ORIGINAL RESEARCH PAPER

Volume-7 | Issue-4 | April-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

RETROSPECTIVE STUDY OF OUTCOME ANALYSIS OF FULL THICKNESS SKIN GRAFT IN FINGER TIP INJURIES

Orthopaedics

Dr. N. Prasanna Venkateshan M.S. Ortho Assistant professor, Department of Orthopaedics, Government Dharmapuri Medical College, Dharmapuri, Tamilnadu , India -636701.

Dr. A. Anandkumar* M.S. Ortho, Assistant professor, Department of Orthopaedics, Government Dharmapuri Medical College, Dharmapuri, Tamilnadu, India -636701. *Corresponding Author

ABSTRACT

Background: Full-thickness skin grafts (FTSGs) are generally considered unreliable for coverage of finger defects with bone or tendon exposure.
Methods: In this retrospective study 14 patients with finger tip injury in 16 Hands treated with Full-thickness skin grafts (FTSGs). The assessment of graft intake sensation done by clinical method – Two point discrimination.
Results: In our study 16 hands were assessed. Patient age ranged from 22 yrs to 56 years. Male female ratio was 2.8:1. FTSG survived with satisfactory functional and aesthetic results (88%). Partial graft loss (7%), depression deformity (7%), mild hyperpigmentation(21%).
Conclusions: We observed excellent graft survival with this method with no additional surgical injury to normal finger, satisfactory functional and aesthetic outcomes, and no need for secondary debulking procedures. Therefore, FTSGs may be an option for treatment of full-thickness finger **defects with bone or tendon exposure defects is <5 mm.**

KEYWORDS

Skin, Skin transplantation, Bone, Tendon, Fingers

Introduction

Full-thickness skin defects of the fingers with exposed bones or tendons can occur through various mechanisms, such as crushing injuries, cut injuries, road traffic accident, deep abrasion. Since the bone- or tendon-exposed area has poor vascularity, vascularized flaps, including local, regional, distant, and free flaps, have been used to cover full-thickness finger defects[1,2,3,4,5,6,7,8]

Skin grafting is the gold standard for covering skin defects. A full-thickness skin graft (FTSG) results in excellent function after engraftment and should be considered in the reconstruction of functionally and aesthetically important areas like the hands and fingers. However, FTSGs are generally considered unreliable when used over poorly vascularized beds. Therefore, there are few clinical reports of its use in this context, although animal studies have shown that an FTSG can survive over avascular or poorly vascularized defects up to 12 mm in diameter[9,10,11]

In our experience, the width of the exposed bones or tendons in full-thickness finger defects is <5 mm. If the healthy peripheral wound bed is wider than the avascular bone or tendon area, an FTSG will take without serious blood supply issues, since the center of the graft can survive over a bone or tendon area through the bridging phenomenon. Furthermore, the addition of a new well-vascularized bed on the wound margin will increase the possibility of complete graft survival, because a graft centered over an avascular area can survive through the bridging phenomenon[12,13]

AIMS AND OBJECTIVES

The purpose of this report is to present the clinical application of FTSG for covering finger defects with bone or tendon exposure and to describe methods of wound bed and graft preparation that improve graft survival.

Methods:

The surgical objectives of FTSG for coverage of finger defects with bone or tendon exposure were as follows: Preoperatively, all the wound were wash with adequate saline. Dead devitalized tissues were excised. Through wound wash given. Margin, base of the wound were prepared.

An FTSG was harvested from either volar or dorsum of forearm, inner side of arm. The FTSG was first excised along with subdermal fat tissue. During trimming of the fascia-fat tissue on its undersurface, the subdermal plexus and scanty fat tissues on the central area of the graft, which were used to cover the bone or tendon, were preserved as much as possible. The deep dermis of the graft along its peripheral margin was excised tangentially with iris scissors. This procedure converted the peripheral graft to a thick split-thickness skin graft, which covered the new vascularized graft bed formed by marginal de-epithelialization We expected that the immediate and complete take of the peripheral graft would allow the central graft covering the bone or tendon to take completely through the bridging phenomenon due to the double blood supply, consisting of the subdermal and intradermal vascular plexi.
The donor site was closed primarily. The skin graft was fixed with a simple interrupted suture with 2-0 ethylon sutures followed by a simple compressive dressing, which was removed on postoperative day 4. The wound was then covered with simple compressive dressings and was checked every two or three days for two weeks. A compression hand garment was applied with a topical moisturizer for three to four months.

Results:

We reconstructed the bone- or tendon-exposed full-thickness defects of 16 fingers of 14 patients (nine males and five females) using FTSG (Table 1). The ages of the patients ranged between 22 and 56 years. The causes of the defects were road traffic accident- 28% (four cases), accidental cut injury- house hold -28%(four cases), machinery –work place injuries-21% (three cases), human bite -14%(two case), and crush injury -14%(two case). The defects were on the dorsal side in 9 fingers (56%), and on the volar side in 7 fingers (44%). The donor site was volar side of forearm in 5 cases (36%), dorsum of 6 cases(43%), arm in 3 patients (21%).

