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Degloved foot sole successfully reconstructed with split thickness skin grafts

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ABSTRACT

INTRODUCTION: The current opinion is that split thickness skin grafts are not suitable to reconstruct a degloved foot sole. The tissue is too fragile to carry full bodyweight; and therefore, stress lesions frequently occur. The treatment of choice is the reuse of the avulsed skin whenever possible, or else the use of a full thickness fascio-cutaneus flap.

PRESENTATION OF THE CASE: A young male sustained a crush injury to his right foot with deglovement of the plantar surface and part of the dorsum.

DISCUSSION: Split thickness skin grafts are not suitable for full weight bearing, but in special circumstances, certain patients, a lot of time and patience, early mobilization and gradual increasing partial weight bearing it is worthwhile to try. To toughen the foot sole pressure distribution is necessary and can be reached in several ways, soft and springy materials of the inlay, but also socks, orthopedic shoes, casting, orthotics or walking aids.

CONCLUSION: This case-report illustrates that the reconstruction of a degloved foot sole with split-thickness skin grafts can be successful; a silicon inner sole was used to prevent stress lesions.

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1. Introduction

The skin on the plantar side of the foot is stressed heavily: a person's full weight and shear forces. The tissue is adapted to this task by having a very thick dermal layer, septofibrous subcutaneous fat and a firm adherence to the underlying bones [1–3]. Similar features are not seen in any other part of skin of the human body [2]. The reconstruction of the foot sole after a deglovement injury is challenging, because stress lesions frequently develop [2,4–6]. The current opinion is that the sole skin pad should be preserved and reused whenever possible [3,5,7]. Successful revascularization of the avulsed sole pad was described by Jeng et al. and Graf et al [3,5]. Another possibility is to graft the dermis and epidermis of the avulsed skin pad on the deepithelialized surface of the ipsilateral calf or thigh, so that it can be transferred to its original location at a second stage [7]. When the avulsed sole pad cannot be reused, a reconstruction with a fascio-cutaneus pedicled or free flap is currently advised [4,7,8]. However, it appears that a much less invasive

treatment can also do the job. In this report, a case is presented in which a degloved foot sole is successfully reconstructed with split thickness skin grafts.

2. Presentation of case

A 26-year-old male fell off a party trailer that subsequently ran over his foot. He sustained a crush injury to his right foot with deglovement of the plantar surface and part of the dorsum and Gustilo type II complicated fractures of the os naviculare and the ossa cuneiformia. Fig. 1. The severity of the injuries to his foot justified an amputation. The lack of skin made an amputation of the foot impossible and therefore, a below knee amputation was considered. The final decision was against this invalidating amputation. The fractures were stabilized with external fixation and Kirschner wires and one day after the accident the degloved foot sole was resurfaced with split thickness skin grafts. The initial postoperative course was uneventful and the grafts took rather well. Nevertheless, it took 8 months for the wound to close completely. Six months postoperatively the patient was allowed to carry some weight on his foot. To protect the fragile skin a silicon innersole was used initially. We added a rocker bar beneath an orthopaedic shoe with an adaptive inlay using several layers of material with different

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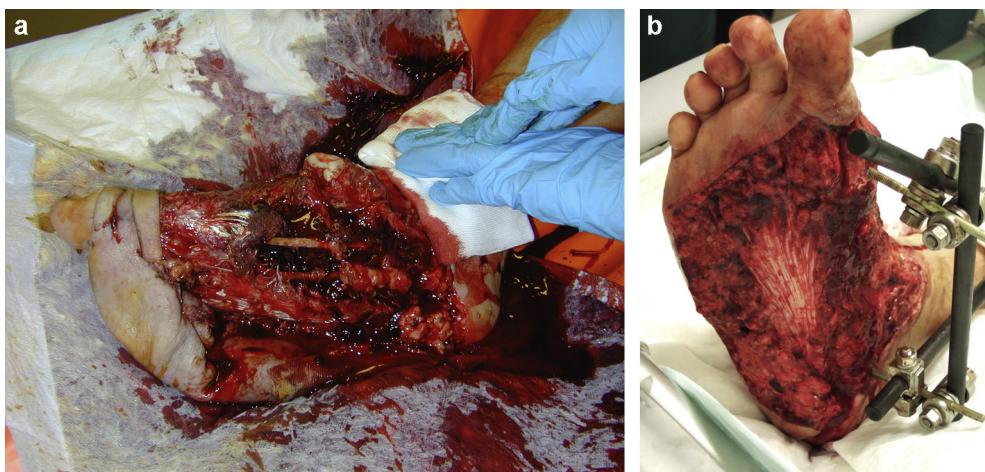


