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RESURFACING POSTBURN LOCALISED LINEAR SCAR CONTRACTURE BY SQUARE FLAP

Plastic Surgery

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ABSTRACT

Introduction
Despite increasing sophistication in the overall management of acute thermal injuries, contracture still occurs. Z plasties are the commonest procedures for localized linear band contractures. We intend to assess the versatility of square flap in these cases.

Subjects and Methods
Fifteen patients with localised linear band contractures over different regions underwent correction by the square flap technique. All patients were followed up for at least six months and analysed for functional and aesthetic outcome.

ResultsAll patients achieved near full range of movement postoperatively with more importantly no recurrence during follow up period and a good aesthetic outcome.

Conclusions:
Square flap is a reliable local flap technique for localised linear or narrow band contractures even when there is significant adjacent scarring on one side of linear band.

KEYWORDS

Square flap, linear contracture, band contracture

INTRODUCTION

A healed burn patient may be left with scars with varying degrees of functional and aesthetic components. Their actual incidence is not known. Despite increasing sophistication in the overall management of acute thermal injuries, contracture still occurs. However, it is inversely proportional to the standards of initial treatment with patients receiving best of care having minimum number and severity of these problems[1].

Z plasty and its different variations as multiple Z plasties in series or interrupted, V-Y plasty are the commonest procedures for localised linear scar-band contractures across different joints [2,3].

Square flap is a tissue advancement and transposition technique first described by Limberg in 1963, later modified by Hyakusoku and Fumiri in 1987 as a method to lenghthen the distance between two points[4]. It is a useful method for scar contracture, various clefts and cryptotia. It gives a theoretical lengthening of 2.80 times the original length and does not the cut across the axillary hair bearing region like Z plasty[4,5]. In our study, we have assessed the outcome of the square flap technique in localised linear scar band contractures of various severity.

Subjects and Methods:
We conducted this prospective interventional study in our institute. The duration was two years from January, 2017 to December, 2018. The study population comprised of the patients attending our outpatient department with localized linear or band contracture with at least supple skin on one side of contracture. We included all consecutive patients, who consented for the surgery (convenience sampling method).

Preoperatively, patients' demographic data, history regarding the cause of burns, and the course of treatment were recorded. Type of contracture, status of adjacent skin and its severity in terms of maximum range of movement of affected joint were noted.

All operative procedures were performed under general or regional anaesthesia. A square was designed adjacent to the linear contracture and two adjacent triangular flaps on the other side of the contracture. The lengths of the sides of the square and triangular flaps were kept equal. The angle of the first triangular flap A was kept at 45 degrees and the second flap B ranging from 60 to 90 degrees (figure1). Lesser angles were used in patients with hypertrophic scarring of the adjacent anterior chest wall or back. Marking is shown in figure 2.

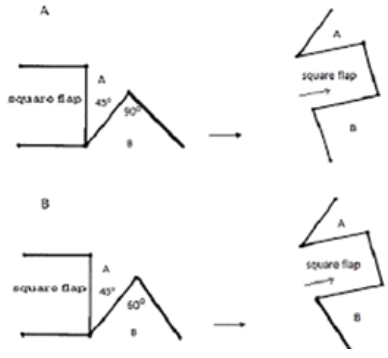


Fig. 1: Square flap - schematic diagram as described by Hyakusoku

After the incisions were made, the contracted scar tissue was released. The square flap was then advanced across the area of contracture and the adjacent triangular flaps were rotated and positioned one on each side of the advanced square flap proximally and distally.

Sutures were removed after complete healing at 10-15 days. Any postoperative complications were noted. Regular physiotherapy was done postoperatively. Follow up visits were scheduled for minimum period of six months and range of motion and photographs were taken at each visit.