Table 1: Summary of patients with bone- or tendon-exposed finger defects

Case No	Sex	Side	Mode of Injury	Donar Site
1	Male	Right	RTA	Volar Forearm
2	Female	Left	RTA	Volar Forearm
3	Female	Left	Machinery injury	Dorsal Forearm
4	Male	Left	Cut injury	Volar Forearm
5	Male	Left	Human bite	Dorsal Forearm
6	Male	Right	Crush injury	Dorsal Forearm
7	Male	Right	Cut injury	Volar Forearm
8	Female	Right	RTA	Arm
9	Male	Left	Human bite	Volar Forearm
10	Male	Right	Machinery injury	Dorsal Forearm
11	Male	Left	Cut injury	Dorsal Forearm
12	Female	Right	RTA	Arm
13	Female	Left	Machinery injury	Dorsal Forearm
14	Male	Right	Cut injury	Arm

All grafts covering the defect of the finger survived completely except 2 fingers (one in crush injury case, one in human bite) The peripheral skin of the FTSG took immediately in all cases. Grafts over the wide avascular bed were purple in the early phase and progressively became pinkish, as seen in traditional composite grafts, resulting in complete

survival. They all achieved good functional and aesthetic results without surgical complications. Two cases needs for secondary revision during the follow-up period. **Static two-point discrimination was evaluated in seven patients and ranged from 10 to 17 mm.**

Minor complications included partial graft loss, depressions, and hyperpigmentation. Partial graft loss was seen in the central area of the graft in one case (Fig-B). The FTSG was partially lost on the poorly vascularized wound bed, and additional grafting was required At five weeks after the first operation, the defect was covered with an FTSG and healed completely.

Fig A: Post Operative Picture

Fig B: Partial Skin Loss (Complication)

A graft depression deformity occurred due to subcutaneous tissue deficiency despite complete graft survival in one patient who sustained wide soft tissue necrosis of finger. At the three-month follow-up, there was significant improvement in the graft depression, but a mild depression remained. The patient refused an additional operation for soft tissue augmentation.

Some degree of graft hyperpigmentation occurred in three cases, especially in areas with wide exposure, but progressively improved.

Discussion

The finger is a very compact, multi-structural, and complex organ, including multiple bones, joints, tendons, ligaments, and fat tissue. Thus, it can be difficult to select appropriate soft-tissue coverage for full-thickness skin defects of the fingers with bone or tendon exposure.

Generally, various types of flaps, including local, regional, and free flaps, have been used to cover small or moderate size full-thickness defects of the fingers.[1,2,3,4,5] Flaps have several advantages, including sufficient soft tissue volume and a good blood supply, but also have some disadvantages, including bulkiness and donor morbidity.

In local and regional flaps, including the adipofascial turn-over flap,[2] reverse homodigital island flap[3], cross finger flap[4], and reversed dorsal metacarpal flap[5], additional surgical injury of the normal structures of the fingers or the hand near the defect is inevitable, especially when the defects are of moderate size, as in our series, resulting in various types of donor morbidity of the hand.

A free flap, such as an arterialized venous flap[6] or a thin skin flap,[7,8] is an excellent treatment choice for covering multiple or wide dorsal defects of the finger without additional surgical injury of the surrounding normal hand. However, these techniques have some disadvantages, such as a long operation time, flap bulkiness, and the need for secondary revision. The venous free flap is a good option for a small or moderate dorsal defect with minimal donor morbidity, but requires a lengthy microvascular technique along with close observation and does not result in improved sensory recovery compared to that achieved with an FTSG. A toe free flap is indicated only for small volar defects. The thin free flap can be thinned down to 3- to 4-mm thickness, but it still looks bulky if it is on the dorsal finger.[8] The bulkiness of these flaps can hamper range of motion and function of the fingers as well as worsen the external appearance, which may be a serious problem for some patients, especially for women.[14]

The FTSG shows excellent function after engraftment and therefore should be considered in the reconstruction of functionally important areas like the hands and fingers. It has several advantages: it is a simple procedure, easily applied to various defect types and sizes, it does not involve additional structural damage of the normal finger surrounding the defect, it is a one-stage operation, it creates adequate thickness for the dorsal skin without bulkiness, it results in minimal donor morbidity. Although FTSGs have many advantages, they are generally considered unreliable over poorly vascularized beds because of concerns about incomplete take or graft loss.

Clinical and animal studies have shown that small bridges of skin grafts survive over small avascular defects.[9,10,11,12,13] FTSGs contain an intact vascular system with horizontally arranged networks of intradermal and subdermal plexi.[15] The circulation can be restored to the FTSG using a smaller number of vascular anastomoses to the recipient site.[15,16] Gingrass et al[10] demonstrated revascularization of FTSGs on the bare cartilage of rabbit ears, and concluded that FTSGs can survive over an avascular or poorly vascularized defect up to 12 mm wide, including 90% graft survival over a silicone sheet 8 mm in diameter. In our experience, the width of the exposed bones or tendons of the full-thickness defects of the fingers is 5 mm. If a good vascular bed along the periphery of the defect is prepared, the peripheral FTSG will take completely and result in subsequent complete survival of the central FTSG over the avascular area of the bone or tendon through the bridging phenomenon. For this reason, we utilized FTSGs to cover bone- or tendon-exposed full-thickness defects of fingers in this series.

