

# **ANALYSIS OF SCAR REVISION**

*Dissertation submitted to*  
**THE TAMILNADU Dr.M.G.R. Medical University**

*in partial fulfillment of the  
regulations for the award of the  
degree of*

**M.Ch., Branch III  
PLASTIC SURGERY**

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## **CERTIFICATE**

This is to certify that the dissertation titled "**ANLAYSIS OF SCAR REVISION**" of **Dr.P.JEYAKUMAR**, is submitted in partial fullfillment of the requirements for M.Ch. Branch III (Plastic Surgery) Examination of the Tamilnadu Dr.M.G.R. Medical University to be held in August 2007. The period of study from August 2005 to March 2007.

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## **DECLARATION**

I, Dr.P. JEYAKUMAR, solemnly, declare that the dissertation titled, **ANALYSIS OF SCAR REVISION** is a bonafide work done by me at Govt. Stanley Medical College/ Hospital during the period of August 2005 to March 2007, under the guidance and supervision of my Head of Dept. Prof. T.C. Chandran M.S., M.C.h.

This dissertation is submitted to Tamilnadu Dr.M.G.R. Medical University towards partial fulfillment for the award of M.Ch. degree Branch III in PLASTIC SURGERY.

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Date :

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Last but not the least, I salute my patients who have uncomplainingly followed my right protocol, I set for them and by doing so have made this study worth while.

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# INTRODUCTION

## **INTRODUCTION**

### **DEFINITIONS**

#### **SCAR**

Scar is defined as the trace of healed wound, sore or burn.

A fault or blemish remaining as a trace of some former condition or resulting from some particular cause.

In Medical Terminology, a scar is non regenerative wound healing

#### **A. Preferred Scar**

Preferred scar is the one that has matured early without contraction or increase in width, formation of collagen that is not more than necessary for its strength.

#### **Scar Revision**

Scar Revision is a commonly requested procedure that is performed frequently by the majority of plastic surgeons. The holistic approach to the patient is paramount in scar revision.

Scar revision is a process that requires careful assessment, technical expertise and recognition of the underlying psychosocial issues if a satisfactory outcome is to be achieved.

Each patient is different and it is inappropriate simply to select standard operation.



## AIM OF THE STUDY

## **AIM OF THE STUDY**

The aim of the study is to analyse the causes of scar which include Road Traffic Accidents, Assault, Burns, Chronic infections & Acne,

To analyse the reasons for scar revision with include - functional aesthetic, psychological problems

To discuss medical / surgical treatment options.

To assess the scar post operatively using Beausang's clinical score and subjective patient acceptance.

To find out incidence of reference from doctors.

To find out Technical differences in the procedure in our set up.

## **PROBLEMS OF A SCAR**

Normal scar is flat, relatively narrow, slightly paler, than the surrounding skin.

### **Aesthetic Problems**

Scars may be stretched in width and be visible.

Disfigurement may be present due to cross hatching suture marks.

Scars may be indurated, depressed below the surroundings tissue producing contour deformity.

Contracture of curved scar will result in heaping up or pin cushion effect.

### **Discoloration of scar**

Hypopigmentation due to dermal injury or mixed depth injury. Hyperpigmentation: may be due to skin grafts, embedded foreign materials.

## **Functional Problems of Scars**

The scar may be tethered to deep structures like Fascia, muscle in which case puckering occurs, which further impairs movements of skin muscles. It can also produce skin contracture and distortion of anatomical land marks. eg. angle of mouth, eyebrow.

Scar contracture of neck leads to restriction of neck movements.

## **Pain in Scar**

Pain and itching are frequently associated with hypertrophic / keloid scar, it is due to immature regeneration of non myelinated 'C' fibres that produce substance P, and calcitonin gene related peptides which causes pain.

Focal pain may be due to cutaneous neuroma.

Scar itself can be painful.

# MATERIALS AND METHODS

## **MATERIALS AND METHODS**

25 patients of facial scars of varied etiology were taken up for study in the period of 2½ years from August 2005 March 2007.

10 female patient

15 male patients

Average age group 15-25 years almost all are in same age group.

### **Etiology of Scar**

Assault - by knife - 6

Road Traffic accidents - 9

Burns - 6

Others - 4

No.of patients referred by medical professionals - 6

Self referral - 19

All patients underwent scar revision surgery, assesed by Beansang;s clinical score - post operatively.

