

Physiotherapy succeeding split skin grafting in a case of degloving injury of hand and keloid formation

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ABSTRACT

A degloving injury is a fairly common outcome of road traffic accidents, and if the soft tissues are not rescued in a short period, it can result in death. Even after soft tissue salvage, if the mobility component is not prioritized, the affected structures will be permanently disabled. This case report follows a case of degloving injury that was treated with split skin grafting, after which the patient developed partial disability for which physiotherapy was implemented that resulted in a significant decrease in pain, decreased restrictions in ranges of joints of hand and foot, and improvement in gait pattern.

Keywords: Split skin grafting, degloving injury, keloid, physiotherapy, case report

1. INTRODUCTION

Skin avulsion from the fingers or hand is a dramatic presentation of an injury. The extensor tendons are revealed when degloving occurs at the subcutaneous level on the hand's dorsum, but the fascia protecting the muscles situated deeply, such as the dorsal interossei, is not breached, hence, the finger's whole musculoskeletal unit could be unharmed, and the victim may frequently do the movement of portions of his bare hand normally. Here the plastic surgeon's job is to resurface the finger or hand with a high-quality flexible sensate skin layer that retains the hand's efficiency and kinematics (Krishnamoorthy and Karthikeyan, 2011). In victims with much more limited degloving injuries produced by avulsion and/or abrasion; free tissue transfer procedures can be employed to cover any exposed underlying bones, tendons, and joints. It's also a good idea to keep doing modest tissue removal (including minimal wound circumcision).

The single-stage microvascular approach is one of the free tissue transfer techniques. The two forms of tissue that can be transplanted are a thigh flap which is an anterolateral skin flap, and a latissimus dorsi muscle flap covered

with a skin graft (Kim et al., 2011). The wound heals by primary intention independent of the procedure done i.e., skin grafts or flap repair (Arnez et al., 2010). If abnormal wound healing is witnessed then keloids may occur, which are benign dermal fibro proliferative nodular lesions that tend to recur following excision. Its symptoms include pain, burning, pruritus, limited mobility, and hyperaesthesia (McGinty and Siddiqui, 2022). This article is about the treatment of the repercussions of degloving injury, split skin grafting (SSG), and keloid formation from a physiotherapy perspective.

2. PATIENT INFORMATION

A 32-year-old female was brought to the emergency room after a road traffic accident with a history of injury over the right hand and lower limb. There was no history of head trauma or loss of consciousness. On examination, a 5 x 3 cm degloving injury with full-thickness skin loss over the dorsal aspect of the right hand with well-defined margins (figure 1A), a 1 x 1 cm laceration over the dorsolateral aspect of the second finger, a 2 x 1cm laceration over the third and fourth finger dorsolaterally was present. An abrasion of 4 x 4 was also seen anteriorly over the lower third of the tibia. All wounds were grossly contaminated along with diffuse swelling and tenderness over the right hand and ankle.

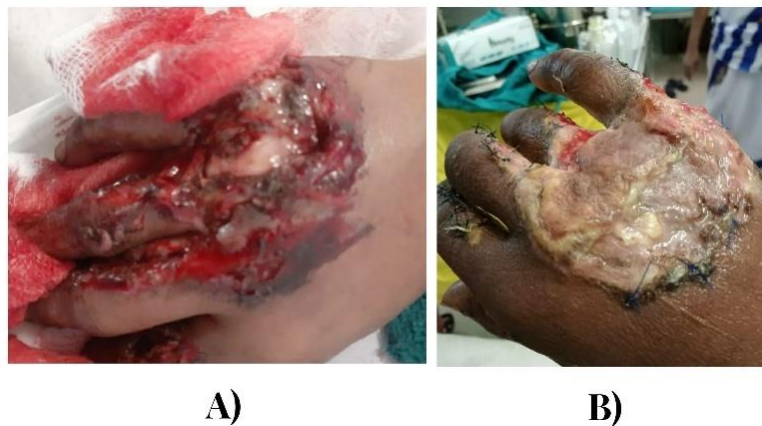


Figure 1 Dorsum of the hand on the day of the accident A), and after grafting B)



Figure 2 A) Site of SSG i.e., over the dorsum of the hand, B) Donor site of the graft, and C) Wound over the dorsal tibia as seen on the day of physiotherapy.

On investigations, her blood parameters came out to be within normal ranges and the chest X-ray was clear. She was then immediately taken for surgery for the degloving injury over the dorsal right hand. In the first surgery, she underwent local debridement with primary suturing under the right wrist block, on the very next day second surgery was performed where split

skin grafting (SSG) was done for which graft was taken from the right thigh and placed over the right hand's dorsal aspect (figure 1B). After a week she was allowed to perform out of bed mobility using a Taylor brace. During her stay at the hospital, she was also diagnosed with urticaria for which dermatological management was undertaken. Daily dressing with Vaseline-soaked gauze was done and after 3 weeks she was discharged. On discharge, she was advised for a high protein diet and meticulous physiotherapy. She visited the physiotherapy department after 2 weeks of her discharge where she was assessed and managed accordingly.

The patient presented to physiotherapy with pain and scar tissue formation over the right hand's dorsum, burning sensation in the 3rd, 4th and 5th fingers, pain over the distal anterior one-third of the tibia & pain and itching in the thigh i.e., donor site of SSG, where keloids were formed (figure 2). She graded her pain at each of the sites as 9/10 on a numerical pain rating scale (NPRS). Along with pain she also had swelling with restrictions in active ranges and severe tightness in the ankle, wrist, and small joints of the hand and lastly difficulty with ambulation.

