The Double Scalpel Flap: A New Technique for the Closure of Circular Skin Defects

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Abstract: Reconstruction needs to be designed attentively to obtain a functional and a good aesthetic consequence for closing skin defects. Numerous local flaps have been defined to conceal skin defects. However, new techniques are still required, especially for circular type of skin defects.

This study describes a new technique that has been well defined to repair the circular type of skin defects. The technique basically uses extra skin relaxation provided with 2 opposing flaps' rotation maneuver in favor of the defect closure. The objective of this technique is for the flaps to start from one border of the defect and extend just to the other border, not invading beyond the defect borders. This enables us to apply the procedure on defects that are close to important anatomical structures because it is sufficient to use only the opposing 2 sides of the defect for its closure.

With this method, 2 opposing flaps that resemble the tip of a scalpel were rotated to the existing circular defect; and by suturing these 2 flaps at the midline, the defect was closed. This technique was applied to 17 patients between the ages of 48 and 83 years. Defect sizes were between 2.5 × 2.5 and 5 × 5 cm.

With the use of opposing flaps designed narrower than half-width of the defect, a tension-free closure could be achieved on both the donor and the recipient site. No flap necrosis was detected on any patients. After a mean follow-up of 11 months (3–26 months), it was realized that a good aesthetic appearance could be achieved in all the patients about 2 to 3 months postoperatively.

Key Words: Defect closure, skin defects, circular defects, local flaps, Z-plasty, double scalpel flap

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Many local flaps have been defined to close skin defects all over the body.[1–17] However, new flaps are still required because of the variety of size, shape, and location of the defects. An ideal local flap should be as identical as possible and as similar color to the recipient site; in addition, it should leave minimum scarring. It should not be so tightened and should not cause any contour disorder when closing the defect. With these objectives in mind, a new flap design has been created for circular skin defects. "The double scalpel flap" is composed of a variation of rotation, advancement, and subcutaneous pattern flaps. The main advantages of this technique are as follows: it needs no extra healthy skin excision and no alteration of the circular defect shape. This flap can also be easily used in large circular skin defects on various parts of the body such as flank, abdomen, and torso in which there is a thick layer of subcutaneous tissue.

SURGICAL TECHNIQUE

In this technique, 2 opposing flaps were used to close a whole circular defect. Initially, the lesion is excised in round form with sufficient free margin, and then the flap design is carried out. After drawing a straight line (line 1) that is parallel to the relaxed skin tension lines, the circular defect is divided into 2 equal semicircles. Two other tangential lines to the circular defect (line 2 and line 2) are drawn parallel to line 1 and also the relaxed skin tension lines (Fig. 1A). Two opposing flaps are intended to be elevated in between these 2 tangential line 2 and line 2. Flap 1 (f1) resembles the tip of a scalpel; its sharp edge facing the defect is planned to be situated tangentially to the existing circular defect. The blunt edge of scalpel is positioned at an angle of 75° to line 1 (Fig. 1B). The width (w) of this flap (f1) is less than or equal to the radius (r) of circular defect. The length (l) of this flap is less than or equal to the diameter (2r) of circular defect. An exact copy is fashioned on the opposite side of the circular defect (f2) as a mirror image of f1 (Fig. 1C). By this drawing, the flaps (f1 and f2) are based opposite to each other.

Subsequently, these 2 pairs of flaps (f1 and f2) are elevated with a minimal undermining of neighboring tissues. Then, f1 is transposed to the defect, rotating at an angle of 75° to reach the lower half of this circular defect. In the same way, f2 is also transposed to the defect, rotating at an angle of 75° aimed to reach the upper half of the present circular defect. The blunt edges of both flaps (f1 and f2) are sutured in the midline (line 1), whereas the semicircular edges are sutured to the upper and lower borders of the circular defect as extending to line 2 and line 2. The donor sites are sutured primarily and closure is then complete (Fig. 1D). Using this plan, the central segment and 2 lateral segments of the final suture lines would follow the relaxed skin tension lines.