Procedure done are linear excision + closure - 12

`Z' plasty - 6

`W' plasty -2

serial Excision - 4

Tissue expansion - 1

Post operative score

12 patients - score of 8-9

8 patient - score of 10-12

4 patients - 13

1 patient - 14

5 patients were not satisfied with result. 20 patients were satisfied.

### **Operative Procedure : Elliptical Closure**

All cases are done under local infiltration anaesthesia - except one cast of tissue expansion of neck -which was done order GA. 1% xylocaine with adrenaline is used.

- Areas cleaned, draping done
- Scar markings done before infiltration
- Local infiltration anesthesia given
- Scar is excised
- Skin flaps undermined, and especially at corners.

Hemostasis obtained with bipolar diathermy Dermal subdermal sutures applied with 4-0 prolene Skin sutured with either simple sutures using 5-0 prolene or subcuticular suture were 3-0 nylon. Compression dressing given.

Post op.followup

Wound inspected after 48 hrs - left opened after 48 hours.

Suture removal of 6th day.

After 3 weeks scar massage

Aloevera cream applied two times a day.

Scar assessed after 4 weeks / 3 / and 6 months.



**PRE-OPERATIVE**



**POST-OPERATIVE**



**"Z" PLASTY**

**PRE-OPERATIVE**



**POST-OPERATIVE**



**SIMPLE EXCISION & CLOSURE**

**PRE-OPERATIVE**



**POST-OPERATIVE**



**EYEBROW CORRECTION**

**PRE-OPERATIVE**



**POST-OPERATIVE OF 4 WEEKS**



**"W" PLASTY**

**PRE-OPERATIVE**



**POST-OPERATIVE**



**SERIAL EXCISION**



**PRE-OPERATIVE**

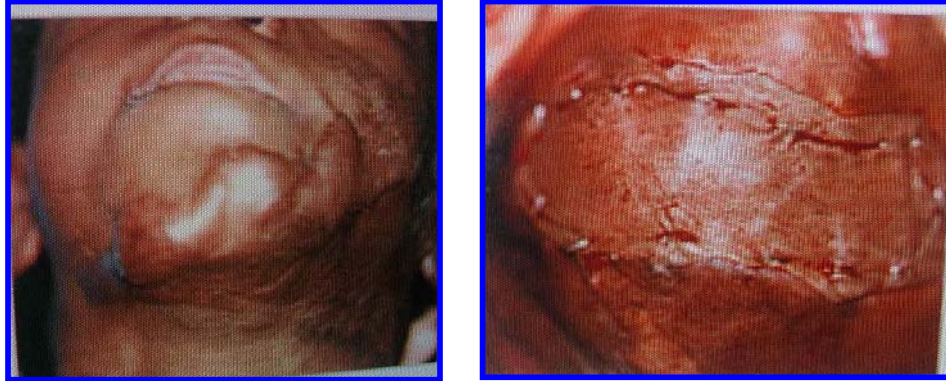


**POST-OPERATIVE**

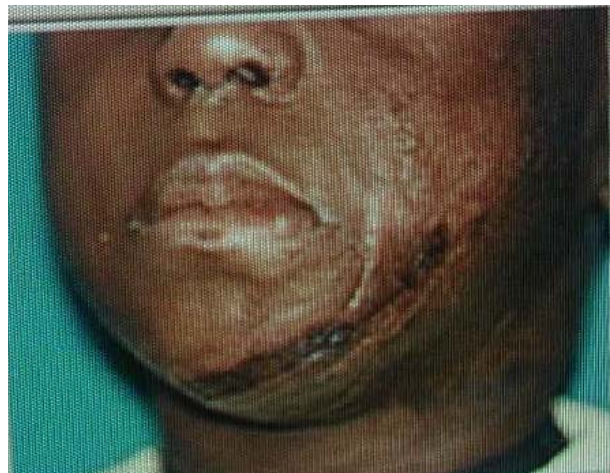


**"Z" PLASTY**

**PRE-OPERATIVE**



**POST-OPERATIVE**



**SKIN RESURFACING WITH SSG**

**PRE-OPERATIVE**



**POST-OPERATIVE**



**UNSATISFACTORY RESULT**



### Patient Data

S. No.	Patient Name	Age	Sex	PS No.	Diagnosis	Treatment
1.	Ramesh	21	M	49715/05	Post burn scar	Serial excision
2.	Ramesh Reddy	25	M	49571/05	Post burn scar	Serial excision
3.	Sumathi	26	F	49922/05	Assault by knife	"W" Plasty.
4.	Manjula	30	F	49993/05	Assault by knife	"Z" Plasty
5.	Murugan	26	M	49262/05	Assault by knife	"Z" Plasty
6.	Gowri	17	F	49296/05	RTA scar	Serial excision
7.	Dhanaselvi	28	F	49183/05	RTA	"Z" plasty
8.	Vijay	15	M	491520	Assault with blade	Excision and closure
9.	Meenashi	20	F	OP/ 801/06	RTA Scar	Excision end closure
10.	Nityanandan	20	M	OP/1146G/06	RTA	"W" Plasty
11.	Dillibabu	12	M	1151/G/06	RTA	Excision and Closure
12.	Kannan	24	M	1260/G/06	Scar due to RTA	Excision & Closure
13.	Alwar	51	M	2055/G/06	Post-operative	"Z" Plasty
14.	Kavitha	25	F	1374/G/06	Post Burns	Excision & Closure