Physiotherapeutic interventions

The patient was managed in the physiotherapy department using various approaches keeping in mind the area of involvement which was the right hand and right lower limb i.e., the dominant side (Figure 3). Refer Table 1 for the same. She was counselled regarding the approaches and duration before initiating the treatment. For management of keloid, she had been advised silicone gel sheet by the plastic surgeon and laser therapy if the condition worsens.

Table 1 Physiotherapy intervention

Sr. no.	Physiotherapy intervention	Rationale	Dosage	Duration
1.	Cryotherapy	To relieve the pain at the operation site & over the keloids.	TD for 15 minutes	Till pain resolves
2.	Scar mobilization	To break or prevent the adhesion formation	TD for 5 minutes	3-4 weeks
3.	Therapeutic ultrasound	To increase healing and provide warmth to the deep tissues to increase blood circulation	OD, for 8 minutes at 1MHz.	1-2 weeks
3.	Myofascial release of hand, leg, and foot of the right side	To soften the adhesions and decrease the tightness of the fascias over the respective areas	TD for 5 minutes	3-4 weeks
4.	AAROM of fingers, hand, ankle & toes right side.	To bring back the range of these joints	TD with 15 repetitions each	3-4 weeks
5.	AROM of the elbow, shoulder, knee, hip bilaterally	To prevent these joints from losing their range due to reduced mobility	BD with 15 repetitions each	3-4 weeks
6.	Prehension and prehensile activities for the right hand with assistance from left.	To bring back the intricate movements of the affected hand due to pain, swelling, and restricted ROM of small joints.	TD for 15 minutes	Till these activities are faultless
7.	Isometrics for quadriceps, hamstrings, gluteal, and gastrocnemius.	To retain or increase the strength of these bulky muscles which will later be required for ambulation and standing	TD with 15 repetitions each	1-2 weeks
8.	Dynamic quadriceps, hamstrings, gluteal, gastrocnemius using	To further strengthen these muscles after pain has been resolved to allow further	OD with 15 repetitions each	From week 3 to week 6

	0.5 kgs weight cuff	activities in these joints		
9.	Toe touch weight-bearing	To acclimatize the affected lower limb gradually for complete weight-bearing later on	TD, standing and walking for 5 minutes each.	From week 1 to week 2
10.	Partial weight-bearing	To further acclimatize the affected lower limb gradually for complete weight-bearing later on	TD, standing and walking for 5 minutes each.	From week 3 to week 4
11.	Full weight-bearing	To make the lower limb powerful enough to stand and walk for a prolonged period of time.	TD, standing and walking for 5 minutes each.	From week 5 to week 7
ROM: Range Of Motion; AAROM: Active Assisted Range Of Motion; AROM: Active Range Of Motion; OD: Once daily; BD: Twice daily; TD: Thrice daily.				



A)



B)



C)

Figure 3 Patient is seen receiving treatment in the physiotherapy department. A) Therapeutic ultrasound is given over the scar tissue of the hand, B) ROM exercises are being taught, C) Gait training is being given.

The outcome of interventions

The outcome of the intervention has been obtained by evaluation of the outcome measures before and after 7 weeks of treatment (Table 2).

Table 2 Outcome measure analysis

Sr. no.	Outcome measure	Day of visit	Day of follow-up
1.	NPRS for hand	9/10	3/10
2.	NPRS for lower limb	9/10	4/10
3.	Assistive devices used for gait	The patient could ambulate only with a walker	The patient could ambulate without any assistance
4.	ROM (Right side)		
	Wrist joint flexion	40°	60°
	2 nd MCP joint flexion	10°	90°

3 rd MCP joint flexion	10°	90°
4 th MCP joint flexion	10°	90°
5 th MCP joint flexion	10°	90°
2 nd PIP joint flexion	20°	100°
3 rd PIP joint flexion	20°	80°
4 th PIP joint flexion	20°	80°
5 th PIP joint flexion	20°	80°
2 nd DIP joint flexion	20°	80°
3 rd DIP joint flexion	20°	80°
4 th DIP joint flexion	20°	80°
5 th DIP joint flexion	20°	80°
Forearm pronation	50°	70°
Forearm supination	60°	85°
Ankle joint plantarflexion	10°	40°
Ankle joint dorsiflexion	0°	20°
Subtalar joint eversion	0°	10°
Subtalar joint inversion	10°	30°
Knee joint flexion	100°	150°
NPRS: Numerical Pain Rating Scale; ROM: Range Of Motion, MCP: Metacarpophalangeal; PIP: Proximal Inter-phalangeal; DIP: Distal Inter-phalangeal.		

3. DISCUSSION

Since the 1980s, silicone-based treatments for keloids and hypertrophic scars have been used, with silicone gel sheets or silicone gel being the first-line therapy for minor keloids and hypertrophic scars (Puri and Talwar, 2009). Cryotherapy has been suggested to be a low-risk, effective approach to keloid treatment with a low recurrence rate (Barara et al., 2012). Ultrasound has been used for the scar because of its beneficial properties such as enhanced flexibility of collagenous structures like scar tissue and tendons, reduction in stiffness within the joint, pain, and increasing the uptake of the graft (ter Haar, 1999). The other conventional methods of physiotherapy for increasing the functionality of the joints have long been proven effective and especially early during the scar formation is highly effective to prevent the disabilities or deformities which can result due to adhesion and contractures. Exercise-physiotherapy has also been found to be superior to pressure garments in the treatment of scars after burns (Karimi et al., 2013).

4. CONCLUSION

Physiotherapy is highly effective if given within specific duration of graft healing. Since the area of injury is such intricate i.e., the dominant hand, it requires utmost attention of the therapists as well as patients to avoid any malalignment or disability.

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Authors' contributions

ML suggested the idea of the publication of case report, TML constructed and formulated the manuscript, PP, ML, SSL, and SSHS improved and approved the manuscript for further processing.

Informed consent

Written & oral informed consent was obtained from the patient.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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