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Original article

Hypertrophic scars and keloids: Assessment of the effectiveness and outcome of different treatment modalities

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Abstract

Hypertrophic scars and keloids occur due to an abnormal wound healing process frequently seen after a surgical procedure or trauma. There has been no general consensus in the management of hypertrophic scars and keloids so far. Our aim was to assess the impact of monotherapy as well as multimodal treatment in hypertrophic scars and keloids. The study was conducted on 66 patients at an institute based hospital. Classification was made according to the morphologic features of the scar and the treatments determined by clinical evaluation. Parameters for scar assessment, previous treatment history, complications, recurrences, and clinical photograph were analysed. Assessment was measured using VSS, and POSAS scales and results were statistically analysed. Burn was the single most common etiology. The number of hypertrophic scars (40.9%) was higher than keloids (33.3%). We had used intralesional corticosteroid in 41 patients, surgical procedures for 29 patients, cryotherapy in 23 patients and CO2 laser for three patients. Ten (15.2%) recurrences were noted with a higher recurrence rate in keloids patients. Non-operative treatments should remain the first line of treatment for post-operative and preventable scars. Multimodal approaches showed significant benefits in keloids and hypertrophic scars. We found cryotherapy to be effective as a monotherapy or as an adjuvant for small scars. Clinically classifying the scar based on their morphological features aids in choosing the type of treatment.

Key words: Hypertrophic scars, Keloids, Multimodal treatments, Pathological scars, Scar assessment scale

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Hypertrophic scar and keloids occur due to an abnormal wound healing process frequently seen after a surgical procedure or trauma. There has been no general consensus in the management of hypertrophic scar and keloids so far. Studies on different treatment modalities for scars as a whole are limited. Therefore, patient has to depend solely on experiences and choice of their respective treating doctors.

We have undertaken this study to analyse the treatment options available for hypertrophic scar and keloids and to evaluate their outcome. The aim was to assess the impact of monotherapy as well as multimodal treatment in hypertrophic scars and keloids on patients from northeast states of India.

Materials and methods

This three-year study was conducted on 66 patients at an institute based hospital. The study population consisted of clinically diagnosed hypertrophic scar and keloid patients. Patients with infected scars, non-healing ulceration, Marjolin's ulcer, etc. were excluded. Prior approval was obtained from the Institutional Ethical Committee (MC/02/2015/35).

The scars were graded based on the morphologic features as follows; normal (Grade I), mildly hypertrophic (Grade II), hypertrophic (Grade III) and keloid (Grade IV)[1]. Scar Assessment was done by taking photographs at baseline and follow-up and palpation for tenderness and consistency. Verniers calliper was used for measuring the size of the scar. Assessment of the treatment outcome was done using Vancouver scar scale (VSS), and Patient and observer scar assessment scale (POSAS).

Statistical analysis

Results were analysed using SPSS 20 software. Paired student *t*-test and analysis of variance (ANOVA) were used. P<0.05 was considered significant.

Results

The study included 66 patients ranging from two to fifty-five years. The mean age of the patients studied was 22.73 years. There were 38 females (57.6%) and 28 males (42.4%).

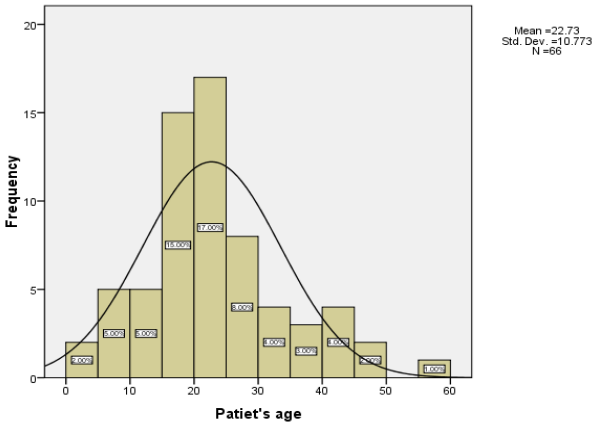

Fig 1. Age distribution

The most common etiologies were trauma (48.5%), flame burn (22.7%) and scald burn (15.2%). The most common site of scar formation was the upper extremities (28.8%) and the chest (27.3%). Keloid formation was noted more frequently on the chest, ear and shoulder regions.