15.	Jeya	21	F	49119/05		Excision & Closure

<b>S. No.</b>	<b>Patient Name</b>	<b>Age</b>	<b>Sex</b>	<b>PS No.</b>	<b>Diagnosis</b>	<b>Treatment</b>
16.	Aravaind	21	M	1628/G/06	Face Scar	Excision & Closure
17.	Appanraj	18	M	46376	Scar due to fall	Excision & Closure
18.	Mohan	28	M	48941	Post Burns Scar	Excision & Closure
19.	Devi	28	F	48969	Cheek Scar due to RTA	Excision & Closure
20.	Daniel	19	M	47801	Face scar due to RTA	Excision & Closure
21.	Kamala	18	F	48307	Scar due to fall	"Z" plasty
22.	Veeramani	22	M	48159	Face scar due to RTA	"Z" Plasty
23.	Karthikeyan	18	M	48205	Infection	Excision & Closure
24.	Ganesh Kumar	24	M	48642	Scar due to RTA	Excision & Closure
25.	Rajalakshmi	20	F	47140	Scar due to - post infective scar revision	Tissue expansion

# DISCUSSION

## **DISCUSSION**

### **Introduction**

People have myth that after scar revision by plastic surgeons, they won't have any scar, but that is not true. Always there will be remaining scar. In this study we analysed the results of scar revision both clinically and subjectivewise.

### **Scar Assessment**

There are large number of subjective and objective tools for scar assessment, currently there is no general agreement on the most appropriate tool for scar evaluation.

#### **1. VANCOVER BURN SCAR ASSESSMENT**

Scar with maturity and to evaluate response to treatment. Four components are considered.

- a. Pigmentation
- b. Vascularity
- c. Pliability
- d. Height of scar

## BEAUSANG'S CLINICAL ASSESSMENT

This scale applicable to variety of scars including surgical/non burn trauma scar.

### A. Colour - Compare to Surrounding Skin

Perfect match to normal skin - 1

Slight mismatch - 2

Obvious mismatch - 3

Gross mismatch - 4

### B. Matte - 1

Shiny - 2

### C. CONTOUR

Flush with surrounding skin - 1

slightly prout - 2

Hypertrophic - 3

Keloid - 4

#### D. DISTORTION

None - 1

Mild - 2

Moderate - 3

Severe - 4

#### F. TEXTURE

Normal - 1

Just palpeble - 2

Firm - 3

Hard - 4

Minimum score 5 - Excellent scar

Maximum 18 - not acceptable scar

#### **MC Fontzl Assessment system**

It is a complex system used for soft tissue injury face in relation with laceration and depth of injury and various factors.

## **OTHER FACTORS**

- Measurement of scar thickness
  - Clinically assessment
  - Ultrasound
  - Histology
  
- Assessment of vascularity spectrophotometric methods, Laser doppler
  
- Contour assessment optical profilo meter
  
- Surface area of scar can be measured by three dismentional CT scan

## **CLINICAL CLASSIFICATION OF SCAR**

Clinically scar is classified in to four types.