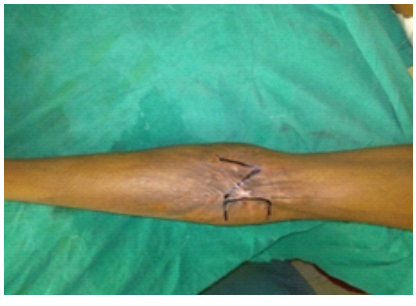


Fig 2: Marking of square flap in elbow contracture

RESULTS:

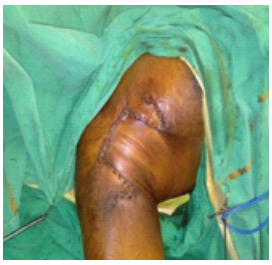
We did square flap in a total of fifteen patients in the age group ranging

from 3years, 6 months to 26 years, of which there were eight males and seven females. The mean age of the patients was 12 years with male:female ratio of 8:7. The mean duration of contracture was 2.3 years. Thermal burns was the cause of contracture in all patients. Four patients had involvement of one axillary fold (either anterior or posterior) and one had bilateral axillary fold involvement. There were four patients with elbow, two with first web space, one groin and four ankle contractures. Twelve of the cases had associated adjacent scarring and three had linear webs with healthy surrounding skin. No skin grafts were needed for cover of the raw area created after release. In two cases, there was tip necrosis of triangular flap; but it healed well with conservative management. No other complication was noted post-operatively in any of the patients. All patients were followed up for minimum six months. Complete range of motion was achieved in all cases and no recurrence was observed (Table 1)(Fig3,4).

Table1: Data of patients included in the study

Sl. no	Name	Age (yrs)	Sex	Region involved	Status of adjacent skin	Placement of square flap	Postop results/ complications	Preop ROM	Postop ROM at 6 mths
1	RS	21	M	Rt. ankle	scar present	non-scar side	tip necrosis	plantar flexion 10°	plantar flexion 35°
2	MF	17	M	Rt.axilla (ant fold)	scar present	non-scar side	uneventful	abduction 30°	abduction 170°
3	AM	19	F	Rt. elbow	scar present	non-scar side	tip necrosis	extension 30°	extension 170°
4	AS	18	M	Lt. Elbow	scar present	non-scar side	uneventful	extension 60°	extension 170°
5	AM	3.6	M	Rt. webspace (1st)	healthy, no scar	either side	uneventful	abduction 20°	abduction75°
6	BH	4.2	M	Lt.webspace (1st)	scar present	non-scar side	uneventful	abduction 10°	abduction 80°
7	RK	18	F	Rt. ankle	scar present	non-scar side	uneventful	plantar flexion 10°	plantar flexion 35°
8	RS	5.2	F	b/l axillae (ant fold)	healthy, no scar	either side	uneventful	abduction 60°	abduction 170°
9	AC	8	M	Rt. elbow	scar present	scar side	uneventful	extension 90°	extension 170°
10	AS	14	M	Rt. ankle	scar present	scar side	uneventful	Plantar flexion 20°	plantar flexion 40°
11	TS	7	F	Lt.axilla (ant fold)	scar present	non-scar side	uneventful	abduction 40°	abduction 150°
12	TS	26	M	Rt. elbow	scar present	scar side	uneventful	extension 120°	extension 175°
13	PH	12	F	Lt. Axilla (ant fold)	healthy, no scar	either side	uneventful	abduction 50°	abduction 170°
14	SK	8.5	F	Rt. axilla (ant fold)	scar present	non-scar side	uneventful	abduction 45°	abduction 165°
15	TK	5.3	F	Rt. groin	scar present	scar side	uneventful	full extension not possible	full extension possible

ROM – range of motion



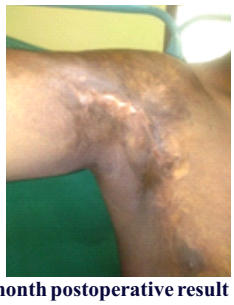


Fig3: immediate postoperative result **Fig4: 6 month postoperative result**

DISCUSSIONS:

Z plasty is the procedure of choice for linear scar contractures if the surrounding skin is healthy. The technique is based on transposition of two triangular flaps. A 60° Z-plasty causes 75% lengthening of central limb or about I .73 times the original length.[6] Multiple Z-plasties can be used for long linear scars while single Z-plasty is done for a short web.

