Original article

Scar after Intradermal Mattress versus Subcuticular Continuous Sutures: A comparative study

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Abstract

Introduction

Subcuticular continuous technique and buried mattress suture produce good results. The study compared results following these techniques using POSAS.

Methods

Patients were enrolled on out-patient basis and grouped into I for Intradermal Buried Vertical Mattress Suture (IBVMST) and II for Subcutaneous Continuous with absorbable suture techniques (SCAST) and followed up to six months. Suture time, number of sutures and POSAS items were evaluated, correlated and analyzed.

Results

Included were 63 patients. No significant difference was noted in Total OSAS as well as in Overall Opinion Scores between both groups, although group I scars were significantly better in relief and pliability, with p value of 0.019 and 0.018, respectively. In group I, category 1-2cm wounds needed more repair time; significant correlation was found between number of stitches and total POSAS; surface area and vascularity were significantly related with Observer Opinion and more scars were smooth, flexible, thinner and less vascular. In group II, category >5cm wounds needed more closure time; surface area was significantly related to Observer Opinion and scars were less expanded. In both groups, colour was significantly correlated with Patient Opinion. Total POSAS difference between the two groups was insignificant 0.9305, indicating no technique was superior, despite favourable group I results.

Conclusion

No group was superior but revealed differences. The scars from IBVMST were favoured by observer opinions while scars from SCAST by patient opinions. More of IBVMST scars were smooth, flexible, thinner and less vascular but more of SCAST scars were less expanded. Lastly, short wounds closure are quicker with IBVMST while long wounds closure are quicker with SCAST.

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Introduction

"A scar is defined as a macroscopic disturbance in the normal tissue architecture that involves regulated collagen deposition in response to tissue injury."[1] An aesthetic surgical closure should produce a scar that is inconspicuous at a social distance, possibly improving appearance.[2] "The surgical scar is truly the signature of the surgeon, and while it may be acceptable for doctors to have poor signatures on their prescriptions, it is unacceptable to have poor signatures on their patients."[3] Therefore, the obsessiveness to achieve pleasing scars.

Quest to achieve better scars

The quest to achieve pleasing scar dates back to his observations in 1887, when William S. Halsted noted that buried suturing techniques comparatively produced wound healing without infection.[4,5] Fortunately, John Staige Davis in 1919, who worked with Halsted, noticed these buried sutures resulted in better scars and conceptualized the aesthetic importance of sutures in his book, "Plastic Surgery, Principles and Practice."[6]

And since then, the race is on. Until now, conflicting results exist.[7] In a study in 2012, different techniques were evaluated in 100 patients.[7] Simple interrupted closure was quick, economical with good results. Vertical mattress suture was time consuming with good result and cost-effective as staplers in longer incisions. The subcuticular technique was expensive and time consuming. Adhesive glue was easy with less infection, economical reducing physicians' services and need for suture removal.[8-11] However, it was cost-ineffective and liable to gapping.[10,12] Staple closure was quick, easy with good patient acceptability of the scar.[13] Subcuticular techniques and glues were preferred where cosmesis was prime concern, age < 10 years, with assumption that candidates had good healing tendencies.[7] Few studies showed superiority of the subcuticular technique, especially when absorbable sutures were used.[14-19]

Intradermal buried vertical mattress suture described by Hoenleutner et al, was a modification of the buried vertical mattress suture technique, described initially by Zitelli, and has been used as a sole skin primary closure technique with comparable good results.[20, 21]

Scar evaluation

There have been many methods of scar evaluation.[22] Patient and Observer Scar Assessment Scale (POSAS), which records observer's and patient's views about the scar, has its second version now widely used.[23,24] For more details, please visit https://www.posas.nl.

Till date, either Intradermal vertical mattress suture or subcutaneous continuous with absorbable sutures produces superior results have not been compared. The aim of this study was to compare aesthetic results following wound closure using these two techniques with the help of POSAS v2 to investigate the superiority of either of the technique.

Methods

The study was a comparative double blinded study conducted in the Department of Plastic Surgery and Burns at Tribhuwan University Teaching Hospital in Kathmandu over a period of 12 months, March 2017 to March 2018.

