Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.JournalofSurgicalResearch.com

Using negative pressure wound therapy on microskin autograft wounds

Fang Zhang, MD,[a,b,1] *Kai-Yang Lv, MD,*[a,1] *Xiao-Chen Qiu, MS,*[c] *Peng-Fei Luo, MD,*[a] *Xing-Feng Zheng, MD,*[a] *Shi-Hui Zhu, MD,*[a,**] *and Zhao-Fan Xia, MD, PhD*[a,*]

[a] *Department of Burn Surgery, The Second Military Medical University affiliated Changhai Hospital, Shanghai, China*
[b] *No.73901 Troop of PLA, Shanghai, China*
[c] *Department of Burns & Plastic Surgery, 309th Hospital of PLA, Beijing, China*

ARTICLE INFO

Article history:
Received 14 July 2014
Received in revised form
16 November 2014
Accepted 11 December 2014
Available online 18 December 2014

Keywords:
NPWT
Skin defect
Microskin graft
Skin grafting
Wound repair

ABSTRACT

Background: Microskin autografts with conventional wrap and compression are used extensively in the treatment of skin and tissue defects. This comparative study aimed at investigation of the clinical application of negative pressure wound therapy (NPWT) in combination with microskin autografts for repair of acute and chronic wounds.

Methods: A prospective case-control study was performed from December 1, 2010–December 31, 2013 in Changhai Hospital, Shanghai. We compared a study group of patients received microskin autografting covered by NPWT with that of a control group of patients received microskin autografting covered by a conventional gauze.

Results: A total of 81 patients were in this study, 27 patients were allocated to the study group and 54 patients to the control group. The study group exhibited significant low infection rate and pain score during removal of inner layer at first dressing change after skin grafting compared with those of the control group ($P < 0.05$). The time interval between skin grafting and first postoperative change was longer in the study group than that in the control group ($P < 0.01$), the study group showed a significant shorter 95% wound healing time ($P < 0.05$), and survival rate of microskin autografts in the study group was higher than that in the control group ($P < 0.05$).

Conclusions: NPWT is beneficial for wound closure after microskin autografts, which prolongs the interval between skin transplantation and first postoperative dressing change, reduces pain during removal of inner layer dressing, increases skin graft survival rate, and shortens wound healing time. Therefore, NPWT can be recommended for repair of acute and chronic wounds with microskin autografts.

* *Corresponding author*. Department of Burn Surgery, The Second Military Medical University affiliated Changhai Hospital, Shanghai 200433, China. Tel.: +86 21 31161821; fax: +86 21 65589829.
** *Corresponding author*. Burn center, Changhai Hospital, Second Military Medical University, Shanghai 200433, China. Tel.: +86-21-31161822; fax:+86-21-65589829.
E-mail addresses: doctorzhushihui@163.com (S.-H. Zhu), xiazhaofan@163.com (Z.-F. Xia).
[1] The mentioned authors contributed equally to this work.
0022-4804/$ – see front matter © 2015 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.jss.2014.12.025

1. Introduction

In clinical practice, skin defects caused by burns, trauma, and chronic ulcers exhibit common problems. Extensive skin defect is a great challenge and major problem in plastic and reconstructive surgery [1,2]. Autologous skin grafting has been the standard for coverage of open wounds, and there are several options for skin defects existing [3]. With regard to saving donor sites and improving survival rate of the grafted skin, microskin autografts are used extensively in the treatment of skin and soft tissue defects with a satisfied therapeutic effect [4]. But wound closed by microskin autografts with a conventional gauge is not easy in observing wound exudation and drainage with a higher infection rate, has unsatisfactory fixation of transplanted microskin, which needs frequent dressing changes. This therapeutic measure not only increases patients' pain but also affects clinical observation of the grafting area.

Negative pressure wound therapy (NPWT) is a therapeutic technique, which facilitates the healing of acute and chronic wounds [5,6]. Nowadays, using NPWT on open wounds has become a hotspot [7,8]. Wild *et al.* [9] have reported that NPWT can promote granulation tissue growth with a 54% increase in growth rate and a higher survival rate of free skin graft. Although research on NPWT in open wounds has been carried out for years, it is mostly limited in open wounds before skin grafting [10,11]. Moreover, the comparative studies on using NPWT and conventional dressing of an open wound with microskin autografts are scarcely reported. Vacuum sealing drainage (VSD; Wuhan Weisidi Inc, Hubei, China) dressing, which is one kind of an NPWT dressing, has become a widely accepted material for treatment of open wounds [12,13]. VSD includes a porous-foam seaweed salt soft pad, which wraps drainage tubes with side holes, the soft pad contacts, and fills the wound defects, which serves as a bridge between wound and drainage tubes. One end of the 30-cm-long silicone drainage tube with side holes was connected to an electric suction bottle with a pressure gauge using three joints. All of the previously mentioned materials were packaged in an aseptic manner [14]. The key technology of VSD is using biological semipermeable membranes for wound thorough coverage in connecting drainage tubes to vacuum source, which creates a fully closed negative pressure drainage condition promoting the expulsion of effusion and liquefied necrotic tissue in the cavities promptly [15]. This study aimed investigation of the clinical application of NPWT in covering transplanted microskin autografts in open wounds (burns, trauma, and chronic ulcers).

2. Patients and methods

2.1. Design

This prospective trial was carried out from December 1, 2010–December 31, 2013. Patients were selected during their admission for skin grafting to Burn Centre of Changhai Hospital affiliated to the Second Military Medical University. The inclusion criteria were patients aged from 20–65 y, irrespective of sex. The range of skin grafting wound was 50 cm^2–1600 cm^2. We excluded patients affected with chronic diseases (diabetes, severe hepatic damage, renal failure, and tumor) and those with wound infection before the grafting operation [16,17].

Two surgeons determined whether the patient met the inclusion criteria. For each study case, two cases with similar age and diagnosis served as controls. Patients in both groups received microskin autografts. The study group was treated with VSD, whereas in the control group conventional gauze dressings were used. All patients have been told that their hospitalization data would be used for scientific research, and they all signed informed consent.

2.2. Treatment protocol

For the study group, general anesthesia or local anesthesia was applied. Split-thickness skin-graft about the wound size obtained using electric dermatome (Zimmer, Warsaw, Indiana, America) was cut into microskin. The wound surface was washed and cleaned repeatedly, and the granulation tissue was debrided by excision down to the fibrous lamina with obvious bleeding (Figs. 1 and 2). Well-prepared wound surface was transplanted by the autologous microskin (Fig. 3), which was covered by a single-layer of mesh gauge as the inner layer dressing (Fig. 4). VSD dressing was trimmed to the shape of the skin grafted area. When two or more of the VSD dressing were needed, silk-interrupted sutures or skin staplers were used for their approximation and complete coverage. The skin grafting area was sealed by a biological semipermeable membrane (Fig. 5). The drainage tube of VSD was connected to a microcomputer electric drainage device for obtaining constant negative pressure, and the negative pressure was set at 125 mm Hg according to clinical practice and experiment *in vitro*, which demonstrated that negative pressure at 125 mm Hg stimulated wound healing significantly [18,19]. As

Fig. 1 – The incision wounds of the compartment syndrome were on the right leg, some muscle of the wound became black and necrotic, there was purulent exudation on the wound. (Color version of figure is available online.)