1. Immature type
2. Mature type
3. Hypertrophic scar
4. Keloid

**1. Mature Scar**

A light coloured flat scar

**2. Immature Scar**

A red some time itchy/painful and slightly elevated scar in the process of healing, many of these mature over time and become flat and assume a pigmentation that is similar to the surrounding skin although they can be paler or slightly darken.

**3. Linear Hypertrophic scar**

A red, raised some times itchy scar confined to the border of original surgical incision.

This usually occurs within weeks after surgery. These scars may increase in size rapidly for three to six months, then after a static phase begins to regress the full maturation may take up to 2 years.

**5. Widespread Hypertrophic Scar**

Wide spread red, raised sometimes itchy scar confined to the border of burn injury.



## **5. Minor Keloid**

A focally raised itchy scar extending over normal tissue, this may develop up to one year after injury and does not regress on its own. Simple surgical excision is often followed by recurrence. There may be genetic abnormality involved in keloid scarring.

## **6. Major Keloid**

A large raised scar possibly painful or pruritic and extending to normal tissue. This often results after minor trauma and can continue to spread for years.

### **Surgical Treatment - options**

1. Direct Elliptical Excision and Primary closure
2. Reorientation of scar
  - a. Z plasty
  - b. Y to V advancement
3. Scar Camouflage
  - a. 'W' plasty
  - b. Geometric broken line closure

4. Serial Excision
5. Tissue Expansion
6. Resurfacing the scar

### **SURGICAL STEPS TO MINIMIZE THE SCAR**

Atraumatic technique with meticulous tissue handling is important.

Using fine instruments is useful.

Accurate skin approximation with eversion of wound edges - improves the healing.

Fine dermal subdermal sutures minimize the scar.

Interrupted sutures are recommended for skin closure.

Tension at suture line to be avoided

Sutures must be removed at an appropriate time to reduce the risk of permanent suture marks.

Use of adjunct to wound support such as tape- steristrips is beneficial.

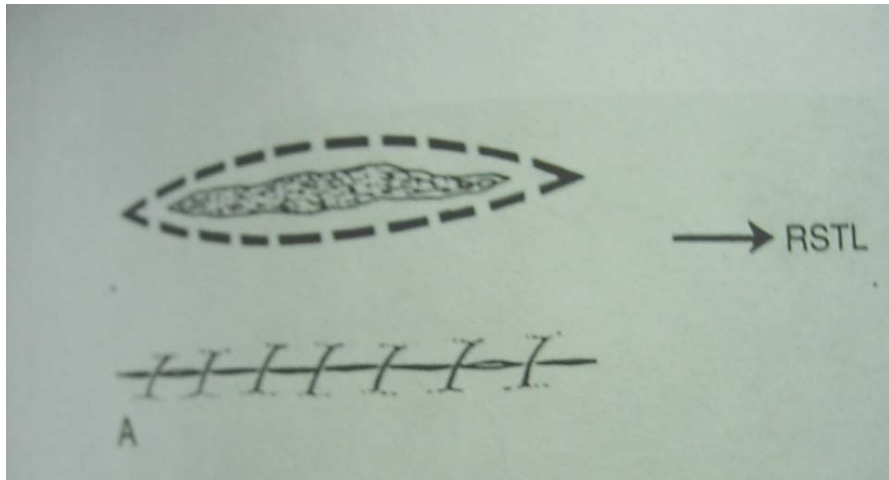
## **Improvement in an unsatisfactory scar**

Can be done with following steps

- Change of direction of scar
- Scars may be broken into smaller segments.
- Levelling effect of scar.
- Improvement in the local conditions of wound using non absorbable dermal subdermal sutures to take away skin tension.
- Halving in depth
- Halving in surface
- Camouflaging by alternating small scars with normal unscarred skin
- Creation of accordion like elasticity in 'W' plasty

## DIRECT EXCISION OR FUSIFORM SCAR REVISION

Direct excision indicated where original scar follows the resting skin tension lines.



## PROCEDURE

The scar is removed completely, close the wound primarily by advancement of adjacent normal tissue.. This may require undermining. It is frequently appropriate to undermine asymmetrically to advance one side of wound more than other to prevent distortion of anatomical land marks. The final scar should be aligned with the resting skin tension lines.