MATERIALS AND METHODS

Over 2 and 1/2 years, "the double scalpel flap" procedure was successfully used in 17 patients aged from 48 to 83 years in our clinic. Detailed informed consents were obtained from the patients for the operation. This technique was used for the closure of skin defects resulting from removal of the skin cancers located at facial area in 10 patients, on upper extremity in 2 patients, and on the trunk in 5 patients. The defect sizes ranged from 2.5 to 5 cm in diameter. These data are summarized in Table 1. All patients of this group were operated with local infiltration anesthesia with 1% lidocaine

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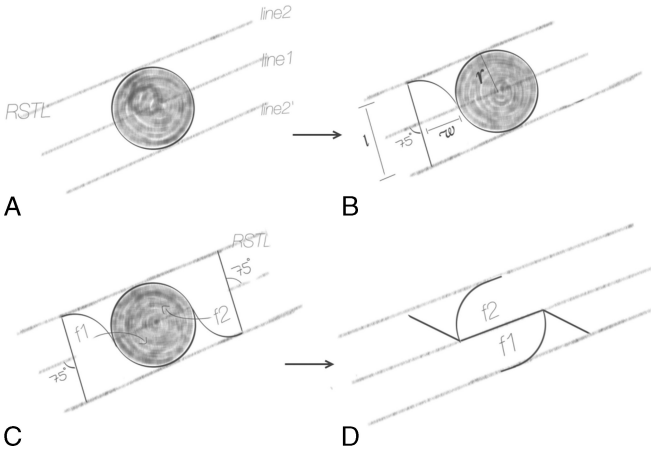

FIGURE 1. Illustration demonstrating the technical details of the procedure. A, A straight line (line 1) and 2 tangential lines to the circular defect (line 2 and line 2) are drawn as being parallel to line 1 and the relaxed skin tension lines (RSTL). B, The blunt edge of scalpel flap1 (f1) is positioned at an angle of 75° to line 1. C, f2 as a mirror image of f1 is fashioned on the opposite side of the circular defect. D, f1 and f2 are transposed to defect and closure is complete. w indicates width of f1; l, length of f1.

solution. All patients were operated by H.K. and U.B., or were under their supervision.

RESULTS

There were no complications such as infection, partial, or complete flap necrosis, so all patients healed uneventfully. No tumor recurrence was observed locally during the follow-up period. In 1 patient with squamous cell carcinoma at preauricular region, metastasis of neck lymphatics developed at 3 months after the operation and a neck dissection procedure was performed. In all patients of this study, an advisable tension-free closure of the defect was successful. It is worth mentioning that in all patients, the defect closure was achieved without any additional healthy tissue excision. In some patients, minor "dog ears" were observed on lateral segments of suture lines at early postoperative period, but later on the whole thing resolved entirely. The "trap-door deformity,"[18] which is a result of the contracting forces in semicircular scars and yielding abnormal depressions in the suture sites, was not observed in any patients.

This technique was found to be suitable for repairing the skin defects up to 5 cm in diameter in this clinical series. An excellent skin match with fine scars was obtained because the defects were closed with neighboring tissues. Furthermore, it was noticed that the zigzag shape of the final suture lines results in a cosmetically satisfactory scar. None of the patients needed a revision surgery. A mean follow-up of 11 months (3–26 months) revealed stable skin coverage in all patients. It is also noteworthy that in 2 patients of this study group, wider defects of the facial region resulting from tumor excision were successfully closed with this technique (cases 1 and 4).

Illustrative Clinical Reports

Patient 1

A 79-year-old male patient consulted with complaint of a long-lasting lesion located lateral of his left eyebrow (Fig. 2A). Under local infiltration anesthesia with 1% lidocaine solution, basal cell carcinoma lesion was excised with 5-mm free margin. The resultant defect was found to be 4 × 4 cm wide (Fig. 2B). Defect closure was accomplished with the double scalpel flap procedure (Fig. 2C). There was no recurrence for the lesion and an acceptable scar was achieved 14 months postoperatively (Fig. 2D). The resulting zigzag scar became almost imperceptible at 14 months after the operation. This patient also had very natural features, and an excellent result was obtained without the displacement of the free margin of the eyelid and the tail of the eyebrow.

