Forehead Defects Reconstruction Using Double Opposing Rotation Advancement Flaps

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ABSTRACT

BACKGROUND

Reconstruction of a forehead defect is a challenge to the reconstructive surgeon. The existing options for closure of forehead defects may range from primary closure to free flaps. We wanted to evaluate the double opposing rotation advancement flaps for closure of small to large forehead defects.

METHODS

We have used double opposing rotation advancement flaps for reconstruction of forehead defects. Small to large forehead defects are closed by this method without distorting the anatomical landmarks like eyebrow and hairline. 25 patients have undergone double opposing rotation and advancement flaps as a single stage procedure.

RESULTS

Suture line healing was good in all cases. Two cases where defect was more than 30 sq. mm witnessed minimal gaps at the reach of tip of each flap. Later, these gaps healed secondarily with good results. No revisions were done in entire series of cases. The dog ear at the lower pole of the defect is handled as per standard techniques described.

CONCLUSIONS

Forehead defects can be closed using double opposing rotation advancement flaps without disturbing the anatomical landmarks of eyebrow and hair line.

KEY WORDS

Double Opposing Rotation Advancement Flaps, Forehead Defect, Eyebrow, Hair Line

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BACKGROUND

Forehead represents upper one third of the face which is bounded superiorly by the hair line and inferiorly by the glabella, brow and supra orbital ridge.[1] The hair line and eyebrows are considered as strong aesthetic lines though the hair line changes with age and sex. The hairline and eyebrows provide camouflaged anatomical boundaries in which to hide incisions. The hair bearing areas simultaneously limit flap designs. The forehead unit can be divided into five subunits. Anatomically, the central forehead is an extension of the scalp and retains many similar characteristics. Central forehead skin is thick, rather inelastic, and tightly adherent to the underlying frontalis muscle. On either side of the central forehead is the lateral forehead or temple are, which more elastic and often act as a reservoir of tissue for reconstruction.[2]

The frontalis muscle is not present in the temple, and the skin is loosely attached to the underlying temporalis fascia. And the central forehead is convex, the temple is somewhat concave. The eyebrow are subunits unto themselves with hair bearing skin.[3] The relaxed skin tension lines run horizontally in the central forehead as demonstrated by the typical forehead wrinkles. The forehead is being supported by squamous part of frontal bone. The structural layers include skin, muscle layer including occipitofrontalis, procerus, corrugator supercilii. Supraorbital, supratrochlear and frontal branches of superficial temporal artery supplies blood to the forehead. The sensory innervation to the central forehead originates from branches of the supra orbital and supratrochlear nerves. Medially they run in more superficially underneath subcutaneous plane. Laterally the nerves run in deep under the frontalis muscle.[4,5]

Forehead defects may follow from trauma, surgical excision mostly skin cancers. Reconstruction ladder for closure of forehead defects ranges from primary closure, skin graft, expansion, local flaps, regional flaps, to free flaps. Forehead defects poses challenge to reconstructive surgeon because of relatively less mobile and thick skin. Bounded by two important anatomical landmarks like eyebrow and hair line. The distortion of these landmarks causes serious aesthetic disfigurement of forehead.[6] The defects without much tissue loss can be closed primarily either vertically or horizontally in fusiform manner but long incisions are needed. And precautions to be considered are elevation of eyebrows and ugly appearance postoperatively. Skin grafting full thickness or partial thickness is another option for closure of forehead defect but leaves ugly scar and mismatch of colour on forehead.[2] Free flaps option comes as final option when no local or regional flap options are not available.[7]

Because of aesthetic prominence, easily detectable defects and difficulty in matching skin colour and texture the reconstruction of forehead defects is a challenge to the reconstructive surgeon. Lack of abundant and transferable tissues in surrounding areas. Tumour resections, trauma leads to extensive loss of skin fascia and muscles. Unable to approximate the cut edges of defect and unyielding skin, even with undermining adds to the problem. Larger defects require meticulous planning and execution. The size of defect determines the most suitable approach. Larger defects demand different methods with complexity other than conventional approaches.

We describe local flaps in a series of 25 patients retrospectively where forehead defects ranging from 9 Sq. cm to 30 Sq. cm are closed without distortion of eyebrow and hair line alignment.

METHODS

25 patients having post traumatic forehead defects were treated with Double Opposing Rotation Advancement local flaps. All the patients were operated in our hospital between October 2017 and May 2019. The age range of patients was between 5 years and 60 years with mean of 30.8 with a standard deviation of 7.5. All were male patients.

