

Original Research Article

Dermo traction as a solution to major skin defects: a prospective study in a tertiary care hospital of South Odisha

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ABSTRACT

Background: Soft tissue loss with exposure of underlying tissue is a challenge to all Orthopedics surgeons. The present prospective study described dermo-traction technique using infant feeding tube or prolene suture as an alternative method for the wound closure.

Methods: This prospective study described 30 cases where dermo-traction technique was used for the closure of the wound using infant feeding tube or prolene suture. Study was conducted in Orthopaedics Department of MKCG Medical College, Berhampur from June 2016 to May 2018. Patients requiring skin grafting for their major soft tissue defects or in whom skin grafting or fasciocutaneous flap could not be done were included in study.

Results: Out of 30 patients, 2 were lost to follow-up. Average age of study participants was 39.1 years. Male constituted 67.8%. 78.5% of patients had wound in leg, 14.3% in thigh region, rest had on ankle. 82.1% had an open fracture wound, 10.7% had post-operative wound dehiscence and 7.1% soft tissue injury. Average wound healing time was 15.3 days with average 5 tightening session of suture. Wounds healed eventually in 26 patients and 2 patients had an infection. Among 26 patients 9 patients had delayed primary and 17 had secondary closure of wound.

Conclusions: It can be concluded that gradual closure of the wounds with soft tissue defects can be achieved by applying dermo-traction technique using prolene suture or infant feeding tube with average 15 days of time. So dermo-traction using infant feeding tube or prolene suture is a simple, inexpensive, effective and technically sound alternate solution for closure of wound.

Keywords: Dermo-traction, Wound healing, Skin grafting, Collagen

INTRODUCTION

Closure of wound is a frequently faced problem. It often becomes a challenge to all Orthopaedic surgeons to deal with the soft tissue loss with exposure of the underlying tissue. For the coverage of this defect, there are many options like primary closure by split skin graft, full thickness graft, fasciocutaneous flap, myocutaneous flap and much more.¹ But these options often add a considerable amount of morbidity and cost to the patients. In addition, at times non availability of the donor site for skin grafting (due to inadequate donor site)

or disagreement of patients hinders the use of these options.² In this context the dermo-traction technique is an alternate option for the wound closure. This procedure uses the natural stretching ability of the skin for the closure of the wound. This prospective study described the dermo-traction technique using infant feeding tube or suture as an alternative method for the wound closure.

METHODS

This study was a prospective in design. In this prospective study, we described 30 cases in which dermo-traction technique was used for the closure of the

wound using infant feeding tube or prolene suture. The study was conducted from June 2016 to May 2018 in Orthopedics Department of MKCG Medical College, Berhampur. During this period, patients coming with open wound with soft tissue defects (with or without fracture) and those qualified the inclusion criteria were managed by the dermo-traction technique for wound closure. In our study, we included the patients who required skin grafting for their major soft tissue defects. We also took patients who were not willing for skin grafting or in whom skin grafting or fasciocutaneous flap could not be done for this defect. Patients with wound more than 20 centimeter or with bizarre shaped wound were excluded from study. Patients with a history of diabetics, distal neurovascular compromised patients, immune compromised patients, patients having allergic dermatitis or local skin diseases like eczema, psoriasis were excluded from the study. Patients with fasciotomy wounds were not included in our study. All 30 patients coming within the study period qualified for the inclusion criteria. Informed consent from patients was taken prior to the study. Out of 30 patients, 25 cases had an open fracture wound, 3 cases had post operative wound dehiscence and rest 2 had soft tissue injury.