## **REORIENTATION OF SCARS**

Optimal scars follow skin tension lines. When orientation of scar is unfavourable the principle should be to reorient rather than simply excise and resuture. Reorientation is achieved by 'Z' plasty and 'W' plasty.

### **'Z' PLASTY**

'Z' plasty is a simple fundamental technique in plastic surgery. The 'Z' plasty is based on geometric principles. The four fundamental functions or 'Z' plasty include.

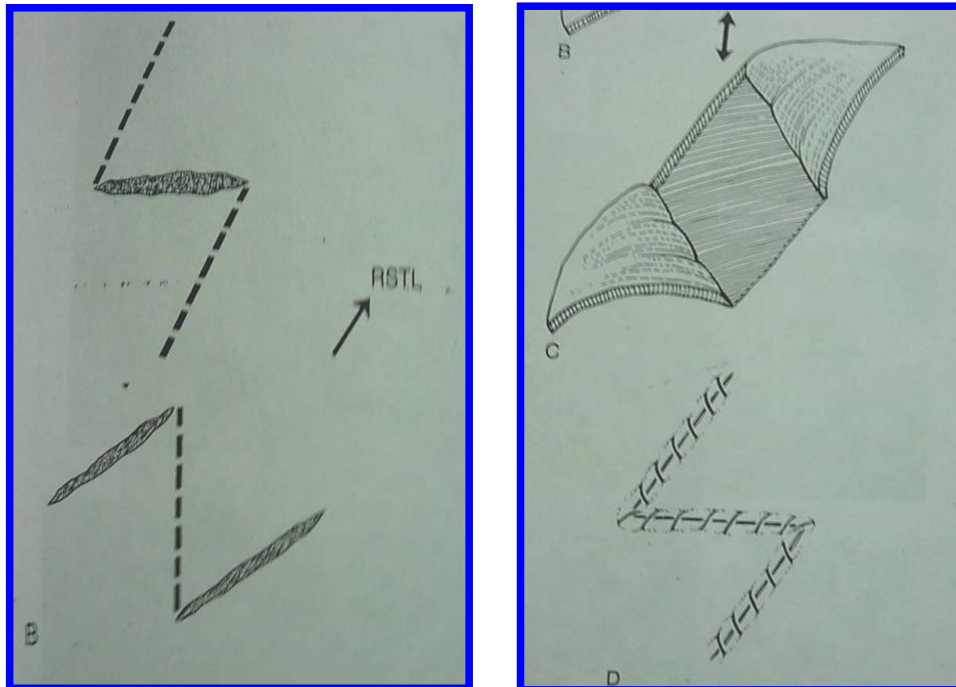
1. To lengthen a scar
2. To break up a straight line
3. To move tissue from one area to another
4. To obliterate or create a web or cleft

In practical use the 'Z' plasty angles may vary according to the placement of the proposed scar

## Technique of 'Z' Plasty

It involves limbs of contractural diagonal and the transverse diagonal, after transposition of flaps there are two effects.

- a. The contractural diagonal lengthens
- b. Transverse diagonal shortens.



In well designed 'Z' plasty when the scar is excised and the flaps are incised, the scar release will naturally result in the flaps transposing themselves into a nearly predicted position, interdigitating in the areas where the scar has lengthened.

If any case 'Z' plasty has been poorly planned, the flaps do not sit comfortably.

### **In Scarred Tissues**

Flaps should be thick, conical and with wide base.

### **Multiple variations in 'Z' plasty**

#### **1. Classic Stereometric 'Z' plasty**

60° degree transposed triangular flap with theoretical increase in length of 73%

#### **2. Plannimetric 'Z' Plasty**

It is useful in correcting scars in plane surface. Angles of Z tend to be 75° to the scar line. It avoids elevation or depression with a pure elongation of skin in the direction of scar.