Fig. 1. (a) Deglovement of the footsole as presented at the emergency room. (b) Situation after debridement surgery at the operation room.

density, thickness and changed both over the months. The main goal was pressure distribution using soft and springy materials at the interface between foot and ground. Eight months post injury full weight bearing was possible. Three years after the accident the patient was invited to the outpatient clinic. At that moment he walked without restrictions. However, some parts of his reconstructed foot sole were hyperalgesic and therefore, he had to wear wide shoes with soft inner soles. See Fig. 2 and Fig. 3.

3. Discussion

Frequent stress lesions hamper the possibility to use split thickness skin grafts to reconstruct the foot sole [1,4]. Reducing this stress by using a silicon innersole in the first weeks of mobilization seems promising. The pressure dividing properties of the silicon innersole avoids that the pressure will rise too high on certain parts of the fragile newly reconstructed foot sole. In earlier literature one case-series is described in which split thickness skin grafts were used as definitive cover of degloved foot soles [1]. Unfortunately no information is given on their ability to bear full weight on their reconstructed foot sole and to walk without restrictions.



Fig. 3. Left at the upper site the initial custom made orthopaedic shoe, right at the upper site a standard hiking shoe. Lower site several individual molded inlays in which different materials are used as toplayer.



Fig. 2. (a) Dorsal site of the right foot several years after the injury. (b) Plantar site of the right foot several years after injury, especially heel part as well as the lateral site has increased since injury (compared to Fig. 1).

Early mobilization and gradual increasing partial weight bearing is our philosophy in toughen the foot sole. The goal of pressure distribution can be reached in several ways, soft and springy materials of the inlay, but also socks, orthopaedic shoes, casting, orthotics or walking aids. Furthermore instructions about how active patients can be by using a pedometer.

There are some disadvantages that have to be taken into account on the use of split thickness skin grafts in reconstructing a degloved foot sole. First of all it might be necessary to perform a second surgical procedure when the grafts do not take well or yet prove to be unsuitable as permanent cover. Another disadvantage is that it takes much more time to be able to carry full weight on the split thickness skin grafts compared to full thickness flaps [3,8]. In our case it took 8 months before the patient was able to carry full weight on its newly reconstructed foot sole, whereas in full thickness flaps it takes about 8–12 weeks [3,8]. On the other hand, the use of split thickness skin grafts also has multiple advantages. First of all there is no need to intervene with the vascular anatomy of the leg [7]. Secondly split-thickness skin grafts give an early wound closure with the least tissue cost so that other options of reconstruction are still possible later on [1]. Furthermore, the split thickness skin grafts attach firmer to the underlying surface which gives the patient a more secure feeling of stability [1]. Finally the regenerating nerve endings penetrate the split thickness skin graft more effectively so that the normal level of sensation is more closely approached [1]. A disadvantage however is that the nerve endings are marginally covered, which caused the hyperalgesia in our patient.

In conclusion, this case-report illustrates that in certain circumstances split thickness skin grafts could be a good alternative to a full thickness fascio-cutaneus flap in reconstructing a degloved foot sole. However, good aftercare should be provided and preferably a silicon innersole is given.

4. Conclusion

This case-report illustrates that the reconstruction of a degloved foot sole with split-thickness skin grafts can be possible, it's not an ideal situation, because it takes lots of time to heal and to recover for full weight bearing, but the alternative is a transtibial amputation. Which is worse? It's possible, but depends on the patient patience and yours.

Conflict of interest

None of the authors have any conflict of interest.

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Consent

Patient signed an informed consent.

Author contributions

L. Janssens: wrote the first draft of this manuscript, writing, pictures.

H.R. Holtslag: treated the patient for a long time, shoe prescription, writing, study design, pictures.

P.P.A. Schellekens: performed the surgery, writing.

L.P.H. Leenen: treated the patient from day one, writing, end responsibility.

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