When study participant came with wound, a thorough debridement of wound was done. Under local anaesthesia (2% xylocaine), necrotic skin margin was remove and debridement of muscle was done up to viable point of muscle. In case of bone fracture, it was fixed by external fixator. During debridement wound was assessed for application of the technique. When wound size within 20 cm and not bizarre shaped, dermo-traction given for wound closure. Because in large wounds, dermo-traction can facilitate closure of wound from edges but unable to do it at middle portion due to large gap. Materials used in this method were prolene (1-0) suture or infant feeding tube (6 French sizes (Fr)) and skin stapler. Infant feeding tube (6 Fr) was used in those cases where wound bed contains muscle fibre. Because prolene suture can cause a cut in muscle fibre when traction is given to it. The required length of the suture or infant feeding tube was more than the double the length of the wound. At one end of the wound suture was fixed with the help of staples and progressed in a zigzag manner throughout the length of the wound. At each point of fixation, suture was fixed to skin with 2 staples keeping at least a distance of 1 cm from skin edge. Between two adjacent fixations, a distance of 2-3 cm was maintained (Figure 1). All these were done to decrease the pressure effect and necrosis in the skin edges. Antibiotics (Inj piperacillin with tazobactam 4.5 g) were given to the patient for 3 days and sample from wound sent for culture sensitivity. After receiving culture report (which was available in 72 hours) antibiotic was changed according the report and given for next two days. Pain management was done with oral medication wherever required. Controlled traction was applied to skin edges by pulling the suture end on every alternate day till the complete apposition of wound

margins. The traction was maintained with the help of loop suture around a needle cap. The tension was carefully maintained to decrease the possibility of skin necrosis and cut off of skin due to traction. Wounds were examined at each tightening session for a sign of skin necrosis or any local inflammation. Staples were removed once the wound margins apposed and epithelisation occurred. Secondary sutures were given for the final closure of the wound wherever necessary. The wounds were inspected thoroughly (looked for any sign of infection, wound margin necrosis, over tightening, pull out of staples) and if required undermining of the edge of the wounds were done during the tightening sessions. To analyze outcome, the wound closure was assessed by seeing its apposition, skin infection and necrosis. Outcome was said to be good if there was good apposition of skin edges without infection and necrosis at the end. After the wound closure the patients were discharged from hospital and asked to come again to hospital after complete healing of wound. In between times they were asked about the progress of healing over phone. All data were collected in a excel sheet and were analysed in SPSS (version 16.0).

RESULTS

The study described 30 patients in whom the wound closure was done by a dermo-traction technique using infant feeding tube or prolene suture. 2 patients were dropped out from the study as they were lost to follow-up. So total 28 patients were followed-up until the end of the study. The average age of the study participants was 39.1 years (ranged from 19 years to 60 years). Male constituted 67.8% (19) while female accounted for 32.1% (9). 78.5% of patients had wound in the leg while 14.3% had in thigh region and rest had it on the ankle. 82.1% had an open fracture wound due to road traffic accident, 10.7% patients had post-operative wound dehiscence and rest 7.1 % had soft tissue injury. The average wound closure time in participants was 15.3 days, highest being 18 days and the lowest time required for healing was 13 days (Figure 2). Average follow up time was 9.1 months in participants. The demographic data elicited in Table 1

Table 2 shows the outcome in patients after the intervention (Table 2). The skin closure was obtained at an average of 5 tightening session of suture. Wounds healed eventually in 26 patients (out of 28 followed up patients). Two patients had an infection with wound margin necrosis which occurred on the 7th day of application of dermo-traction and required secondary procedures. In those two patients, debridement was done and skin grafting was done. Among 26 patients 9 patients had finally delayed primary wound closure and 17 had secondary wound closure. Image 2 and 3 were the intra-operative and post-operative photographs showing application of dermo-traction by suture and healing of wounds in post-operative period (Figure 3 and 4).

