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Role of Cyclical Negative Pressure Wound Therapy in Healing of Skin Graft Donor Site

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Abstract

Aim of this case report is to assess the role of cyclical negative pressure wound therapy (CNPWT) in management of skin graft donor site healing. Clinical examination of the donor site before and after the use of cyclical negative pressure wound therapy (CNPWT) was done. Cyclical negative pressure wound therapy (CNPWT) is effective in healing of donor site wound. Cyclical negative pressure wound therapy (CNPWT) may be used in donor site healing.

Keywords: Cyclical negative pressure wound therapy (CNPWT); Skin graft; Donor site; Scar management.

INTRODUCTION

Management of skin graft donor site wound poses a challenge regarding improving the general condition of the patient and adequate dressing of the wound. Usually, the donor site is not opened after grafting till it heals. If it is opened due to some reasons like infection, one of the available methods of donor site wound care is negative pressure wound dressing which utilises a vacuum device to create negative pressure over the wound, which then improves the wound blood supply, improves wound granulation and removes exudates.[1] The aim of this case report is to assess the role of cyclical negative pressure wound therapy (CNPWT) in management of skin graft donor site healing.

MATERIALS AND METHODS

This study was conducted in the department of Plastic Surgery at tertiary care centre after getting the departmental ethical committee approval. Informed written consent was taken from the patient. The details of the patient in study are as follows: The subject is a 22 year-old male patient, with no comorbidities, with a history of injury to right upper limb by a cement machine 2 months back. On examination, the patient's vitals were

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stable. On local examination a grossly contaminated wound extending from right shoulder to right hand was seen with exposed congested muscles, exposed ends of fractured humerus, impaired distal sensation and distal pulses, and cold and paralysed upper limb. He underwent right above elbow guillotine amputation on the same day, and wound care was given in the form of regular sterile dressing. He was admitted for management of the non-healing wound over the right upper arm amputated stump (post traumatic raw area). Split Skin Graft taken from the right thigh (Fig. 1) and it is used to cover the raw area over right upper arm stump.

Fig. 1: Skin Graft donor site before CNPWT

The donor site is treated with collagen scaffold dressing and Cyclic Negative pressure wound therapy applied over the skin graft donor site for 2 weeks. (Fig. 2)

Fig. 2: CNPWT applied over skin graft donor site

RESULTS

Cyclic Negative pressure wound therapy (CNPWT) is useful in healing of donor site wound and fasten the wound healing in our patient. (Figure 3) No complication noted with this procedure. Patient discharged successfully.

Fig. 3: Skin graft donor site healed after CNPWT

DISCUSSION

Since the introduction of the negative pressure wound therapy (NPWT) system by Morykwas and Argenta, it has been applied to a number of wounds and has become an influential and effective technique for healing simple and complex wounds. The conventional NPWT system adopts either 'intermittent' or 'continuous' mode.

While the continuous mode constantly applies a sub-atmospheric pressure of −125 mmHg, the intermittent mode creates a sub-atmospheric pressure of −125 mmHg for 5 minutes and a 2 minutes resting phase of 0 mmHg.

In experiments performed on animal models, the intermittent mode showed increased perfusion level and formation of granulation tissue in the wound area compared with the continuous mode.[1,2] Despite the effectiveness of intermittent mode in wound healing, it has been avoided in clinical application because of the pain occurring every few minutes during the initiation phase of the system to reach −125 mmHg. Thus, 'cyclic' mode would minimize the pain while maintaining the superior efficacy of the intermittent mode.

The cyclic NPWT system is similar to the intermittent mode in terms of using the same maximal sub atmospheric pressure, but the pressure never reaches zero in the cyclic mode. So, it continuously creates certain pressure gradient that oscillates between −125 mmHg and the preset sub atmospheric pressure. The cycle runs based on the changes in sub atmospheric pressure, not time, and thus its frequency reflects the wound volume.[3]

Types of NPWT

1. Continuous NPWT: The continuous mode constantly applies a sub-atmospheric pressure of −125 mmHg.
2. Intermittent NPWT: The intermittent mode creates a sub-atmospheric pressure of −125 mmHg for 5 minutes and a 2-minute resting phase of 0 mmHg.
3. Cyclic NPWT: The cyclic NPWT system is similar to the intermittent mode in terms of using the same maximal sub atmospheric pressure, but the pressure never reaches zero in the cyclic mode. So, it continuously creates certain pressure gradient that oscillates between −125 mmHg and the preset sub atmospheric pressure.

Variables Affected by NPWT

a. Cutaneous capillary network can be investigated with regards to blood flow (BF), velocity (VELO), postcapillary oxygen saturation (StO_2), and relative hemoglobin content (rHb).[4]

b. Blood Flow (BF)

Regardless of the application of different pressure levels, intervals of suction and cutaneous blood flow below the foam dressing was significantly enhanced in all three types.

c. Post-capillary Tissue Oxygen Saturation (StO_2)

Corresponding to enhancements in cutaneous BF, StO_2-values steadily increased when suction was active.

d. Relative Hemoglobin Content (rHb) and Red Blood Cell Velocity (VELO)

Both parameters were significantly altered due to the NPWT stimulus.

e. Pain/Discomfort

As expected, reported levels of discomfort were nominal. No statistic difference was found in comparison of maximum values between groups ($p > 0.05$).

f. Surface Pressure

Applied suction caused significant changes in the surface pressure (sp) of the underlying skin.

g. Remote Effects

Cutaneous microcirculation of the contralateral thigh was also affected by NPWT treatment. It shows virtually a linear increase in BF 90 min in all three types.

Advantage of cyclic NPWT

1. Less painful when compared to intermittent NPWT.
2. Superior effects on local and remote cutaneous perfusion in the cyclic type compared to others.

Disadvantage of cyclic NPWT

1. Requires expansive devices to fluctuate between sub atmospheric pressure.
2. To perform cyclic NPWT in classic suction device is cumbersome.

CONCLUSION

Cyclic negative pressure wound therapy is found to be effective in improving wound healing in skin graft donor site, by enhancing the blood supply and tissue oxygenation.

CONFLICTS OF INTEREST

This study does not require any institutional approval.

DECLARATIONS

Authors' contributions: All authors made contributions to the article.

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