Case Report

Regulated negative pressure wound therapy combined TopClosure® in treatment of skin defect for open fracture in lower extremity: a case report

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Abstract: Open fracture in lower extremity is the common trauma. However, some of the wound may easily developed into the skin defect. Regulated negative pressure-assisted wound therapy (RNPT) has been widely used to treat infected wounds and chronic wounds that may decrease bacterial load and promotion of wound healing. TopClosure® was used to as an innovative skin extension and wound closure-secure system that reducing tension across wound edges. In this case, RNPT combined with TopClosure® were employed to treat the skin defect in lower extremity, which may aid immediate wound closure and downgrade treatment time and the dress changing frequency for a wide range of applications on a global scale.

Keywords: Regulated negative pressure wound therapy, Top Closure, open fracture, skin defect, treatment

Introduction

Open fracture in lower extremity is the common trauma, which can easily form the skin defect during the process of wound healing. The poor blood supply and high tension around the wound tissue makes the treatment of the skin defect difficult. Currently, the traditional effective treatment method is skin flap grafting. However, the flap transplantation treatment has several disadvantages, which as follows: First, relatively more complex surgical procedures and high technical requirements, which limit the use in the treatment of skin defect in the primary hospitals; Second, the cost is high; Third, significant morbidity and extended hospitalization and recovery periods [1-3]. Now new method of wound healing, regulated negative pressure-assisted wound therapy (RNPT) combined Top Closure, was employed to treat the skin defect in lower extremity, which has gotten a good result, and now we reviewed this case.

Case report

A 27 year-old male patient, usually in good health, was admitted to hospital in 16 September, 2013, 4 hours after a traffic accident. His right lower extremity severely damaged and deformed accompanied by severe hurt and restricted function.

Physical examination showed as follows: Vital signs are stable. A 8 cm long irregular wound was exposed with a large area of contusion surrounded. Right lower extremity deformed with abnormal movements. X-ray showed: Right tibiofibula fractures.

Primary diagnosis: right tibiofibula open fractures

Treatment schedule: “Open reduction and locking titanium external skeletal fixation with regular vacuum drainage” was performed on the day the patient was admitted to the hospital. Antibiotic therapy was given to the patient at the same time.

On 29th Sept. The wound unhealed with much exudation. The exudate bacteria culture showed enterococcus faecalis infection. Ulcer formed on the site of open fracture in the size of 8×5
RNPT and Top Closure for skin defect of open fracture in lower extremity

Figure 1. RNPT combined TopClosure before the treatment of right lower extremity chronic ulcer wound. 7 cm×4 cm×1 cm in size, the surface showed relatively fresh with little necrotic tissue and exudation for the vacuum treatment before. However the growth of the wound was slow.

Figure 2. RNPT combined TopClosure when the surgery finished. The long arrow showed the regulated negative disc, which can avoid the secondary damage caused by duct under the vacuum. The short arrow showed the placement for TopClosure.

Figure 3. Day 6 after RNPT combined TopClosure treatment. It showed the ulcer totally closed without exudation. The long arrow showed the device of TopClosure. The short arrow showed the mobilizable belt which could adjust the force between two sides of the wound.

Figure 4. Day 9 after RNPT combined TopClosure treatment. It showed that the wound well recovered with the scab fall down. 2 days later, TopClosure was removed.

cm, depth 1.5 cm. “Chronic wounds” was performed with antibiotic treatment.

On 9th Oct. The wound surface unhealed with much more exudation. “Negative-pressure therapy for chronic wounds” was performed.

On 19th Oct. The wound surface still unhealed, in the size of 7×4 cm, depth 1 cm (Figure 1). Regulated negative pressure-assisted wound therapy (RNPT) and the Top Closure system (for skin stretching and a secure wound closure) was applied to help wound repair (Figure 2). The surgical technique of Top Closure and RNPT was applied in previous report [1, 4]. The wound dressing changed every 3 days. The open wound nearly closed on the 3rd day after surgery; It was totally closed on the 6th day (Figure 3) and the scab fallen down on the 9th day (Figure 4).

Discussion

Chronic wounds, which have failed to proceed through an orderly and timely process to produce anatomic and functional integrity, or proceed through the repair process without establishing a sustained anatomic and functional result [5]. Ulcer-like wounds or chronic wounds are common in diabetic foot and open fracture, especially when the open fracture happen in the lower extremities [6]. It is accepted that hard to heal wounds are largely attributed to the chronic wound fluid [7]. The efficacy of traditional treatments was poor, as the secondary skin ischemic damage can easily occur during the treatments, which can lead to necrosis. In
modern, traditional medicine, human recombinant epidermal cell growth factor and hydrocolloid dressings, combined with the vacuum therapy has been widely employed to manage the chronic wounds. These methods can keep the wound surface in the dry and relatively clean status. However, the closure of the wound is slow. And slower the wound get closed, the higher of the wound infection rate, which goes further is amputation [8-11]. A greater number of wounds in the wound vac-treated closed and a faster rate of granulation tissue formation and fewer amputations [12].

Based on the reorientation of the interwoven network of elastin and mainly collagen fibers provides the skin with the ability to stretch and expand [13, 14]. Hirshowitz designed the Sure-Closure® skin-stretching system in 1993, which helped primary closure of relatively small to medium-size skin defects [15]. However, the nature of its invasive, high margin tension that was leading at time to pressure necrosis limited its use [16, 17]. Recently, Moris Topaz invented the TopClosure® Tension-Relief System harnessing the viscoelastic properties of the skin, which eliminate absolutely most of adverse effects of the traditional tension sutures and internal tissue expanders. This innovative device, which highly improved wound healing, can highly promoted the chronic skin defects. During the process of treatment, the Top Closure system can be adjusted through a mobilizable belt to get right tension for both sides of the wound in an easy way, which can help wound closing. Besides this, the RNPT system was substantially improved by Prof. Topaz to avoid the disadvantages like secondary skin damage, etc, resulted from the local skin ischemia and necrosis, can dramatically accelerate the wound healing [18, 19].

RNPT combined TopClosure® in the treatment of open wounds has been initially applied to clinic, which can shorten treatment time and reduce the dress changing frequency, and achieved good efficacy. However, the treatment still need to be studied further with the methods of translational medicine, to further prove its advances and effectiveness.

Disclosure of conflict of interest

None.

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References

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