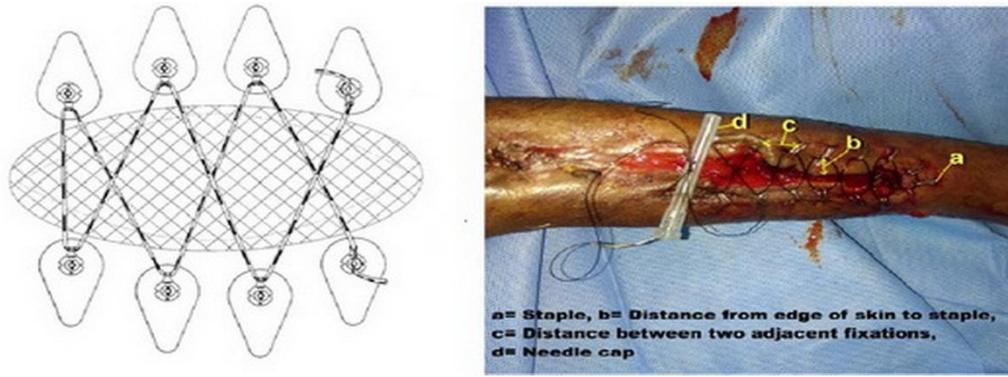


Figure 1: Basic principles of suturing in dermo-traction technique using prolene suture.

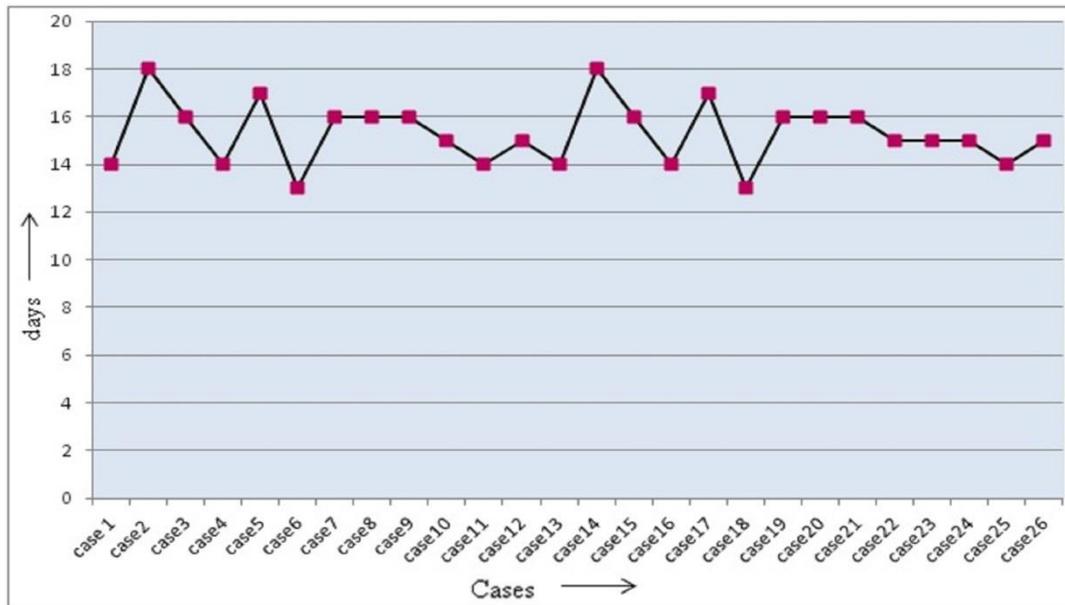


Figure 2: Duration of wound healing in days applying dermo-traction technique in only followed up participants (excluding two cases who had skin grafting, n=26).

Table 1: Characteristics of the study participants (excluding lost to follow up patients) in whom wounds were managed by dermo-traction technique (n=28).

Characteristics	Value
Age in years (mean±SD)	39.1±10.3
Sex, N (%)	
Male	19 (67.8)
Female	9 (32.1)
Site of wound, N (%)	
Thigh	4 (14.3)
Leg	22(78.5)
Ankle	2 (7.1)
Mode of injury, N (%)	
Open fracture due to road traffic accident	23 (82.1)
Soft tissue injury	2 (7.1)
Post-op wound dehiscence	3 (10.7)
Duration of wound closure in days (mean±SD)	15.3±1.34
Follow up in months (mean±SD)	9.1±2.2

Table 2: Outcomes of the dermo-traction technique in the study participants (n=28).

Characteristics	N (%)
Method of final wound closure in patients	
Delayed primary*	9 (32.1)
Secondary**	17 (60.7)
Skin graft (as infection occurred)	2 (7.14)
Number of tightening session	
3 times	2 (7.14)
4 times	4 (14.2)
5 times	18 (64.2)
6 times	4 (14.2)
Outcome of the procedure in patients	
Good result	26 (92.8)
Infection	2 (7.1)

*Delayed primary wound closure: surgical closing of wound several days after the injury.

