

Reconstruction of Chronic postburn contractures in different body sites by the use of rhomboid and double Z-plasty flaps technique

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ABSTRACT

Aim: Is to evaluate the efficacy of using rhomboid flap with double Z – plasty in the management of post burn scar contractures.

Patients & Methods: Twenty five patients with post burn scar contracture in various parts of body were operated by using rhomboid flap and double Z-plasty in Alshahid Gazi Alhariri and Alwasity hospitals between April 2009 and April 2010. All patients' data including age, sex, duration of contracture, preoperative and postoperative contracture degree have all been recorded.

Results: Mean follow up period was six months postoperatively. All flaps healed with no reported case of complete or partial flap necrosis. All patients had excellent results regarding functional improvement in movement in comparison with preoperative range of motion and all patients had no recurrence of contracture during follow up period. The donor site of flap was acceptable with no contour deformity.

Conclusion: Rhomboid flap with double Z-plasty is considered successful technique to be added to the armamentarium of the reconstructive surgeon for the management of chronic postburn contracture.

INTRODUCTION

One of the significant problem that frequently encountered postburn is contracture which is regarded as one of the challenging and distressing problem in both developing and developed countries. Since all types of burn (except 1st degree) healed by scarring, postburn contracture is one of inevitable problem that could occur even in best burn centres, postburn contracture had both functional and aesthetic impact on patient and it is seen frequently because of increasing in rate of survival after major burn.⁽¹⁾⁽²⁾⁽³⁾ Surgical correction of postburn contracture usually involved incision or excision of scar tissue and coverage with skin graft, local or distant flap, for linear scar contracture Z – plasty or V-Y plasty can be utilized, however for wide postburn contracture another surgical modalities can be used such as double opposing Z-plasties fig1, propeller flap, circumferential incision technique and rhomboid flap.⁽⁴⁾⁽⁵⁾⁽⁶⁾⁽⁷⁾⁽⁸⁾ Uzunismail et al. was 1st who described the use of subcutaneous rhomboid flap in the surgical management of postburn scar. Later on modification of this flap was done which involved adding two Z-plasties to its both ends along its long axis, this modification was done by Ulkur et al.^(9,10). In this study we evaluated the use of rhomboid flap with double Z-plasty in management of postburn contracture. Fig 2

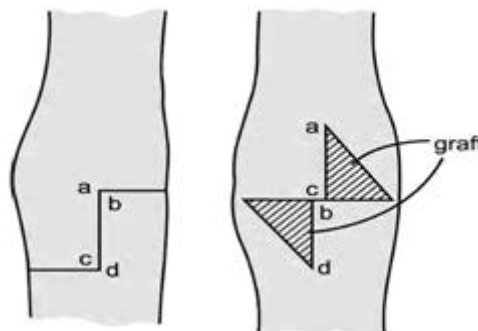
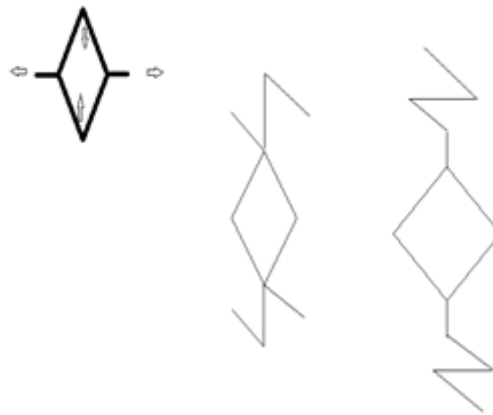


Fig1 double opposing Z-plasty (90 degree) with skin graft



Fig(2) schematic drawing of rhomboid flap and double Z –plasty showing the direction of movement &angles of rhomboid flap , transposition of Z-plasty flaps and the ultimate resulting lengthening with sharply broken incision closure