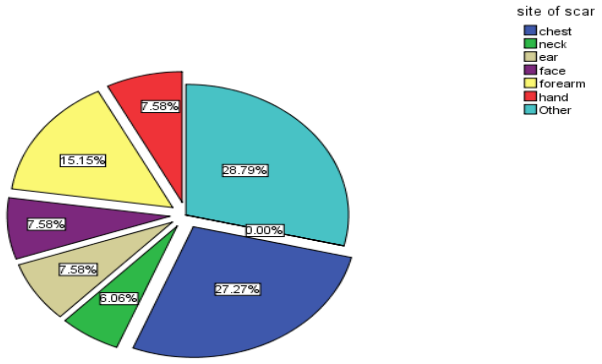

Fig 2. Site of scar

Most patients came to seek treatment due to their aesthetic concern. Pruritus was the most frequent associated symptom in patients with keloid. One patient had scar contracture severe enough to hamper his daily activities. The total number of patients with hypertrophic scars was 44 against 22 keloid patients. There was no significant relationship between the type of scar diagnosis and the etiologies.

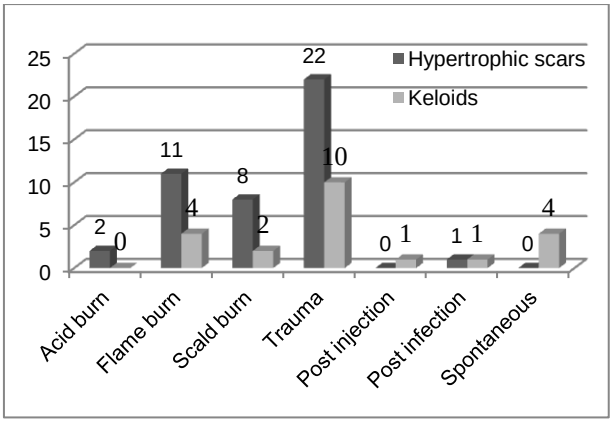

Fig 3. Causes of hypertrophic scars and keloids

Grading: Grade 3 (hypertrophic) was the most frequent, observed in 27 patients (40.9%) followed by grade 4 (keloid) in 22 patients (33.3%). There were 16 patients (24.2%) diagnosed as mildly hypertrophic and one grade 1 (1.5%).

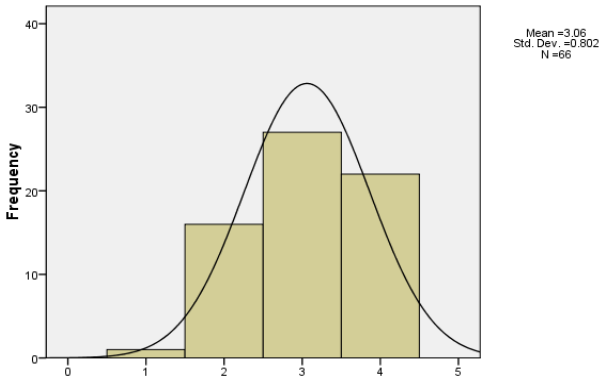

Fig 4. Grading according to morphological features

Treatment

The most common treatment modalities used were intralesional triamcinalone acetonide (TA) 40mg (n=41, 62.1%), surgical procedures (n=29, 43.9%), cryotherapy (n=23, 34.8%) and CO2 laser (n=3, 4.5%).

Intralesional corticosteroids: Intralesional triamcinalone acetonide was used in 20 hypertrophic scar and 21 keloids either as a monotherapy or as a multimodal treatment. We found the results to be satisfactory for both forms of treatments usually after an average of 5th to 8th sessions. Better outcome was achieved when we combine intralesional triamcinolone acetonide with other modalities (E.g. cryotherapy). For ear keloids the best results were observed when we combine intralesional excision with triamcinolone acetonide injection or cryotherapy which was given as a three weekly regimen.