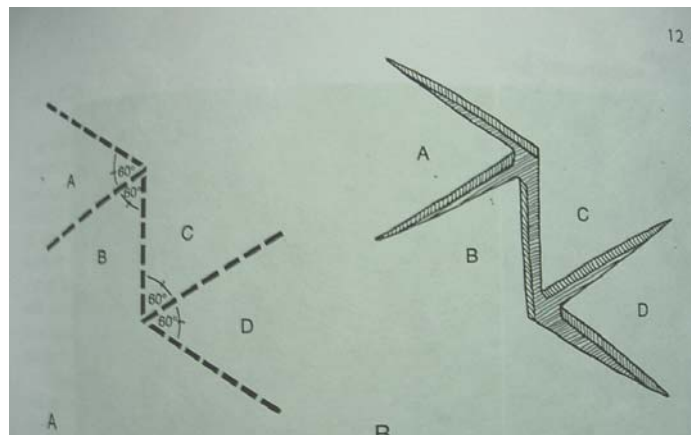
- #### **3. The skew 'Z' plasty - technique in which the tip angle of the two triangular flaps are unequal. This technique is useful when local tissues prevent a symmetric Z' plasty. This allows topographic features of unequal size to be shifted in to relatively normal anatomic position.**

#### 4. Multiple 'Z' Plasties

Multiple 'Z' plasty has the advantage of producing a length increase similar to single 'Z' plasty but with less shortening of the Transverse diagnals. One problem is that flaps do not always interdigitate easily.

The multiple 'Z' plasty include

- Double opposing 'Z' plasty
- Four flap 'Z' plasty

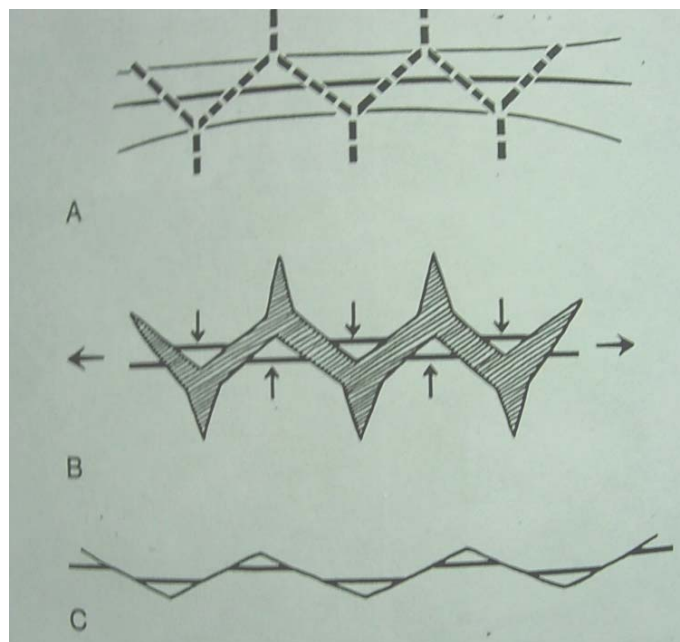


- Six 'Z' plasties



## Y TO V ADVANCEMENT

A disadvantage with the 'Z' plasty is both the flaps require undermining to allow transposition. This may compromise the blood supply to these flaps, particularly in those areas that have been, previously scarred, where there is linear contracture this will be released by Y-V principle. In Y-V plasty linear scar to be lengthened without any flap, transposition and compromise of blood supply. To lengthen the scar the triangular flaps of the Y is pushed in to the stem of the Y forming V. The incision is carried through the full thickness of the scar in to the soft tissue beneath the scar, No. Undermining of flap tips is carried out but these are simply pushed in to the defect.



## **GEOMETRIC BROKEN LINE CLOSURE**

It is a refined technique of scar irregularisation, produces irregularly irregular scar with a random design in the final scar. It needs meticulous planning and execution.

It is technically difficult and may require the mapping of a design on paper before surgery.

## **SERIAL EXCISION**

Serial excision is recommended when a scar is too large for a single fusiform excision without excessive tension on the skin closure.

Serial excision requires multiple procedures, at each procedure part of the scar is removed and the wound closed, primary after local undermining or advancement if appropriate.

The number of stages is determined by the local tissue elasticity and it is important not to excise too much tissue at each procedure.

The low complication rate of serial excision makes it a reliable method of scar revision with minimal morbidity between stages.

## **TISSUE EXPANSION**

Staged tissue expansion can also be used to provide more tissue for advancement or local flap coverage. However it has a higher complication rate. There are certain sites where tissue expansion is the method of choice

### **Example**

- Burns alopecia
- Facial scars

Both tissue expansion and serial excision make use of similar biomechanical properties of skin (stress relaxation/creep) to make use of greater quantities of normal tissue.

Immediate intraoperative tissue expansion has been suggested as a way of increasing the area of potential excision, and avoiding the complications of staged tissue expansion.