Square flap can be called a three flap Z-plasty[Fig 5]

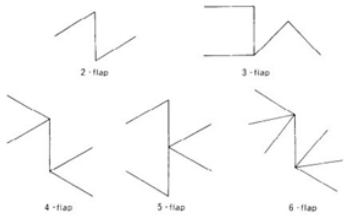


Fig 5: Square flap shown as 3 flap Z plasty

The method is an advancement transposition technique which consists of advancement of central square flap and transposition of two triangular flaps. If the tip of second triangular flap is a right angle, it gives lengthening of 2.80 times (180%) the original length. This is better than that achieved by the other methods[7].

There are certain prerequisites to be fulfilled for a successful square flap reconstruction [4] –

1. The angle of the triangular flaps are kept 45 and 60-90 respectively for better lengthening effect and to prevent necrosis of triangular tips. Sometimes triangular flaps are placed in scar tissue; thus, a narrow angle is to be avoided.

2. Square and triangular flaps should be elevated to a conventional thickness of skin flap.

3. The marginal length of the square flap is determined based on the possibility of the flaps joining, that is to say, it depends on the tension of the vertical direction to the elongation course.

4. The skin surface, adjacent to the band contracture, must be soft and supple for tension free advancement of the square segment. If square flap designed to a band contracture, where both sides are grossly scarred, then there will be tension at insetting and hence chance of marginal flap necrosis.

We recommend square flap in localized linear or narrow band contractures for the following reasons:

1. This method has superior lengthening effect to Z-plasty ; this method can be applied to reconstruct scar band contracture with a better outcome. This is evident even from Geometrical analysis. Square flap provided a gain in length of almost 180% as per simple geometric analysis and about 90% elongation when skin elasticity and 3D deformation were taken into consideration by computer aided analysis. More recent studies using stereometric geometric modelling revealed that square flap yields a larger flap area, higher length breadth ratio compared to Z plasties and is associated with the lowest physiological tension, which means that the deformity of the adjacent

skin and the dependence on the laxity of the adjacent skin is minimal[8].

2. The design is simple and easy to replicate. The contracture is cut across at a point and the square advancement flap breaks the line of the contracture. Added advantage is that the final suture line is not parallel to line of lengthening. These are probably the reasons for low recurrence.

3. Z plasty in certain specific regions as in axillary contracture divides the hair bearing area of the axilla and displaces a part of it anteriorly over the chest wall, giving aesthetically poor result[9]. Square flap obviates the problem.

4. In the developing world scenario like ours, patients come from poor socioeconomic groups, often travelling from distant regions and are not always compliant with prolonged splinting protocols and follow ups. In square flap technique like in any other flap technique, postoperative splints are not mandatory.

The only complication seen in our series was tip necrosis of triangular flap, probably due to poor vascularity of the adjacent scar tissue on which the triangular flap was raised. Though supple skin on either side of scar band is highly desirable, it is often not so in burn patients. Many a times, one side of the band scar is supple, other side has minimal hypertrophic scar. Placing square flap on normal skin and triangular flaps on scar side in our initial cases led to necrosis of triangular tip and delayed healing. Subsequently we shifted to placing base of the square part on scar side and making the two triangular flaps at supple side on opposite side. The square flap being an advancement flap, has linear translatory motion and is more versatile than triangular flaps. The flaps had no vascular compromise, thus resulted in better predictability of survival and short hospital stay.

CONCLUSIONS:

Square flap is a reliable local flap technique for localised linear or narrow band contractures even when there is significant adjacent scarring on one side of linear band.

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Conflict of Interest:
The authors declare no conflict of interest.

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