In this series, FTSGs were harvested from the either volar (Fig A) or dorsum of forearm, inner side of arm. The forearm skin has compact dermoadipofascial tissue with rich intradermal and subdermal vascular networks. Its skin rigidity ensures that postoperative shrinkage of the graft is minimal.[12,13]

FTSGs demonstrated excellent function after engraftment and should be considered in the reconstruction of functionally and aesthetically important areas like the hands and fingers. We applied FTSGs to cover full-thickness skin defects of the finger with bone or tendon exposure. The surgical principles that increased the graft survival rate were healthy granulation tissue formation on the wound bed, marginal de-epithelization of the normal skin, preservation of the central subdermal plexus of the graft, and tangential excision of the deep dermis along the graft margin.

Compare with **Wright JK, Brawer MK** et al, **Burm JS, Hansen JE** et al 88% of grafts had complete survival, with the exception of two case with graft loss. Despite other minor complications, including partial graft loss in one patient,(8%),depressions (8%), and hyperpigmentation (22%), this method showed excellent graft survival, no surgical injury of the normal finger, and satisfactory functional and aesthetic outcomes without the need for debulking procedures. Therefore, FTSG may be a valuable option for covering full-thickness finger defects with bone or tendon exposure.

Conclusions

We observed excellent (88%) graft survival with this method with no additional surgical injury of the normal finger, satisfactory functional and aesthetic outcomes, and no need for secondary debulking procedures. Therefore, FTSGs may be an option for treatment of full-thickness finger **defects with bone or tendon exposure defects is <5 mm**

References:

1. Khouri RK, Badia A. Reconstructive surgery of individual digits (excluding thumb) In: Mathes SJ, Hentz VR, editors. Plastic surgery. Vol. VII. Philadelphia: Saunders; 2006. pp. 207–252.
2. Lai CS, Lin SD, Yang CC, et al. The adipofascial turn-over flap for complicated dorsal skin defects of the hand and finger. Br J Plast Surg. 1991;44:165–169. [PubMed]
3. Bene MD, Petrolati M, Raimondi P, et al. Reverse dorsal digital island flap. Plast Reconstr Surg. 1994;93:552–557. [PubMed]
4. Lee NH, Pae WS, Roh SG, et al. Innervated cross-finger pulp flap for reconstruction of the fingertip. Arch Plast Surg. 2012;39:637–642. [PMC free article] [PubMed]
5. Dautel G, Merle M. Dorsal metacarpal reverse flaps: anatomical basis and clinical application. J Hand Surg Br. 1991;16:400–405. [PubMed]
6. Woo SH, Kim KC, Lee GJ, et al. A retrospective analysis of 154 arterialized venous flaps for hand reconstruction: an 11-year experience. Plast Reconstr Surg. 2007;119:1823–1838. [PubMed]
7. Cho YJ, Roh SY, Kim JS, et al. Second toe plantar free flap for volar tissue defects of the fingers. Arch Plast Surg. 2013;40:226–231. [PMC free article] [PubMed]
8. Kim SW, Jung SN, Sohn WI, et al. Ulnar artery perforator free flap for finger resurfacing. Ann Plast Surg. 2013;71:72–75. [PubMed]
9. Rees TD, Ballantyne DL, Jr, Hawthorne GA, et al. Effects of silastic sheet implants under simultaneous skin autografts in rats. Plast Reconstr Surg. 1968;42:339–342.
10. Gingrass P, Grabb WC, Gingrass RP. Skin graft survival on avascular defects. Plast Reconstr Surg. 1975;55:65–70. [PubMed]
11. Wright JK, Brawer MK. Survival of full-thickness skin grafts over avascular defects. Plast Reconstr Surg. 1980;66:428–432. [PubMed]
12. Burm JS, Hansen JE. Full-thickness skin grafting with marginal deepithelialization of the defect for reconstruction of helical rim keloids. Ann Plast Surg. 2010;65:193–196. [PubMed]
13. Burm JS. Reconstruction of the nasal tip including the columella and soft triangle using a mastoid composite graft. J Plast Reconstr Aesthet Surg. 2006;59:253–256. [PubMed]

14. Lin TS, Jeng SF, Chiang YC. Resurfacing with full-thickness skin graft after debulking procedure for bulky flap of the hand. J Trauma. 2008;65:123–126. [PubMed]
15. Smahel J, Clodius L. The blood vessel system of free human skin grafts. Plast Reconstr Surg. 1971;47:61–66. [PubMed]
16. Zarem HA, Zweifach BW, McGehee JM. Development of microcirculation in full thickness autogenous skin grafts in mice. Am J Physiol. 1967;212:1081–1085. [PubMed]