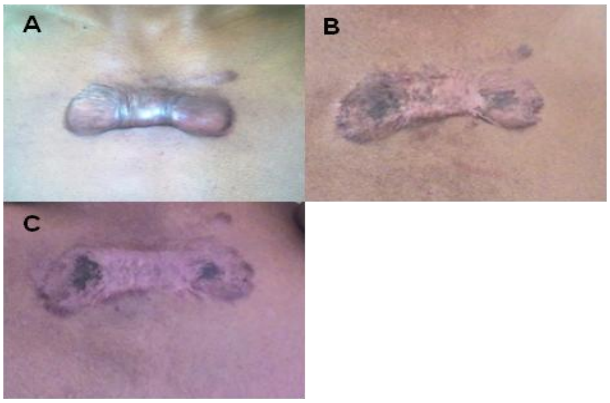

Fig 5. Intralesional Triamcinalone. A) Pre-treatment, B) At 4th session & C) At 6th session

Laser: Fractional CO2 laser treatment was used in three facial post-actinic scars. Our observers and subjective scar assessment showed satisfactory outcome for all treated patient without recurrences during the study period.

Cryotherapy: It was used in 14 hypertrophic scars and 9 keloids. We found cryotherapy to be equally effective as a monotherapy or in combination with intralesional triamcinalone acetonide in small scars.

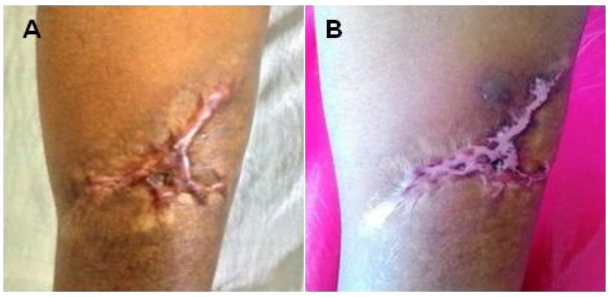

Fig 6. Cryotherapy + Intralesional Triamcinalone. A) Pretreatment & B) After 5th session

Surgical treatment: The most frequent surgical procedure performed was tangential-serial excision with split thickness skin graft (STSG). The idea was to excise serially toward the base leaving behind about one millimetre of scar tissues which will provide scaffold, and reduce tension thereby preventing recurrences.

Hypertrophic scar: We had performed seven scar excision with primary closure/Z-plasty and serial excision for six patients. Most of the surgical interventions performed were for hypertrophic scars (Grade 1 & 2). The outcome was satisfactory for most of the hypertrophic scar baring one Grade 1 (normal scar) patient who was not fully satisfied with results of serial excision we did on her.

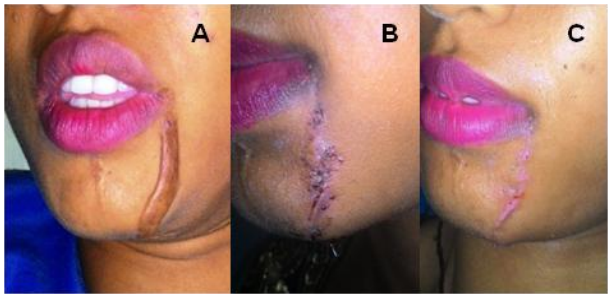

Fig 7. Serial excision + primary closure. A) Pre-treatment, B) 3rd week post-treatment & C) 16th week post-treatment

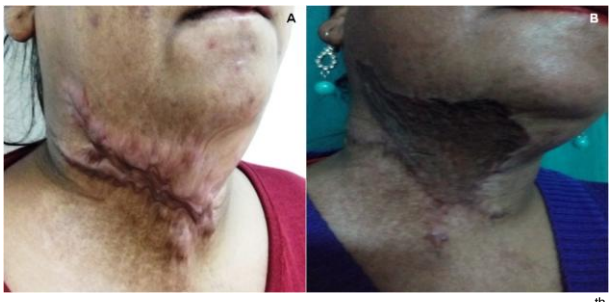

Fig 8. Tangential/serial exicison + STSG. A) Pre-treatment B) 4th month post-treatment

Keloid: Surgical procedures were performed for five of the total 22 keloids. The smaller lesions (<1.5cm D) were given intralesional triamcinolone acetonide in five to six sittings till regression (**Table1**). Among the two large keloid where we tangentially excise and skin grafted, one recur within 4 weeks.