**Secondary wound closure: wounds where gap is filled by granulation tissue matrix built up in the wound.

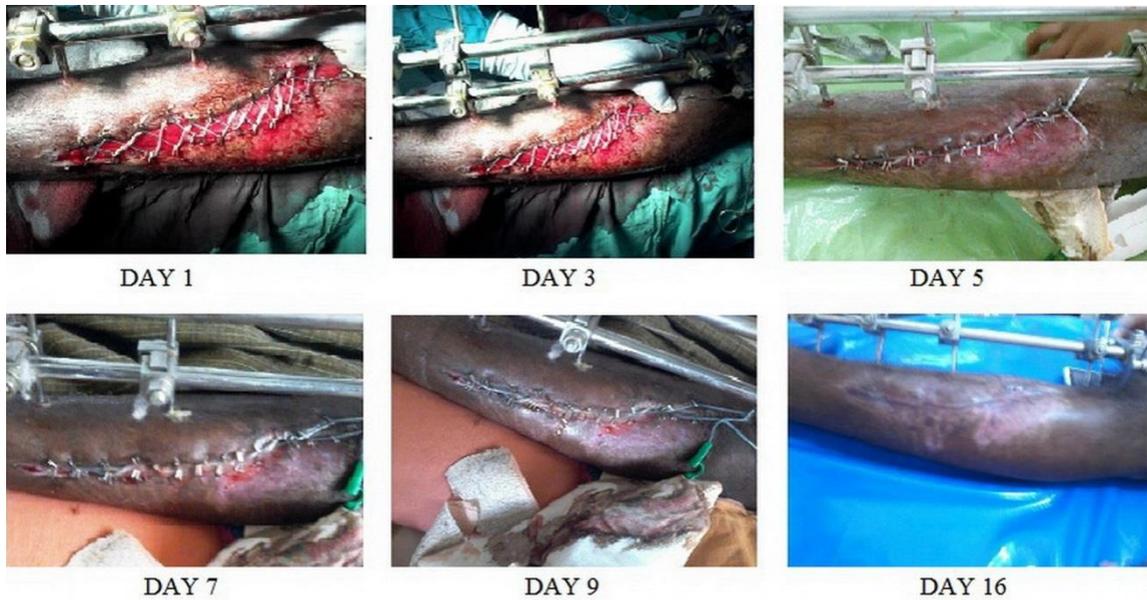


Figure 3: Dermo-traction by prolene suture in a wound and its healing in post-operative period in a 48 years old male patient.



Figure 4: Post-surgical wound dehiscence in thigh region at day 1 and its healing at day 15 after managed with dermo-traction technique in a 39 years old male patient.

DISCUSSION

In our study, we did dermo-traction techniques for closure of wound using infant feeding tube or prolene suture. Wound base containing bulkier muscle belly may get damaged when prolene suture is used for this technique. So instead of prolene suture, infant feeding tube was used in this situation. Dermo-traction technique offers an alternate solution with a low morbidity for the complex wound closure. The main principle behind this dermo-traction is the viscoelastic property of skin. Collagen which is a major component of the dermis (part of skin) is a stretchable protein in nature. So when skin is stretched with a constant tension it will expand. Mechanical stretch allows the skin to gradually stretch beyond the limits of its normal extensibility. So when a gradual traction force is applied to wound margins without tensioning to the skin, wound margins will appose themselves. This technique was first described by Cohn in 1986 for the fasciotomy wound closure. The initial procedure was performed using vessel loops arranged in shoelace pattern.³ After that, the technique was performed with various modifications like skin stretching device, Ty-Raps, skin anchors, silicone elastomer, wisebands device, K wire with silver wire, catheter and suture for the closure of different types of wound.⁴⁻¹² In our prospective study, suture or infant feeding tube was used for applying traction to the wound margins. Using suture or infant feeding tube for dermo-traction is very simple, easy to learn. It uses affordable materials those are readily available in contrast to other devices used for applying traction to the skin for closure. The results of dermo-traction have been shown to be superior to a skin graft. Because it provides better cosmetic appearance, give sensate skin, avoids morbidity from a donor site and immobilization of extremity. In addition to this, it has a low rate of complication, low morbidity and satisfactory clinical results. It allows patients to return to normal activity early. It also avoids autologous skin grafting related problems like donor site unavailability, infection, scar, anaesthesia complications and technical experts. Another important advantage of this procedure is that sensation of skin remains intact in this procedure which is lost in skin grafting.