PATIENTS AND METHODS

Between April 2009 and April 2010, twenty five patients with history of postburn contracture in different sites of body were presented to us.Their ages were ranging from 4-35 years,twenty patients were males,five were females .Those patients were surgically treated using rhomboid flap and double Z-plasty in Alshahid Gazi Alhariri and Alwasity hospitals .Patients distribution according to site of contracture are shown in table 1

Table 1 patient distribution according to anatomical sites

Contracture site	No.
Axilla	10
Metacarpophalangeal,interphalangeal,interdigitalweb space joints	10
Knee joint (popliteal fossa)	3
Neck	1
Elbow joint (antecubital fossa)	1

Axillary postburn contracture further divided according to anatomic basis(Kurtzman and Stern,1990⁽¹¹⁾)as shown in table 2 below

Table 2 Axillary Postburn Classification

Group	Site	No.
type 1a	contracture involving the anterior axillary fold	5
type1b	contracture involving the posterior axillary fold	3
type 2	contracture involving both the anterior and posterior axillary fold	0
type 3	contracture is of type 2 plusaxillary dome	2

All of our patients had history of protracted healing time associated with poor splinting and physiotherapy twenty two of our cases healed by 2ndry intension ,three of our cases were managed by applying skin graft to close raw area, three of our cases had previously failed surgical intervention with scar excision and resurfacing with skin graft ,those patients had recurrence of contracture after 3 months postoperatively. In general all of our patients had more than one year history of contracture. Preoperative history and examination were done for all of our patients, Examinationwas focused on assessment of thickness and maturity of contracture, range of motion and preoperative measurement of the degree of contracture,X-ray of joints involved to evaluate the joint congruity and excluding any concomitant deformity.Routine investigations (blood tests,viral screening...etc) and preoperative photography were done to all patients ,All operations done under general anaesthesia and use of pneumatic tourniquet when indicated ,After prepping and draping ,marking all lines of surgical incisions to create rhomboid and double Z-plasties flaps, rhomboid flap is designed in the centre of the scar along the long axis of the contracture band,the wide angles of flap (120) were located laterally, while the narrow angles of flap(60) were made in both proximal and distal ends of the flap.Then two Z-plasties

(classical with) with equal limbs and 60 angles were made on proximal and distal ends of rhomboid flap fig 3a,b. The rhomboid flap is incised down to healthy subcutaneous tissue to obtain full release of scar tissue, while both Z-plasties done in the same manner (i.e. keeping thick flaps by dissection to sub facial level in order to ensure vascularity of the flaps). The long axis of rhomboid flap is advanced from V-Y shaped, while Y-shaped lateral relaxing incision is closed with interrupted prolensutures. fig 3 c,d . Dressing then is applied using antibiotic impregnated gauze as 1st layer, covered by dry gauze as a second layer, for the large joint area we used splint for at least 7 days postoperatively to prevent flap from excess folding while in the neck we used neck collar and in fingers simple woody or metal splints were used, the dressing opened in the next postoperative day to inspect the flaps and the patients were discharged and keeping them on oral antibiotic for several days with daily change of dressing to keep the wound clean, the stiches were removed 2 weeks postoperatively and the patients instructed to use scar softening remedies like contractubix gel for 2 months with massage ⁽¹¹⁾ and for 4 months on silicone gel or sheets in order to achieve optimal functional and cosmetic results. Patients were encouraged to resume full function across the joints gradually to achieve maximum functional results, follow up period was 6 months postoperatively.