Patient 2

A 59-year-old male patient consulted with a complaint of a lesion that had been growing for the last 6 months on the left alar wing of his nose (Fig. 3A). Under local infiltration anesthesia with 1% lidocaine solution, the basal cell carcinoma lesion was excised with a 5-mm free margin and the resultant 2.5 × 2.5 cm defect was planned to be closed with this newly designed technique (Figs. 3B and C). By transposition of the flaps, a tension-free closure was achieved without any extra healthy skin excision and dog-ear formation (Figs. 3D and E). A very satisfactory scar was achieved on the patient at 11 months postoperatively (Fig. 3F).

Patient 3

An 83-year-old female patient consulted with complaint about a growing lesion on the right preauricular region. Under local

TABLE 1. Patient Summary

Patient No.	Age	Sex	Defect Location	Defect Size (cm)	Pathology	Follow-up (months)	Recurrence
1 (case 1)	79	E	Left eye lateral	4 × 4	BCC	14	No
2 (case 2)	59	E	Left nasal wall	2.5 × 2.5	BCC	11	No
3 (case 3)	83	K	Right preauricular	3 × 3	SCC	12	Neck metastasis
4 (case 4)	72	E	Left cheek	5 × 5	In situ malign melanoma	4	No
5 (case 5)	57	K	Right infrascapular	4 × 4	In situ malign melanoma	3	No
6	52	E	Right infrascapular	2.5 × 2.5	BCC	16	No
7	51	E	Right deltoid	3 × 3	BCC	18	No
8	49	E	Chest	4.5 × 4.5	BCC	9	No
9	75	E	Left arm	3 × 3	BCC	26	No
10	48	K	Chest	5 × 5	BCC	6	No
11	76	K	Left malar region	3.5 × 3.5	BCC	3	No
12	58	E	Left malar region	4 × 4	BCC	2	No
13	73	E	Right submandibular	2.5 × 2.5	BCC	6	No
14	80	E	Right preauricular	2.5 × 2.5	BCC	12	No
15	71	K	Right supraclavicular	3 × 3	BCC	17	No
16	74	E	Left hypochondriac	4 × 4	SCC	4	No
17	67	K	Left malar region	3 × 3	BCC	6	No

BCC, bazal cell carcinoma; SCC, squamous cell carcinoma.

FIGURE 2. Patient 1. A, A 79-year-old male patient with a lesion located lateral of his left eyebrow. B, Basal cell carcinoma lesion was excised with 5-mm free margin, the resultant defect, and elevation of the double scalpel flaps. C, Immediate postoperative view. D, Late postoperative view at 14 months after surgery.

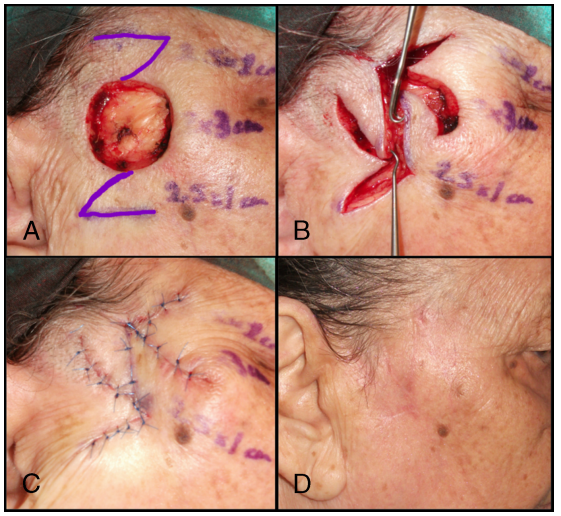

FIGURE 4. Patient 3. An 83-year-old female patient with a lesion on the right preauricular area. A, Excisional defect and surgical plan. B, Elevation of the flaps. C, Immediate postoperative view. D, Postoperative view at 3 months after surgery.

infiltration anesthesia with 1% lidocaine solution, the tumor was excised with 10 mm of intact margin (Fig. 4A). The closure of the resultant defect was accomplished with the double scalpel flap (Figs. 4B and C). Pathologic investigation revealed an invasive squamous cell carcinoma. The flaps healed uneventfully, and an aesthetically acceptable scar was achieved at 3 months postoperatively (Fig. 4D). She developed a metastatic disease on her neck at the 8th month of her first admittance. The follow-up and treatment of the patient who was given a neck dissection procedure is still continuing in our clinic.