Surgical Technique

In all cases debridement was done to remove all the devitalised tissues. Marking of the flaps done by drawing a tangential line over superior margin of the defect. This line is planned in such a way that the line parallels much of the non-hair bearing area on forehead. Then a vertical line is drawn at about 70 degrees from the tangential line. The length of this vertical line more or less equals the diameter of the defect. The marking of this line is selected on the side of defect where maximum non hair bearing area is available. 3rd line is then drawn parallel to the 1st line with a minimal curvature toward the defect. The final marking for incision looks like capital `T' with drooping horizontal limbs. The length of the horizontal incision is adjusted according the reach and coverage as the surgical procedure moves on. After adrenaline saline infiltration along the incision line and lag period observed for its action. Blunt dissection is done in sub-galeal plane over the pericranium on either side of the defect. As galea is tough and non-yielding, intra operative tissue expansion is done by putting sufficient surgical mops to creative sufficient pressure underneath the flaps. After a time period of 15 minutes, after observing minimal expansion of the flaps the incision is given as per the markings. The flap with acute angle and with maximum non hair bearing area is rotated onto the defect. The opposite flap is used as advancement flap to fill the gap after rotation of the first flap. Minimal dog ear at inferior aspect of defect is adjusted accordingly. Suturing is done in two layers. First layer of dermal suturing done with absorbable monofilament. 2nd suturing done with non-absorbable monofilament material.

RESULTS

25 patients with forehead defects following trauma have undergone Double Opposing Rotation Advancement flaps closure. All male patients with age ranging from 5 yrs to 60 yrs., with mean age of 30.8 years. Defect size ranging from 9 Sq. mm to 30 Sq. mm. Suture line healing was good in all cases. Two cases where defect is more than 30 Sq. mm witnessed minimal gaps at the reach of tip of each flap. Later these gaps healed secondarily with good results. No revisions were done in entire series of cases. The dog ear at the lower pole of the defect is handled as per standard techniques described.

Size of the Defect	No. of Patients
< 10 Sq. Mm	12
10-20 Sq. Mm	04
21-30 Sq. Mm	05
>30 Sq. Mm	04

Table 1. Size of the Defect and the No. of Patients

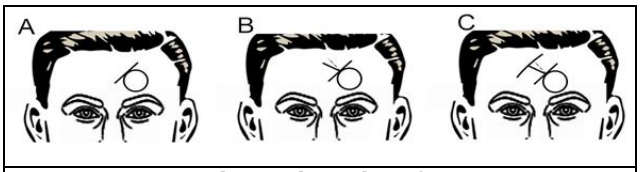

Figure 1. Showing the Markings for Incision

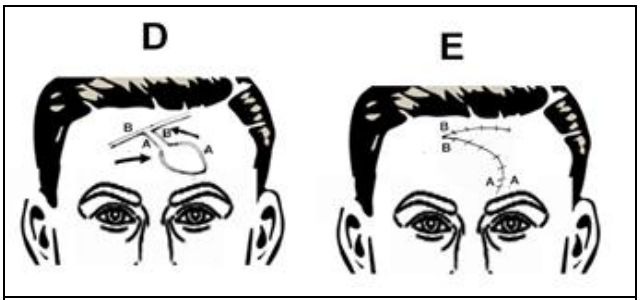

Figure 2. Showing the Movement of Flaps and Final Scar Diagram

Figure 3.
Markings for Incision

Figure 4.
Showing Intra Operative Tissue Expansion

Figure 6.
Final Suture line after Flaps Inset

DISCUSSION

Forehead having been with unyielding tough tissue and no loose surrounding tissue for transfer poses a challenge for reconstructive surgeon. Easily noticeable scars and bounded by hair line and eyebrows necessitates to think of options other than skin grafting and secondary intension healing. Repair by primary closure stands as the first option but is limited to defects size less than 3 cm.[7] Still more larger defects can be closed using H flaps. These flaps uses local tissue and is also reliable but is limited the defects having size up to 6 cm.[8] Skin grafts are useful to cover larger defects, but colour matching and depth irregularities makes them as last option. Dual plane A to T flap technique is good option as it can cover larger defects. Older persons with more lax skin get optimum results and young patients with tight skin may face sub optimal results.[9] To follow the rule of `like to be replaced by like', local flaps give good colour match and Double Opposing Rotational Advancement flap technique adequately covers the larger defects. And this technique characteristically does not disturb the vertical height between Hair line above and eyebrow below. Using this technique small defects to large defects can be closed easily. With the adopted method of intra operative tissue expansion technique gives tensionless closure of flaps even in large defects. This technique has got the advantage of extending the incision along the superior marking as the procedure goes on to ensure required reach of the flaps. Particularly this technique has got the advantage of usefulness in all age groups ranging from children to elderly persons.

CONCLUSIONS

Double opposing rotation advancement flaps to reconstruct the forehead defects can be used for small to large forehead defects. The procedure can done in a single stage. The vertical alignment between eyebrow and hair line is maintained even in large defects.

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