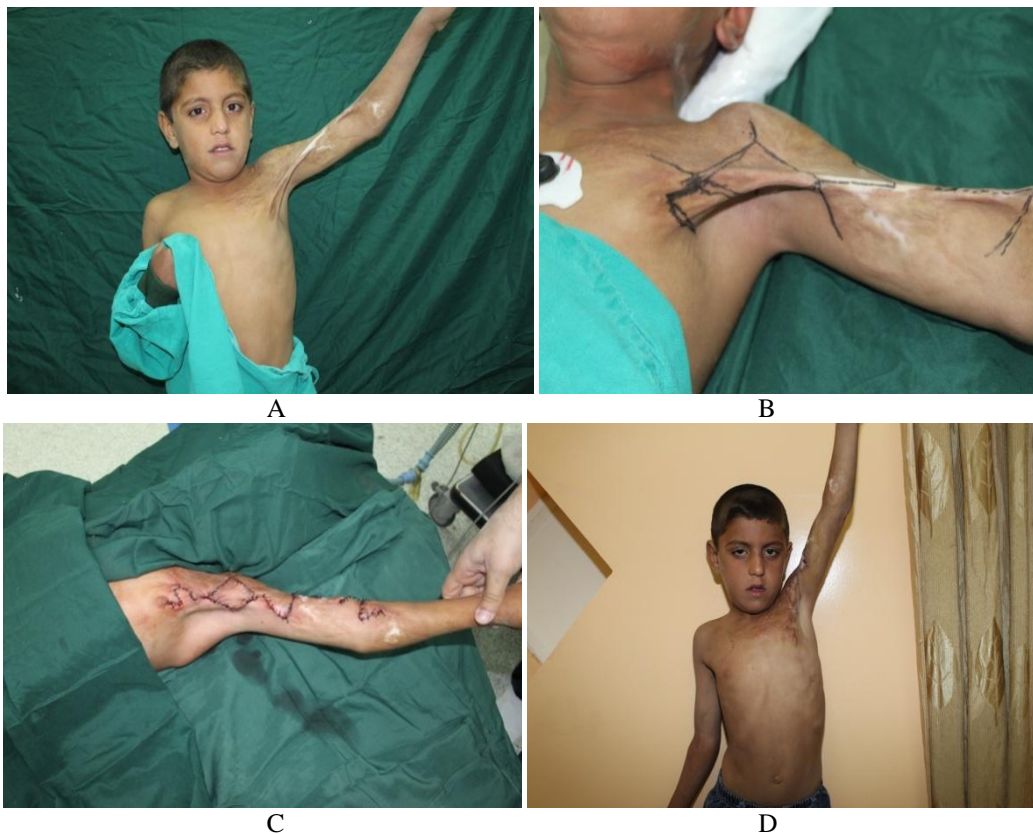


Fig. (3) Axillary postburn contracture preoperatively A, B, preoperatively C, two months postoperatively D.

RESULTS

During follow up period, No early major postoperative complications were encountered in all of our cases like haematoma, infection, wound dehiscence or neurovascular injuries in those cases were the contracture related to interdigital webspaces. All of our flaps healed uneventfully fig 4 with no complete or partial necrosis apart from partial epidermal loss at tip of Z-plasty flaps in three cases which has been managed conservatively and did not affect the final result. All of the patients were regained active full range of motion and they regarded the operation improved their movement in comparison with presurgical range of motion. Functional improvements of the range of joint movement are shown in table 3 below by comparison of both pre and postoperative degree of contracture.

Table -3- Functional improvement according to degree of contracture both preoperatively and postoperatively. During follow up period, we reported no recurrence of contracture, no hypertrophic or keloid scar was noticed in all of our patients fig 4 c,d.

Site of contracture		No.ofpatients	Pre-operative degree of contracture	Post-operative degree of contracture
Axilla	Type 1A	5	80 - 100°	0°
	Type 1B	3	70 - 90°	0°
	Type 3	2	60 - 100°	10°
Hand	MCP Joint	4	40 - 70°	0°
	PIP Joints	3	30 - 90°	0°
	Interdigital web space .fig4a,b	3	15 - 50°	0°
Other	Popliteal fossa	3	30 - 60°	0°
	Neck	1	45°	0°
	Anticubital	1	35°	0°