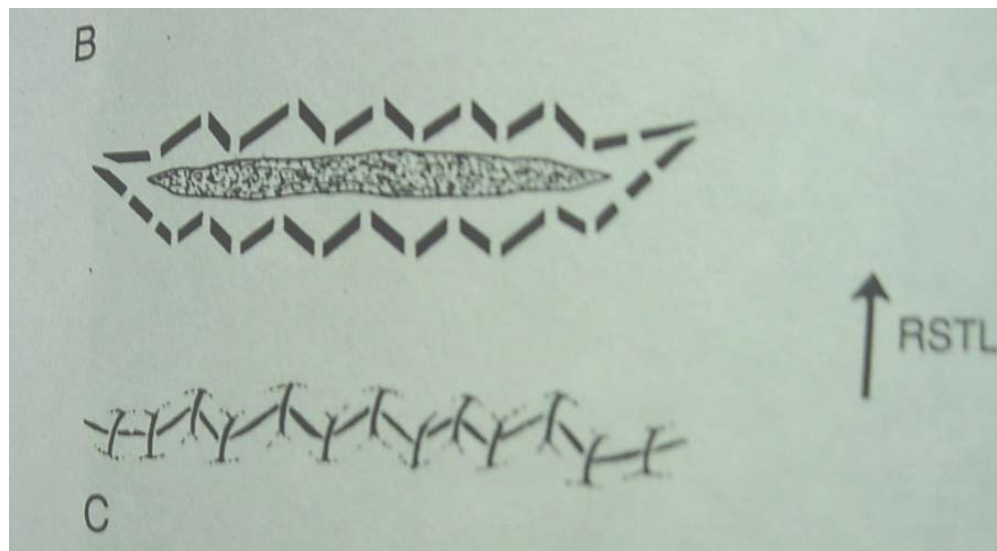
## **SCAR CAMOUFLAGE**

There are many techniques available for scar camouflage.

## W-PLASTY

W plasty is recommended in specific areas where scars are oriented perpendicular to resting skin tension lines. It produces regularly irregular scar with removal of some normal tissue.

- It has shorter limbs
- It produces no overall change in length
- Standard 'W' plasty effective technique for removal of Forehead scars



## **RESURFACING SCARS**

Resurfacing is used to replace the unattractive, tight and certain areas like face/hand.

Resurfacing Agents - may autologus like. Full thickness skin graft (FTSG) or SSG.

## **ACNE SCAR MANAGEMENT**

It presents with problems of multiple punched ice pick scars and general irregularity of the surface.

In mild to moderate irregularity.

- CO<sub>2</sub> laser or chemical peeling may be effective.
- Direct excision of the facial pits extremely effective.

One or two pits excised initially to asses the result.

Focal excision is carried out with vertically incised edges, releasing the deep tethering and very fine sutures were used to close the wound.

When there is cluster of deep scars, it may be worth excising the groups together.

## **Medical Treatment for Scars**

Many treatment modalities have been developed for the prevention and management of scars, hypertrophic scars and keloids.

### **Prevention**

1. Sun protection to reduce scar hyperpigmentation is essential.
2. Silicone gel sheeting it is widely used to prevent hypertrophic scar and keloids.

### **Mechanism of Action**

It causes improved hydration and occlusion. It leads to temperature elevation of 1°C that can affect collagenase kinetics.

It also cause change in adhesion molecule expansion of lymphocytic infiltration.

### **3. Sillicone Based creams**

It can be used when silicone gel sheeting not feasible in certain sites like scalp / neck.

#### **4. Microporous, Hypoallergenic tape**

Can relieve tension across the wounds and minimize the excessive scar risk from shearing. The tape is applied for few weeks after surgery.

#### **5. Steroid Injections**

In patients who are at extremely high risk such as after excision of keloid or hypertrophic scar, concurrent intralesional steroid injections can be given prophylactically, followed by monthly injections as necessary.

Injection Triamcinolone is commonly used.

#### **Advantages**

- Low cost
- Easy to administer

#### **Disadvantages**

- Multiple sessions of Treatment
- Teleangiectasia
- It can cause hypopigmentation

## **6. Pressure Therapy - compression Garments**

- Non invasive method
- Some proven efficacy

### **Disadvantages**

- Cumbersome garment
- High cost if custom made
- should be continued for months to years.