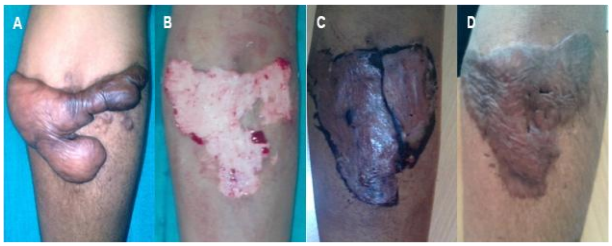

Fig 9. Keloids recurrence after tangential/serial excision + STSG. A) Pre-treatment B) Immediate post-treatment C) 3rd week post-treatment & D) Recurrence after 6th months

Table 1: Grading according to morphological features

Type of surgery	Grade 1 (normal)	Grade 2 (mildly hypertrophic)	Grade 3 (hypertrophic)	Grade 4 (keloid)
Nil	0	6	13	17
Excision + Primary closure	0	3	0	0
Excision + Z plasty	0	3	1	0
Serial excision	1	4	1	0
Tangential serial excision + STSG	0	0	8	2
Excision + local transposition flap	0	0	2	0
Excision + Reverse sural flap coverage	0	0	1	0
Expander + Excision + Flap advancement	0	0	1	0
Intralesional excision	0	0	0	3

Table 2: Differences (D) between Baseline score (B) & at > 6 months post-treatment

Treatments	VSS			OSAS			PSAS		
	B	6th months post-treatment	D	B	6th months post-treatment	D	B	6th months post-treatment	D
Nil/Non-surgical treatment	9	5	4	36	24	12	33	24	9
Excision + Primary closure	8	3	5	31	16	16	26	15	11
Excision + Z-plasty	8	4	4	39	16	22	35	17	18
Serial excision	7	4	3	27	17	12	26	16	10
Tangential serial excision + STSG	11	6	4	43	26	18	43	25	18
Excision + Local transposition flap	8	2	6	40	16	23	36	16	20
Excision + Reverse sural flap coverage	12	1	11	43	13	30	41	14	27
Tissue expansion + excsicion + flap advancement	10	5	5	37	14	23	40	14	26
Intralesional excision	8	4	3	38	25	12	33	25	8

Multimodal approach: Multimodal approach was used in 33 patients (50%). We had also observed that the need for using multimodal treatment increases with higher grades of scar.

Scar assessment

Vancouver scar scale (VSS): Significant improvement of the scar score was observed for all grade/types of scar after more than six months of treatment. However, the outcome in one Grade 1 scar was not satisfactory (Fig 10).

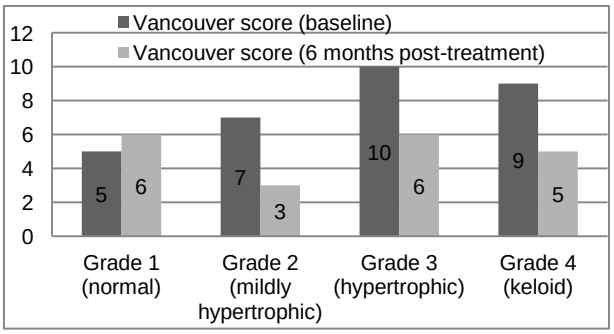

Fig 10. VSS score for specific morphological grades of scar

We found all the parameters of VSS to improve after the scar treatment which was revealed by the paired sample t-test between baseline and at six months' post-treatment (P<0.05). There was a remarkable improvement in the pliability scores of the VSS parameters for hypertrophic scars (Fig 11).