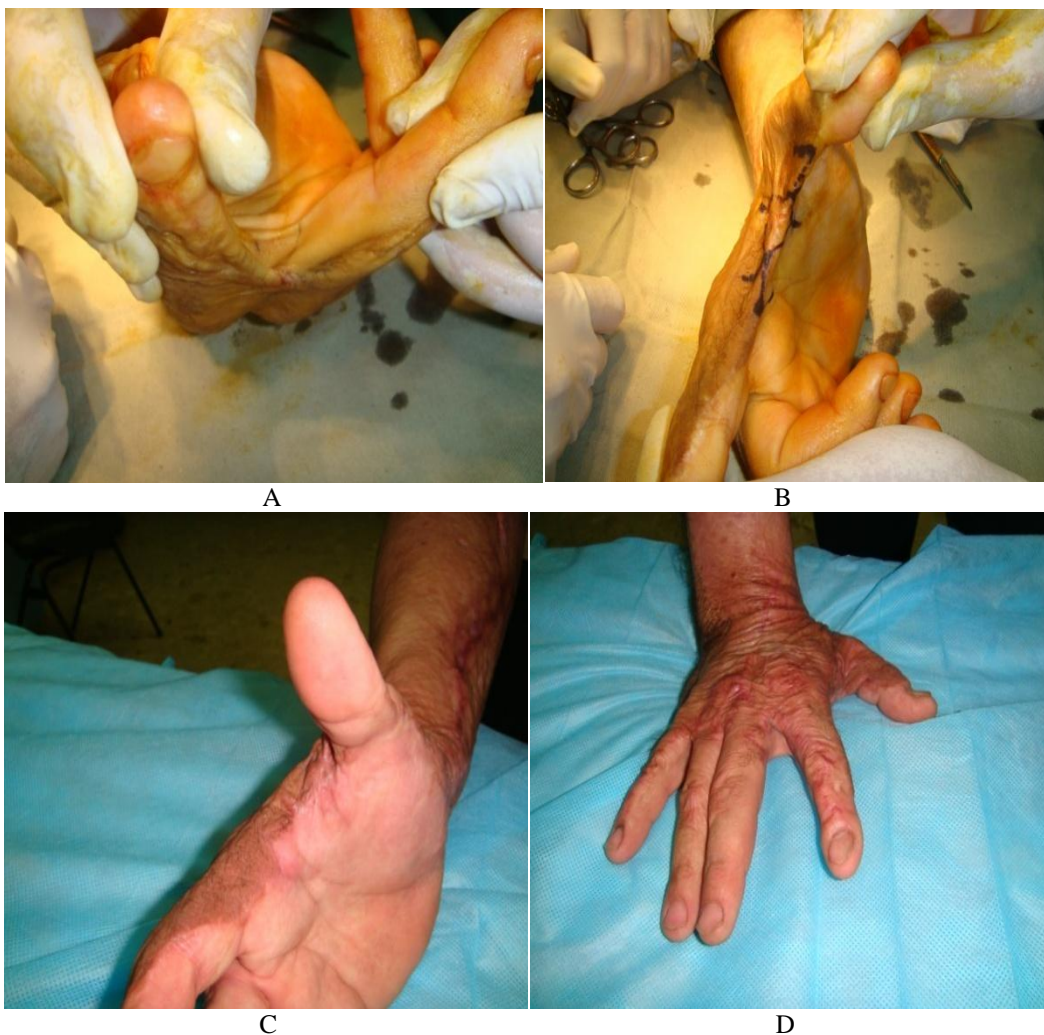


Fig.(4) Interdigital web space contracture A &B, rhomboid double Z technique release five months postoperatively C&D.

DISCUSSION

Despite the development in burn management and new strategies still many patients had large surface area who badly managed due to socioeconomic and conflicts, so it is expected to face one of late complications of the burn, namely postburn contracture.