The major variables studied were wound length, suture application time, number of stitches per scar, scar characteristics according to POSAS. Inclusion criteria were patients ≥16 years of age, having clean linear wound with incisions >5mm. The patients excluded were those with wound under tension, loss of any of the skin layers, incisions across the RSTL and over areas of very thin or glabrous skin, complicated results, preoperatively contaminated or infected wounds, comorbid conditions that may affect wound healing, psychiatric disorder and dementia, and those who denied follow up.

The sample size was calculated with the expected mean score of POSAS of 11, a power of 80%, and confidence interval of 95%, corresponding to a p threshold of 0.05.[14] The calculated sample size for each group was 24. Adding 10% drop out rate, sample size for each group became 27. Hence the total sample of the study was to be 54. Written consent was taken. Ethical clearance was obtained from the Institutional Review Board of Medicine.

Two groups of patients were created, group I - Intradermal buried vertical mattress suture technique (IBVMST) and group II - Subcutaneous continuous by absorbable suture technique (SCAST).

Wound length was classified into 6 categories, i.e., <1cm, 1 - 2cm, >2 - 3cm, >3 - 4cm, >4 - 5cm and >5cm as shown in table 1. The suture application time was calculated based on the time taken to close each category of the wound length. The number of stitches per wound length was evaluated. The number of stitches in group I was straight forward, but the number of stitches in group II required special consideration. There were 2 knots at the ends but none in between. Every "passing through bite" on either side was considered as a pair resulting in one stitch. So for example, if there were 2 knots at the ends and 6 passing through bites, then the total number of stitches was 2 + 6/2 = 5 knots.

POSAS was used by patients as well as two registered Plastic Surgeons as observers without their knowledge of the type of procedure performed to evaluate scars. It contained 5 types of major scores: two each for patient's and observer's evaluation. The Patient scores constituted of Patient Scar Assessment Scale score (PSAS) and Observer Scar Assessment Scale score (OSAS) for Observer. The observer scores were represented by the mean of total scores of both the observers. The fifth score was Total POSAS Score (TPOSASS) which was the sum of total patient and observers scores. There were also Overall Opinions for patient as well as observer which were not included in the total POSAS score. The group that had lesser total POSAS score by ≥ 1 and lesser Overall Opinion score was considered to have better result.

The patients were enrolled on out-patient basis and interviewed, then randomized by the computer generation randomization. The excision procedures were performed. Adipofascial approximation was done by polyglactin 910, 4/0. Wounds closed as per the technique using polyglactin 910 and dressed.

The wound was assessed on the 7th postoperative day. At the end of 6 months, the patients and observers were requested to evaluate the scar with POSAS evaluation sheets. Photographs were obtained.

Data evaluation was performed using SPSS version 20. Man-Whittney U test was used to compare the values of each group. Correlations were expressed as Pearson correlation coefficient (r). Linear multivariate regression analysis was used to evaluate the contribution of each patient and observer item to the score of 7th item (Overall Opinion). A difference of ≥1 between the Total POSAS scores of both groups and a p value of ≤0.05 was taken as significant. The Total POSAS score was the cumulative of the means of the Total PSAS score and mean of the sum of the Total OSAS score of two observers [Total POSAS score = Total PSAS score + (Total Observer 1 score + Total Observer 2 score)/2].

Results

Seventy four patients were assessed for eligibility and randomized for operation. Thirty seven were allocated to each group. Six patients in group I and 5 patients in group II were excluded due to lack of follow up. Sixty three patients were evaluated. Group I had 31 and group II, 32. No complications were identified. Mean age of patients was 31.33 years (±13.31SD). The mean age for patients who underwent IBVMST was 31.84±13.83 and 29.88±12.87 for patients who underwent SCAST. There was no significant difference between the two groups in relation to age. Majority of the patients were operated for epidermoid cysts and scars.