## **RADIOTHERAPY**

It is indicated in

- High risk patient
- Recurrent keloids after surgery.

### **Disadvantages**

- Costly
- Risk of carcinogenesis



## **Laser**

Pulsed dye 585 nm laser best for decreasing red colour

Carbon dioxide Nd:Yag, pulsed erb:yag lasers have some reported efficacy.

It is a emerging technology

## **Disadvantges**

- Costly
- Needs multiple treatment

## **CRYOTHERAPHY**

It has some proven efficacy in keloid reduction.

## **Disadvantages**

- Hypopigmentation
- Pain
- Skin atrophy

## Physical Methods to decrease scar

Which include

- Ultra sound
- Pulsed electrical stimulation
- Hydrotherapy
- Massage

These measure causes increased joint range of motion, can decrease scar pain/Pruritus.

Antinflammatory, Anti proliferative medicines Interferons, 5 flurourail, Belmeyin.

These are used as creams. Early controlled studies shows some efficacy, emerging therapy.

Finally make ups and camouflage can be used.

# OUTCOME OF THE STUDY

## OUTCOME OF THE STUDY

1. Most of the patients came for scar revision in the age group of 15-30 years - especially they came for scar treatment when they are preparing for marriage. All the patients have thought that after plastic surgery treatment there will be no scars.
2. Most of the patients came for oesthetic reasons only Functional problems like painful scar / or contour deformity in face relatively rare.
3. Most of the scars due to Assault with knife, Road traffic accidents, burns.
4. After surgical revision most of the patients (18/25) were satisfied with the result.  
  
5 patients were not satisfied  
  
Of the 5, 2 patients developed scar contracture and bad result.
5. Medical treatment will be useful in superficial scars, and for prevention a severity and scar.

6. Post operative Beausang's score

12 patients score - 8-9

8 patients score - 10-11

3 Patients score - 13

2 Patients score - 14

7. Reference from primary physicians to specialist for scar management is comparatively less.

8. Using various techniques like 'Z' plasty or 'W' plasty, depends upon location and scar, direction of scar relate to RSTL - if used properly gives good results.

9. Scar revision in post traumatic scar gives good results than post burn scar

# CONCLUSION

## CONCLUSION

- People have myth that after scar revision by plastic surgeons, they won't have any scar, but that is not true. Always there will be remaining scar. When we explained these to patients, 10% of patients - refused surgery.
- Z Plasty in face - size of the `Z' is not more than 3mm, so that scar size will not increase.
- Dermo epidemal suture using 4-0 prolene gives consistantly good results.
- Scar revision post traumatic scar gives better result them post burn scar.
- Dermabrasion will not be useful in post burn scar due to absence of dermis.
- `W' plasty - used in face especially forehead, cheek where limbs of `W' runs parrells to reliving skin tension lines.
- `Z ' plasty we used whenever there is need for lengthening of scar, to break it small segments also to get along the RSTL lines.
- Post operative application of Allovera gel alongwith scar massage significantly reduces scar severity.

## REFERENCES

1. Beausang E, Floyd H. Dunn KW et al: A new quantitative scale for clinical scar assessment plast. Reconstr. Surg. 1998 : 102 : 1954 - 61.
2. Sullivan T., Smith, Kermade, et al Rating the burn scar. J. Burn care rehabilitation 1990, 11:256-260
3. Lee RH Gamble WB, Robertsan B manson Pn : The MCFontzl classicification System of Soft tissue injuries to the face PRS 1999:103 1150-1152.
4. Chang CW, Ries WR : Non operative techniques for scar management and revision facial plastic surg. 2001-17 283 - 288.
5. Borges AF : scar analysis and objectives of Revision Procedures. Clinic. Plast-Surg 1977:4 223-227.
6. Mostafapour SP, Murakani CS Tissue expansion and serial excision in scar revision. Facial plast. Sug.2001. 17 245-252.



7. Hindson 12A - some thoughts on choosing a 'Z' plasty : the z made simple : PRS 2000 : 106 665-671
8. Hove CR Williams EF III. Rodgers 'Z' plasty a concise review facial plastic surgery 2001 17:289-294.
9. Lyle WG : silicone gel sheeting plastic reconstructive surg.2001 107 272-275.