The most common reasons for development of postburn contracture is lack of adequate early management and failure of post-healing care namely physiotherapy and using of splints. In general any reconstructive procedure that plan for burn contracture management should be postponed till the scar gained its full maturity.^(1,12,13)

There are many surgical modalities that had been used for management of postburn contracture, one of these modalities is subcutaneous pedicled rhomboid flap. This flap can give up to 104% length gain as it was noted by Ertas et al when they used it in the management of postburn scar contracture it is superior when compared with V-Y and multiple Z-plasty in management of long linear and wide postburn contracture.⁽⁹⁾ In this study the subcutaneous pedicled flap were modified by combining it with double Z-plasties. The idea of adding double Z-plasty at both ends of rhomboid flap is to close the donor site of the flap by sharply broken incisions and thus avoid linear scar which may lead to recurrence of contracture later on. Also the double Z-plasty serves to lengthening the periphery of rhomboid so it will lead to scar elongation along the longitudinal axis of contracture scar which had the most tension and restrictive force that limits the movement of the joint. The donor site of rhomboid flap is closed in V-Y fashion (i.e advancement of V to Y shape) while lateral relaxation incision which are added to rhomboid flap is closed without the need for skin graft which means reduction in contracture recurrence and donor site morbidity.

Rhomboid flap with double Z-plasty technique was used successfully in this study for treatment of postburn contracture in various parts of the body. Our results showed excellent outcomes functionally and aesthetically without contour deformity. This is particularly applicable for axillary postburn contracture when we did not encountered axillary hair transposition in unnatural sites. All of flaps survive uneventfully apart from two cases with epidermal loss of Z-plasty flaps which managed conservatively with success, meanwhile Rhomboid flap had reliable blood supply, since we did not undermine its base and keeping it attached to subcutaneous pedicle providing adequate blood supply and in regard with Z-plasty elevation of flaps done sub-facially with good thick flaps to preserve the vascularity. Splints used postoperatively to prevent folding of flaps and provide favourable condition of healing in the early period comparing that to the length use of splint in skin grafted reconstruction.

Our study in general consistent with Ulker et al were they used rhomboid flap with double Z-plasty in 12 patients who had post burn contracture with successful results, however Ulker et al ⁽³⁾ did not include in their study neck, interdigital web space, MCP and PIP joints contracture as we did our study to increase the anatomical applicability of this technique.

Post burn scar contracture can be treated by scar excision or incision with resurfacing the defect created with either skin graft or flaps. Both graft and flap need donor site sacrifices with donor site morbidity and sometimes especially for those with large burn surface area there is no available sufficient donor site, using of skin graft is associated with scar contracture recurrence and prolonged use of splints postoperatively. Although the use of regional flaps (scapular, radial forearm, posterior interosseous flaps) had proved its excellence in large defect resurfacing, but still these flaps are sometimes bulky and thick which may restrain movement.^(1,8) Local flap can be used for releasing of postburn contracture e.g. Z-plasty and V-Y plasty or combination, however these local flaps are applicable for linear scar contractures and not for wide area contracture, using of single Z-plasty is not suitable for postburn axillary contracture since it requires large skin flap in limited area with shifting of hair bearing area to unusual site, double Y-V plasty procedure required undermining of scarry tissue which may lead to flap vascularity compromise and flap necrosis.⁽⁸⁾

Multiple Rhomboid flap had disadvantage of donor site defect which created along the axis of contracture which in turn lead to linear scar contracture and recurrence of contracture, also multiple Rhomboid flaps can lead to damage of delicate anatomic structures.

Finally, propeller flaps had been used for management of postburn scar contracture in groin, axilla and popliteal region, however these flaps need intact nearby skin, technically demanding and will need skin graft after flap inset.⁽⁷⁾

CONCLUSION AND RECOMMENDATION

Rhomboid flap with double Z-plasty provided excellent postoperative functional results for treatment of patients with postburn scar contracture with no contour deformity, it can be safely used for wide postburn scar contracture without risk of flap necrosis and it showed no recurrence of contracture during follow up period.

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