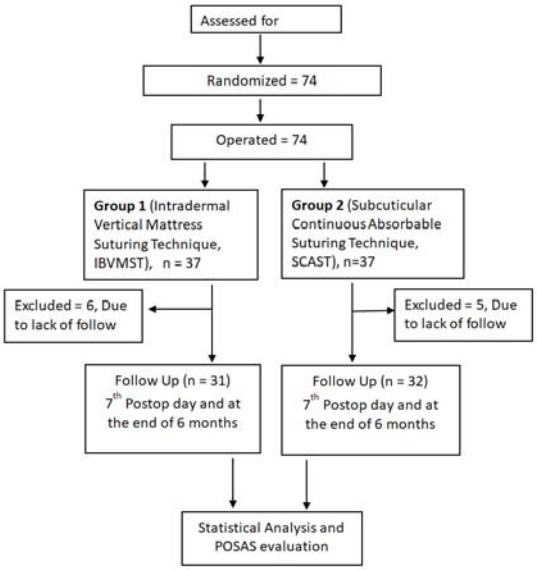

Figure 1. Flow chart of plan of selection, randomization, operative, classification and follow up

Suture application time

The difference in overall time spent to perform wound closure for both groups was insignificant. Time taken to perform closure of category 1-2cm wounds was different for both groups, for group 3.92±2.39 minutes whereas, for group II, 6.57±1.9 minutes, with significant p value of 0.022. On the contrary, it took 14.2±5.11 minutes to close category >5cm in group I, while only 7.0±0.81 minutes in group II, with significant p value of 0.029 as shown in **Table 1**.

Table 1. Suture application time per wound length for each group

Characteristic	Group I (n=31)	Group II (n=32)	Overall (n=63)	p Value
Suture Application Time (Mean, Minutes)	7.38 ± 4.86	6.68 ± 2.11	7.03 ± 3.71	0.451
< 1 Cm	5.0 ± 0.0	4.0 ± 1.41	4.5 ± 1.00	0.423
1 - 2 Cm	3.92 ± 2.39	6.57 ± 1.9	4.85 ± 2.5	0.022
>2 - 3 Cm	8.42 ± 3.15	6.0 ± 2.0	6.94 ± 2.75	0.066
>3 - 4 Cm	9.5 ± 4.2	8.16 ± 2.22	8.7 ± 3.02	0.526
>4 - 5 Cm	--	8.5 ± 2.12	8.5 ± 2.12	--
> 5 Cm	14.2 ± 5.11	7.0 ± 0.81	11.01 ± 5.26	0.029

Number of stitches

No difference was noted in the number of stitches between both groups as shown in **Table 2**. Pearson method revealed correlation between the number of stitches and the total POSAS scores to be significant for group I.

Table 2. Number of stitches per group and wound length categories with Pearson correlation coefficient and p values in correlation with the total POSAS score.

Wound length categories	Group I	Group II
< 1 Cm	2.5±0.707	3.5
1 - 2 Cm	3.46±0.877	4.5
>2 - 3 Cm	5.57±5.57	5.09±0.97
>3 - 4 Cm	7±13.00	7
> 4-5 Cm	NA	8
>5 Cm	13±4.06	10±1.22
Total	5.87±3.91	6.01±2.04
Correlation coefficient (r) in correlation with total POSAS score and p value	0.394, 0.028	0.17, 0.35

Patient Scar Assessment Scale (PSAS)

No statistical difference in patient scale items was observed in both groups. Most of the PSAS items did not exceed scale of 2. Linear regression analysis between overall opinion and PSAS items, as shown in **Table 3**, revealed scar color to have significant relationship in both groups.

Table 3. Regression analysis between Patient's (PSAS) items and Patient Overall opinion, and Observers' (OSAS) items and Observer Overall Opinion

		β - standardized Coefficient	p value
Patient score			
Colour	Group I	0.583	0.003
	Group II	0.52	0.002
Observer Score			
Group I	Vascularity	0.65	0.00
	Surface area	0.329	0.021
Group II	Surface area	0.582	0.00

Observer Scar Assessment Scale (OSAS)

No significant difference was noted in Total OSAS as well as in Overall Opinion Scores between both groups, although group I showed better scores with significant difference in relief and pliability, with p value of 0.019 and 0.018, respectively, as seen in **Table 4**. Pearson correlation coefficient was significantly higher between the OSAS items and the overall observer opinion score as shown in **Table 4**. Linear regression analysis between OSAS Overall Opinion and OSAS items showed significant relationship between surface area and vascularity in group I, and surface area in group II in **Table 3**.

