rhomboid shape. The defect is closed by means of transposition flap, and the flap donor site is often closed under considerable amount of tension in spite of stretching and undermining of wound edges as mentioned by Mehmet Mutaf et al [15].

The original method of modified O-T advancement flap was introduced in 2017 by Zhuo Rau Li et al on 48 patients in different sites for variety of skin lesions. Their results showed that 41 out of 48 patients had satisfactory results with 2 cases had scars, 3 cases had wound infections and flap tip necrosis in 2 cases only. The defect size in above mentioned study was ranging between (0.9 – 11 cm) [12].

CONCLUSION:

Modified O-T advancement flap is a reliable, practical and effective reconstructive option for the closure of the circular and oval tissue defects with less loss of normal tissue. However, larger series of patients and prolonged periods of follow up are required for an accurate assessment.

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