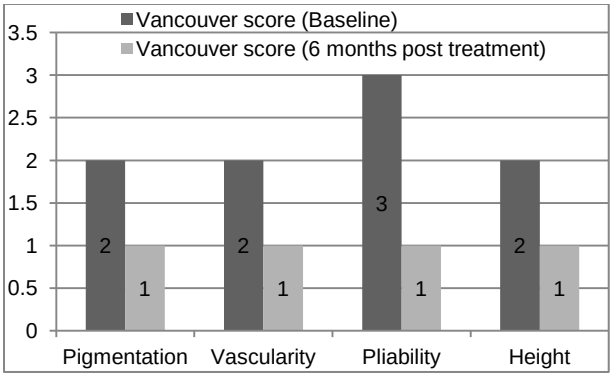

Fig 11. VSS parameter improvement for hypertrophic scars

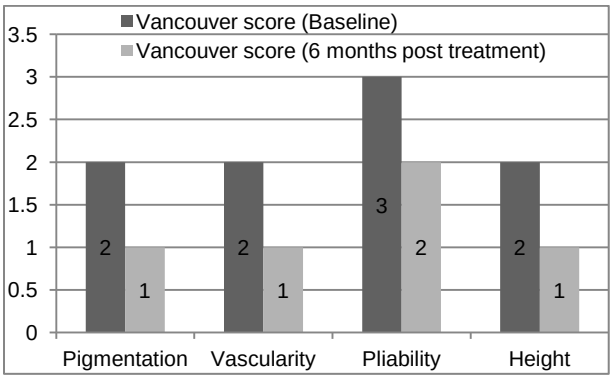

Fig 12. VSS parameter improvement for keloids

Observer scar assessment scale (OSAS): All the parameters were significantly improved in the treated patients (P<0.05). Among the parameters the best score was observed for relief and the least for pigmentation.

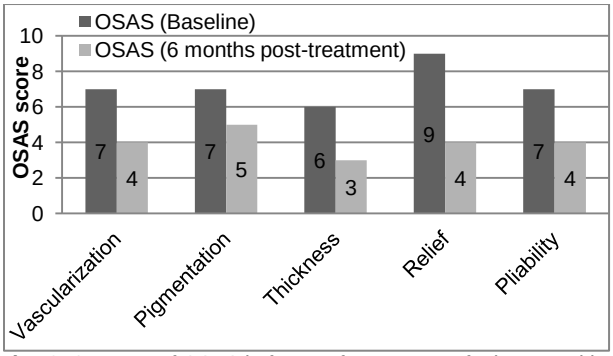

Fig 13. Outcome of OSAS before & after treatment for hypertrophic scars

Almost all of the surgical procedures, intralesional corticosteroid and cryotherapy resulted in variable post-procedure pigmentary changes during the follow-up period.

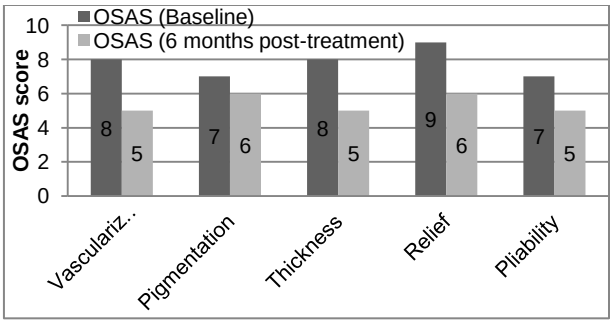

Fig 14. Outcome of OSAS before & after treatment for keloids

OSAS for hypertrophic scars and keloids were found to be significantly improved after all forms of treatment with slightly better outcome for hypertrophic scars than keloids (Fig 15). However, the differences in the reduction of OSAS score post-treatment were not significant statistically between them.

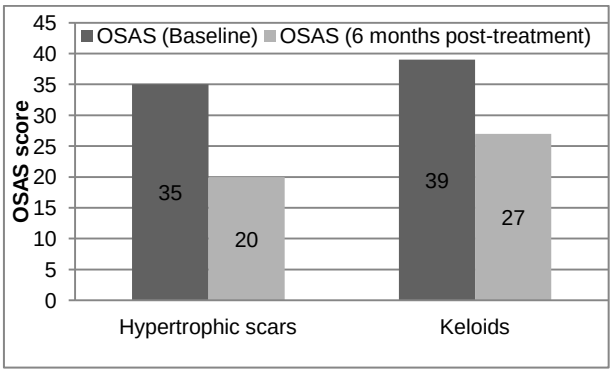

Fig 15. OSAS for hypertrophic scars & keloids

Patient scar assessment scale (PSAS): Most of the parameters studied showed statistically significant improvement after treatment (P<0.05). Pain was the only parameter which did not show notable changes for both hypertrophic scars and keloids. This may be due to the subjective complaint post procedures as we observed pain to be a common associated complication of scar treatment. However, pain as a primary symptom was negligible in the study.