Total POSAS score

The Total POSAS score of group I was 20.2258 and 21.1563 for group II with a difference of 0.9305 as shown in **Table 5.**

Table 5. Comparison of Total POSAS scores and Total Overall Opinion of observers and patients

	Group I	Group II	Difference
Total POSAS	20.22±6.09	21.15±8.46	0.9305
Total Overall Opinion			
Patients	2.06±1.15	1.96±1.53	
Observers	2.33±0.87	2.43±1.12	
Mean	2.195	2.195	

Overall Opinion

From **Table 5**, it is seen that group I had better Observer Overall Opinion Score while group II had better Patient Overall Opinion Score. However, the Total Overall Opinion Score for each group were the same.

Qualitative analysis of the POSAS items

Nearly nineteen percent (18.74%) of the group II scars had higher vascularity as compared to group I as shown in **Table 6**. Both groups had almost equally distributed percentage of hyperpigmented scars. There were thicker scars in group II (25%) as compared to group I (19.35%). Scars in group I (51.61%) had lesser relief than in group II (37.5%). Above twenty two percent (22.17%) of group II scars were stiff in comparison to 9.62% of scars in group I. Surface area in both groups exhibited nearly equal contracting behaviors but higher expansive character in the group I.

Discussion

A distortion like a scar does hardly boost anyone's confidence but only to cause anxiety, therefore, the need to improve scar quality. As most of our methods of wound closure constitute application of different types of suturing techniques, it is important that we use the method that would result in the best of the scar quality.

In our study, although, it was found that group I provided better POSAS scores, but with insignificant difference of 0.9305, indicating both being equally good. However,

Table 4 Comparison of mean scores with standard deviation of the OSAS items between groups and Correlation between Observer Opinion and Observer items

Groups	Vascularity	Pigmentation	Thickness	Relief	Pliability	Surface area	Total OSAS	Overall Opinion
I	1.98± 0.73	1.88± 0.72	1.90± 0.73	1.69± 0.52	1.69± 0.57	1.51± 0.61	10.61± 3.05	2.33± 0.87
II	2.03± 0.47	1.95± 0.26	2.28± 0.98	2.09± 0.76	2.09± 0.72	1.82± 1.26	12.28± 3.87	2.43± 1.112
p value	0.762	0.632	0.09	0.019	0.018	0.219	0.074	0.687
Correlation Coefficient (r), P value								
I	0.699, <0.001	0.653, <0.001	0.634, <0.001	0.450, <0.013	0.64, <0.001	0.673, <0.001		
II	0.638, <0.001	0.395, 0.003	0.766, <0.001	0.819, <0.001	0.789, <0.001	0.877, <0.001		

Table 6. Distribution of intensity spectrum of OSAS items of both groups

OSAS items and their quality	I (n=31)	II (n=32)
Vascularity		
Pale	25 (80.64%)	20 (62.5%)
Pink	5 (16.12%)	6 (18.75%)
Red	0	5 (15.62%)
Purple	0	0
Mix	1 (3.22%)	1 (3.12%)
Pigmentation		
Hypo	21 (67.74%)	22 (68.75%)
Hyper	7 (22.58%)	8 (25%)
Mix	3 (9.67%)	2 (6.25%)
Thickness		
Thicker	6 (19.35%)	8 (25%)
Thinner	25 (80.64%)	24 (75%)
Relief		
More	15 (48.38%)	20 (62.5%)
Less	9 (29.03%)	6 (18.75%)
Mix	7 (22.58%)	6 (18.75%)
Pliability		
Supple	28 (90.32%)	25 (78.12%)
Stiff	1 (3.22%)	3 (9.67%)
Mix	2 (6.4%)	4 (12.5%)
Surface area		
expansion	14 (45.16%)	12 (37.5%)
contraction	16 (51.61%)	16 (50%)
Mix	0	2 (6.25%)