In our study, we described 30 cases in whom the closure of wound with major soft tissue defects was done with the application of dermo-traction technique. The age of the patients ranged from 19 years to 60 years with the average age being 39.1 years. Majority of the patients were male (67.8%). Most of them (78.5%) had wound in the leg. Out of the total cases, 23 had an open fracture wound and 3 patients had post operative wound dehiscence. 2 had soft tissue injury as a result of Road traffic accident. From our study, it was seen that average wound healing time in patients was 15.3 days. Minimum days required for the healing of the wound was found to be 13 days while maximum days being 18 days. Majority of the patients (60.7%) had a secondary method of final wound closure while only 32.1% had delayed primary

method of wound closure. In our study, out of 30 cases, 2 cases were lost to follow up. So only 28 cases could be followed up until the end. Out of these 28 cases, 26 cases had an uneventful recovery and had satisfactory wound coverage with scar having a better cosmetic appearance. Only 2 patients developed an infection around wound margin with necrosis. This occurred on the 7th day of the wound management. In those 2 cases, secondary procedure that is skin grafting was done. In our study, all 26 wounds closed on an average 5 tightening sessions in 2 weeks. Each tightening session provided an opportunity for the wound examination and subsequent re-debridement wherever necessary. The final outcome of the procedure in term of total wound closure and healing was good. It was seen that in 92.8% (26 patients) of cases the result was good that means they had satisfactory wound coverage with the dermo-traction procedure. Additionally, the wounds had a good cosmetic appearance with minimal scar.

In wounds with edematous tissue and retracted skin edges methods relying on the visco-elastic physical property of skin have proved successful. Many cases were reported success in the closure of wound with the help of dermo-traction technique. Galois et al, Zorrilla et al and Harris used shoelace technique in their cases for fasciotomy wound closure with success.⁴⁻⁶ Hirshowitz et al used a skin stretching device for closure of wound which gave a better result than a skin graft.⁷ Govaert et al and Barnea et al also got good results using Ty-Raps and wisebands device respectively for the closure of the fasciotomy wounds.^{8,9} Bassir used K wire with silver wire for wound closure using this dermo-traction mechanism in his cases.¹⁰ Weissman et al applied this technique with the help of adhesive skin closure (steri-strips) for fasciotomy wounds and achieved favourable results.¹¹ Marek et al and Ridgeway et al utilized suture and catheter for this technique.^{12,13} Ridgeway et al in their cases found that wound closed averagely by 9 days applying dermo-traction by the urinary catheter.¹³ Chiverton et al and Eid et al also utilized suture and catheter for the closure of fasciotomy wounds and got satisfactory results.^{14,15} So closure of wounds with soft tissue defects could be done by applying the dermo-traction technique in a better effective way than skin grafting.

Limitation

In bizarre shaped wound this technique cannot be used. This dermo-traction generally is not possible in old age patients due to age related skin laxity. This study suggested that this technique can be an alternate solution for wound closure which can be confirmed by more analytical and randomized trial. However this study formed a platform for further experimental study.

CONCLUSION

From our study, it can be concluded that gradual closure of the wounds with soft tissue defects can be achieved by

applying dermo-traction technique using simple, inexpensive and readily available materials like prolene suture or infant feeding tube. Wounds healed finally by either delayed primary closure or secondary closure with an average of 15 days. So dermo-traction using infant feeding tube or prolene suture can be a promising, effective and technically sound alternate solution for the closure of the wound with soft tissue defect.

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