Patient 4

A 72-year-old man presented with an irregular-bordered lesion located at the left malar region (Fig. 5A). Preoperative biopsy revealed an in situ malign melanoma. Under local infiltration anesthesia with 1% lidocaine solution, the tumor was excised with 1 cm of intact margin (Fig. 5B). The closure of the resultant 5 × 5-cm defect was accomplished with the double scalpel flap procedure (Figs. 5C and E). The flaps healed uneventfully, and an esthetically acceptable scar was achieved at 3 months (Fig. 5F).

Patient 5

A 51-year-old female patient consulted with complaint about a growing lesion on the right infrascapular region (Fig. 6A). Preoperative biopsy revealed an in situ malign melanoma. Under local infiltration anesthesia with 1% lidocaine solution, the tumor was excised with 10 mm of intact margin. The closure of the resultant 4 × 4 cm defect was accomplished with the double scalpel flap (Figs. 6B and D). The flaps healed uneventfully at 3 weeks postoperatively (Fig. 6E).

DISCUSSION

Reconstruction needs to be planned carefully to obtain a functional and a good aesthetic result especially meant for the closure of facial defects. Circular-pattern defects are undoubtedly more

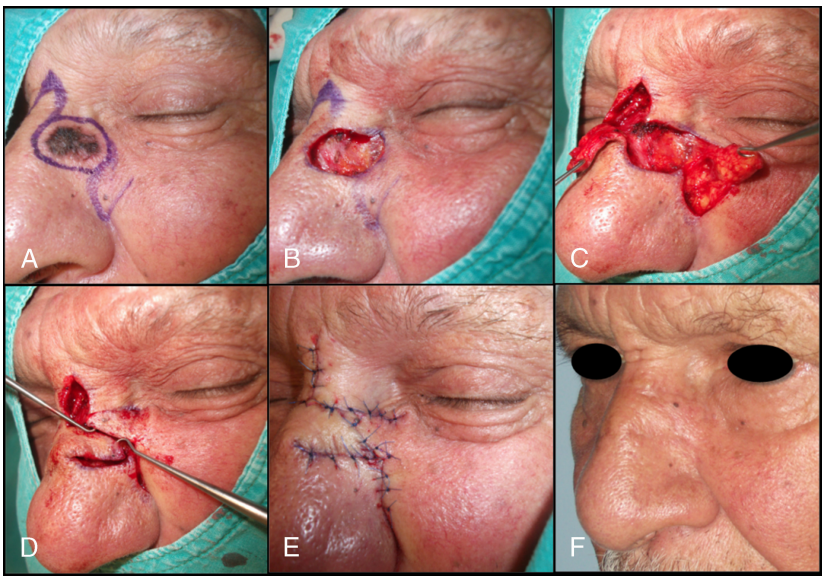

FIGURE 3. Patient 2. A, A 59-year-old male patient with a lesion on the left alar wing of his nose. B, Excised lesion with a 2.5 × 2.5-cm defect. C, Elevation of the flaps. D, Transposition of the flaps. E, Immediate postoperative view. F, Late postoperative view at 11 months after surgery.