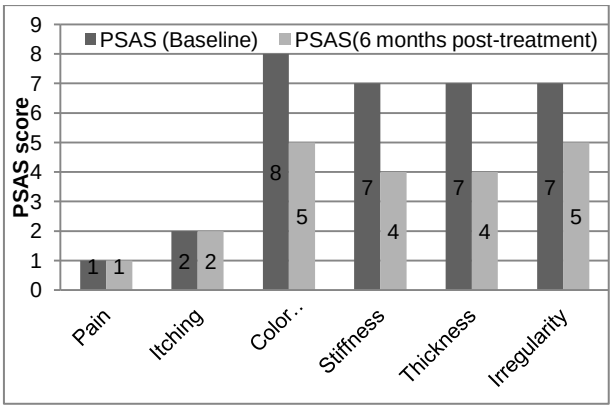

Fig 16. Outcome of PSAS before & after treatment for hypertrophic scars

We had also control of itching to be better in patients with keloids after the treatments (Fig 16 & 17). The best response of keloid treatment measured by PSAS was seen as a reduction in thickness of the scar (Fig 17).

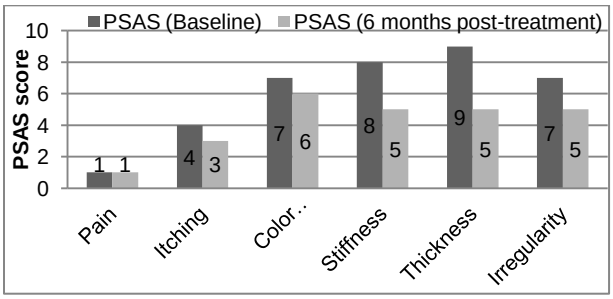

Fig 17. Outcome of PSAS before & after treatment for keloids

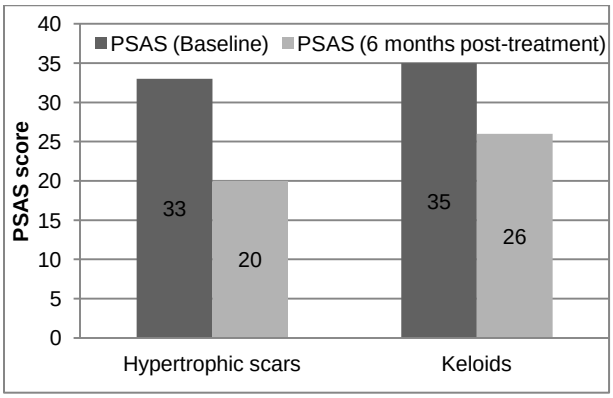

Fig 18. PSAS for hypertrophic scars & keloids

The outcome of the three scar assessment scale used did not vary much (Fig 19). All scales showed that the management of hypertrophic scars yielded better outcome than keloid. But the differences in the scar assessment score were not statistically significant.

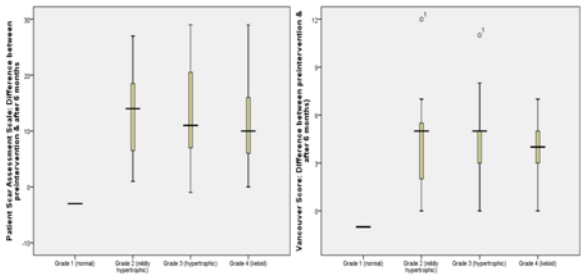

Fig 19. Grading according to morphological features

Recurrences: There were ten (15.2%) recurrences within the follow up period. A statistically significant higher recurrence rate was noted in patients with keloids compared to hypertrophic scars (P<0.05).