the observers' assessment was significantly influenced by pigmentation in group I, and relief in group II owing to their correlation. The influence of scar colour was significant on the patient overall opinions in both groups but symptom assessment was indifferent as shown in **Table 3**. The significant influence of surface area and vascularity over observer overall opinion indicates us to provide better subdermal strengthening approximation. Either, we might need less sutures as well as stronger suture material. In a study from Netherlands in 2004, itching and thickness were predominantly influential on patient's opinion, while none of the items has superiority in our study.[23] Although, neither of the groups had any advantage with regards to Total Overall Opinion, but **Table 5** shows that group I was favoured by observers and group II by patients.

Table 7 Comparison of POSAS score of group II in our study with subcutaneous continuous group of Consorti et al[14]

POSAS scores	Consorti et al[14]	Our study
Total OSAS Score	10.17±3.8	12.28 ± 3.87
Total Overall Opinion of Observers	2.06±0.09	2.43 ± 1.12
Total PSAS Score	11.44±11.4	8.83±5.07
Total Overall Opinion of Patients	2.17±2.0	1.96±1.53

Figure 2. Results of both the techniques at the end of 6 months. a) Closure with Subcutaneous Continuous with absorbable sutures. The scar has near normal pigmentation, minimal relief, mildly thick and slightly expanded. b) Closure with Intradermal vertical mattress sutures. The scar has nearly invisible, near normal pigmentation, almost smooth, thin and well contracted, but very small dog ears at the ends.

In 2013, a study in Italy had one group similar to our group II.[14] The study showed better Observer scores, whereas our study revealed better Patient scores towards group II as shown in **Table 7**.

The qualitative analysis shown in **Table 6** reveals that more scars in group I were smooth, flexible, thinner and less vascular but expanded, whereas more scars in group II were contracted. In a study in Germany, parameters evaluating scar were wound dehiscence, pigmentation, hypertrophic and keloid scarring.[20] Their patients had scars hyperpigmented in 2%, hypopigmented in 12.1%, hypertrophic scarring in 10.1%, keloid formation in 1.3%, granuloma in 3.4% as shown in **Table 8**. Cosmetic outcome depended on body region, where face showed better results. Length of the wound had no influence on aesthetics of the scar. In our study we had 23.8% of patients with hyperpigmentated scar irrespective of the type of repair. Among these patients, in group I, hyperpigmented scars constituted 22.58% (7 patients), while 67.74% (21 patients) had hypopigmented scars. The degree of pigmentation did not exceed the scale of 2. Furthermore, more than 48% of patients in group I had minimally expanded scars with scale not exceeding 3, where more than 97% were in the scale of < 2, which signifies that there are hardly any hypertrophic or keloidic changes in the scars in our study.

Table 8. Comparison of scar qualities between Hohenleutner et al's study and our study.

	Hohenluetner et al[20]	Our study
Hyperpigmentation	2%	22.30%
Hypopigmentation	12.10%	67.74%
Hypertrophy	10.10%	< 3% with mildly expanded scars (>97% with scale < 2 of scar expansion)

Although, there was no significant difference between both groups in the number of stitches, a significant correlation was revealed between the Total POSAS of group I and the number of stitches, which indicated that the higher the number of stitches in group I the higher its POSAS score.

This possibly might be attributed to the presence of knots in group I in contrast to assumption of stitch knots in group II.

Time taken to apply the stitches in both groups differed in two categories. It took significantly more time to apply in category 1-2cm of SCAST group, whereas more time was required to apply in category >5cm of IBVMST group. This could indicate that it would be better to apply IBVMST for shorter wounds while SCAST for longer ones.

Conclusion

No group was superior but revealed differences. The scars from IBVMST were favoured by observer opinions while scars from SCAST by patient opinions. More of IBVMST scars were smooth, flexible, thinner and less vascular but more of SCAST scars were less expanded. Lastly, short wounds closure are quicker with IBVMST while long wounds closure are quicker with SCAST.

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