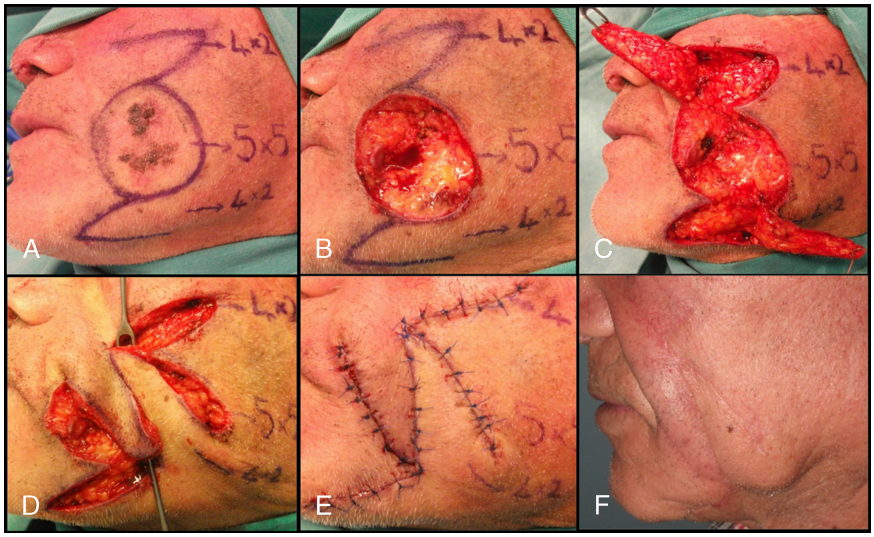

FIGURE 5. Patient 4. A 72-year-old man with an irregular-bordered lesion located at the left malar region. A, Surgical plan. B, Excisional defect. C, Elevation of the flaps. D, Transposition of the flaps. E, Immediate postoperative view. F, Postoperative view at 3 months after surgery.

challenging in this manner. In this study, a new technique for the closure of circular-type skin defects is described. The technique was named the *double scalpel flap* because its opposing flaps' design resembles the tip of surgical scalpels.

Circular defects are often encountered after the excision of skin tumors. For the closure of circular skin defects, several local flap procedures including the Dufourmentel,[3] Limberg,[4] banner,[7] double-z rhomboid technique,[10] note,[12] and the double opposing semicircular flaps[15] have been described in the literature. However, most of these flaps have some negative outcomes such as large scars and distortion of the surrounding tissues due to the tension and wider flap diameter and length. Nevertheless, particularly on the face, it is important that the scar should be as small as possible and there should not be contour distortions on important anatomical structures.

Limberg flap[4] is a well-known and a frequently used technique. It has been used for long periods and has proven to be a practical alternative for defect repair when a direct or elliptical closure is not suitable. As this flap is rotated from only one neighboring side, the potential of extra tension is greater on the donor side, which makes it difficult to be applied on especially larger defects. In addition, it requires careful positioning of the rhomboid defect, and it is sometimes difficult to design sides of equal length and forming precise angles of 60° and 120°, especially in facial regions.

Rotation flaps are rarely applied on face because of the wider arch of rotation. Moreover, a skin graft usage becomes necessary to close the donor side frequently, which results in an undesirable scarring on the face.

In all transposition, rhomboid, and rotational flap usage, as the flap is rotated from only one neighboring side, it might cause distortions on important anatomical structures due to tension of the donor side. Our technique borrows tissue from 2 sides of defect area. Therefore, it helps to distribute tension and brings about a reduced tissue distortion and displacement of the neighboring anatomical landmarks.

This flap design uses 2 different flap movements as transposition and rotation. The skin distensibility around the defect is