Discussion

The common causes of these pathological scars in this study were burn, surgery, trauma, and infection. Most pathological scars were prevalent between 15 to 25 years consistent with other report[2]. The greatest risk for keloid or hypertrophic scar formation is the second decade of life[3]. Injury in adolescents and young adults normally results in worse scarring than in elderly people, reflecting the altered inflammatory and cytokine profile of old wounds, which in many respects resemble those of the early embryo[4].

We found upper extremities to be the most common site for pathological scars. We believe that the conspicuousness of this site might be the reason why most of the patients seek treatment for scar. Keloid was seen more commonly on the chest, shoulder and trunk. Anterior chest, shoulders, earlobes, upper arms and cheeks have a higher predilection for keloid formation. Eyelids, cornea, palms, mucous membranes, genitalia and soles are generally less affected[5].

Different studies suggest that hypertrophic scarring and keloid formation are result of excess collagen accumulation in a healing wound. In keloids, type I procollagen levels are increased (compared to normal skin), and this is paralleled with an increase in its messenger RNA (mRNA) levels[6]. Monofilament absorbable synthetic biopolymers produce the least immune reaction, therefore, it was the suture of choice in this study. Minimizing tension acting on the wound by aligning the incision parallel with the natural skin lines or use of local flaps will also help to reduce the incidence of postsurgical hypertrophic scars[7].

The control and treatment of hypertrophic scars or keloids continues to be an ongoing challenge. Several approaches from simple conservative therapy to major surgical excision have been suggested by various authors[8]. Multimodal management depending on the type of scar and the morphological features seems to offer the best outcome.

The International Clinical Recommendations on Scar Management recommend silicone gel sheeting and intralesional corticosteroids (TA) as first-line therapy[9]. Steroid injection may be sufficient depending on the particular wound. Scar revision with an excision and atraumatic closure and with possible reorientation of the scar can usually improve widened hypertrophic scars[10]. The serial excision and scar excision with primary closure or Z-plasty/ V-Y advancement etc. that we performed were mostly for hypertrophic scars.

Keloids of ear were given preoperative and postoperative intralesional corticosteroids (TA) along

with intra-keloidal excision in this study based on its effectiveness reported by many studies[11].

A remarkable outcome with excellent patient satisfaction for small scars was achieved when we combined cryotherapy along with intralesional corticosteroids (TA). Recurrences were not observed after the cryotherapy sessions during our follow-up period similar to findings of other studies[12].

Among the scar assessment commonly used the VSS appear to be more convenient to use than the POSAS. However, studies point out that VSS lacks clarity in distinction between pigmentation and vascularity changes which was also noticed in our clinical settings during the study[13].

Subjective scar assessment which is a component of POSAS has been reported to be the most reliable assessment for scar by many authors. The POSAS includes subjective symptoms of pain and pruritus and expands on the objective data captured in the VSS[14]. It consists of 2 numerical scales: the 'Patient scar assessment scale' and the 'Observer scar assessment scale'. It assesses vascularity, pigmentation, thickness, relief, pliability, and surface area, and it incorporates patient assessments of pain, itching, color, stiffness, thickness, and relief[13]. The POSAS has been applied to postsurgical scars and used in the evaluation of linear scars following breast cancer surgery, demonstrating internal consistency and inter observer reliability when compared to the VSS with the added benefit of capturing the patients' ratings[15]. Pain as a subjective parameter was the only one which did not show significant changes in both the hypertrophic scars and keloids. Itching as another subjective parameter was improved in keloids however the outcome was negligible in hypertrophic scars in this study.

Conclusion

Prevention of pathological scar should be the paramount aim in the management of scar. Non-operative treatments have a good outcome and should remain the first line of treatment for post-operative and preventable scars. Cryotherapy is effective as a monotherapy or as combination with intralesional corticosteroids in small hypertrophic scar and small keloids in this study. It has a place as a first line treatment for hypertrophic scars and keloids.

Multimodal approaches showed significant benefits in keloids and hypertrophic scars in this series. Clinically classifying scars based on their morphological features aids in choosing the type of treatments.

Conflict of interest: Nil

Acknowledgements: Nil

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