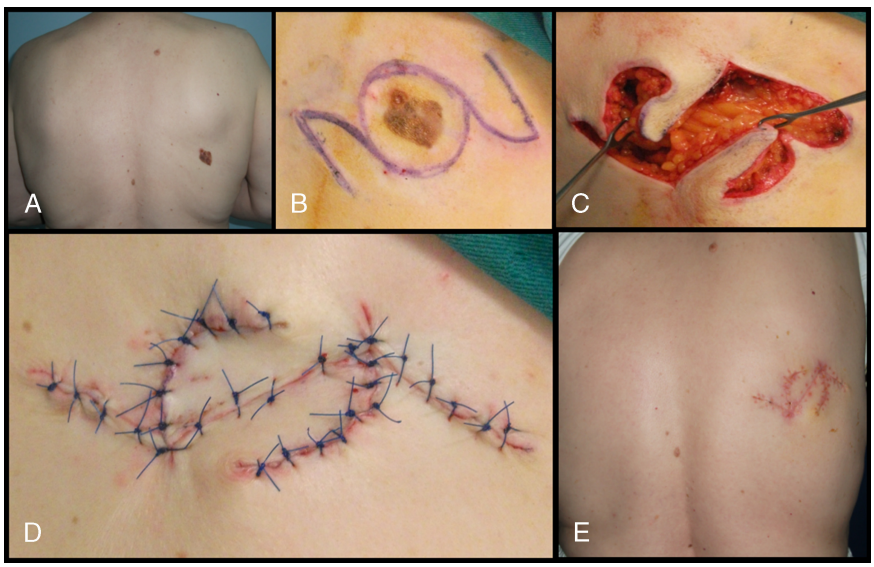

FIGURE 6. Patient 5. A, A 51-year-old female patient with a lesion on the right infrascapular region. B, Surgical plan. C, Elevation and transposition of the flaps. D, Immediate postoperative view. E, Postoperative view at 3 weeks after surgery.

major determinant for these movements. These 2 flaps benefit both their and neighboring tissue laxity during defect closure, which is especially useful in older patients. In this manner, texture, color, and thickness matches are also very good in these patients.

The closure of a skin defect with a flap is determined by borrowing skin from neighboring tissues. It is obvious that being conservative on this tissue usage improves the efficiency of repair.[15] As stated by Golomb and Neumann,[2] the amount of the healthy tissue excision during the procedure is inversely related to the efficiency of a technique for the closure of a circular defect. However, most of the previously reported closure techniques require some additional healthy skin excision either for the alteration of defect's shape[3,4,8–10] or to convert the flaps into the shape of the defect.[7,12,15–17] Repairing the surgical defects with no extra healthy tissue excision from the defect or from the raised flaps is important for reconstruction. The defect closure was achieved without additional healthy tissue excision in all patients of this study. Both 2 transpositional flaps fit into circular defect borders without extra skin excision. In addition, no patient developed dog-ear formation in this clinical series presumably because of the elastic nature of the human skin. In addition, with an appropriate planning before surgery, 3 of 5 segments of the final suture lines sit parallel to the relaxed skin tension lines at the end, which makes closure easy as well as makes resultant scar tissue easily hidden in the natural creases. During the preoperative planning, the clinician should also pay attention to sketch the flap design as it would not interfere with or distort adjacent anatomical landmarks finally.

In the double opposing semicircular flap described by Keser et al,[15] which is designed to distribute the tension equally, the opposing upper and lower flaps intrude beyond the right and left sides of the defect borders, so manipulation of all 4 sides of the defect becomes obligatory. This limits the usage of that flap design especially on the regions like preauricular area where skin tumors are frequently seen. In our technique, as the flaps start from one border of the defect and extend just to the other border so not to invade beyond the defect borders, it is sufficient to use only the opposing 2 sides of the defect. This enables us to use the technique on defects that are close to important anatomical structures such as eyebrows or oral commissures.

On the purpose of closing the donor site without tension, a number of flap techniques have been designated. Mutaf et al[17] reported a novel technique named the *reading man procedure* that is inspired by the z-plasty. In this article, it is pointed out that an important criterion to evaluate the efficiency of the defect closure techniques is the length of the resultant scar.[17] We think that the entire overlaying scar area at the end of procedure is more important than the resultant scar length. Thus, we calculated the ratio of the entire scar area over the defect area and compared the results of "the reading man procedure," "the double opposing semicircular flap," and our technique. For the reading man procedure, the ensuing scar area as a result of this method of defect closure approximately overlays 2.7 times as much surface as the defect area. Intended for the double opposing semicircular flap, this ratio is much higher, that is, 3 times as much surface as the defect area. However, in our technique, the scar formed as a result of the procedure is limited to an area of 1.25 times as much surface as the defect area. This shows that the defect is repaired by closer, that is, similar tissues. Moreover, with the reading man procedure, the need for a second flap to close the donor site defect causes both the scar's being on a wider area and the flap's not being able to be used in some anatomically difficult areas.

In conclusion, we strongly believe that "the double scalpel flap" method, which is aesthetically acceptable, practical, and easily applicable, is a useful alternative to close circular skin defects with different sizes and locations of the body.

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