

NEGATIVE PRESSURE WOUND THERAPY

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INTRODUCTION

A controlled negative pressure (sub-atmospheric) system that is delivered topically onto the wound is referred to as NPWT.

Negative pressure wound therapy is a medical procedure that involves the use of a vacuum dressing to aid and promote wound healing in both acute and chronic wounds.

To produce a negative pressure environment in the wound, a sealed wound dressing attached to an NPWT device is used.

The vacuum can be delivered constantly or occasionally, depending on the wound kind and location.

RESEARCH QUESTION

What is the effectiveness of NPWT in wound healing?

OBJECTIVES:

PRIMARY-

To study the mechanism of NPWT.

SECONDARY-

To study effectiveness of NPWT over traditional wound healing.

Method

- The Study design involves a systematic review
- The literature was searched in the Medline, PubMed, and Cochrane databases, and reference lists of pertinent systematic reviews and health technology assessments were inspected.
- At least one patient-relevant outcome was examined in studies that were eligible (e.g., wound closure).
- PICO analysis was done on the various randomized controlled trial studies.

Process of Systematic Review

Developing Research Question

Research Paper Analysis

Including Criteria – Studies which were complete with a proper conclusion (23 Included)

Exclusion Criteria – Studies having no conclusion and not having the information related to subject specific (11 studies excluded)

PICO Analysis of Randomized Control Trials

Discussion of PICO Analysis

Conclusion

PICO ANALYSIS

- 23 Studies were included for PICO Analysis.
- Steps to PICO Search:
 - PICO Question was formulated : Effectiveness of NPWT on wound healing.
 - Key words searched : Effectiveness of NPWT on Diabetic Foot Ulcers, Traumatic Wounds, Infected Wounds, Pressure Ulcers, Chronic Wounds and Cost effectiveness of NPWT over traditional healing.
 - Literature was reviewed on the basis of PICO model: Patient/ Problem, Intervention, Comparison and Outcome

PICO ANALYSIS

STUDY	DESIGN	NO. OF PATIENTS	INCLUSION CRITERIA	OUTCOME	COMMENTS
Traumatic wounds					
Hersovici et al. (2003)	Consecutive non randomised	21 patients	A vacuum-assisted closure device was used to treat 21 high-energy soft tissue wounds at a Level 1 trauma centre, including 6 tibial, 10 ankle, 5 with lesions of the forearm, elbow, femur, pelvis, and a below-knee stump.	Twelve wounds required less invasive operations; nine patients (43%) required free tissue transfer (57 percent)	Sponge changes were conducted at the bedside for 77% of patients, indicating that this could be done there might lessen the requirement for substantial reconstruction
Pressure ulcers					
Mullner et al. (1997)	Prospective study	17 patients	Sacral pressure injuries that are resistant to conventional therapy	With a favourable response rate of 12/17 (80%), 3/2 local flaps and 9/12 skin grafts were used.	VAC made it easier to apply skin grafts early; nevertheless, there is no proof to back up this assertion; not using a control

Chronic wounds					
Joseph et al. (2000)	Prospective randomised controlled trial	24 patients, 36 wounds	Chronic wounds that had been present for more than a month; half were treated with VAC, the other half with saline dressings.	At six weeks, there was a significant difference favouring VAC in the percentage change in wound volume (78 vs 30 percent)	Blinded investigation came to the conclusion that NPWT improves the rate of wound healing.
Infected wounds					
Wongworawat et al. (2003)	Prospective	14 patients	Lower limbs with orthopaedic infected wounds larger than 20 cm	In just 10 days, the average wound shrank by 43%.	NPWT promotes wound healing and has the advantage of limiting staff exposure to infected wounds.
Diabetic wounds					
McCallon et al. (2000)	Randomised controlled study	10 patients	Randomized use of NPWT and moist-gauze dressings to diabetic foot wounds	Reduce the time needed for healing to be sufficient while favouring VAC. Gauze: 42.08 days to 32.05 days; shift in percent surface area in favour of VAC: 22.08 days to 17.4 days.	Despite the lack of blinding, it was determined that NPWT promotes quicker healing and a decrease in wound surface area than saline dressings.

NPWT EFFECT ON WOUND

MACROSTRAIN

- Visible alteration when NPWT applied
- Draws wound edges together
- Direct and complete wound bed contact
- Evenly distributes negative pressure
- Removes wound exudate and infection causing material

NPWT EFFECT ON WOUND

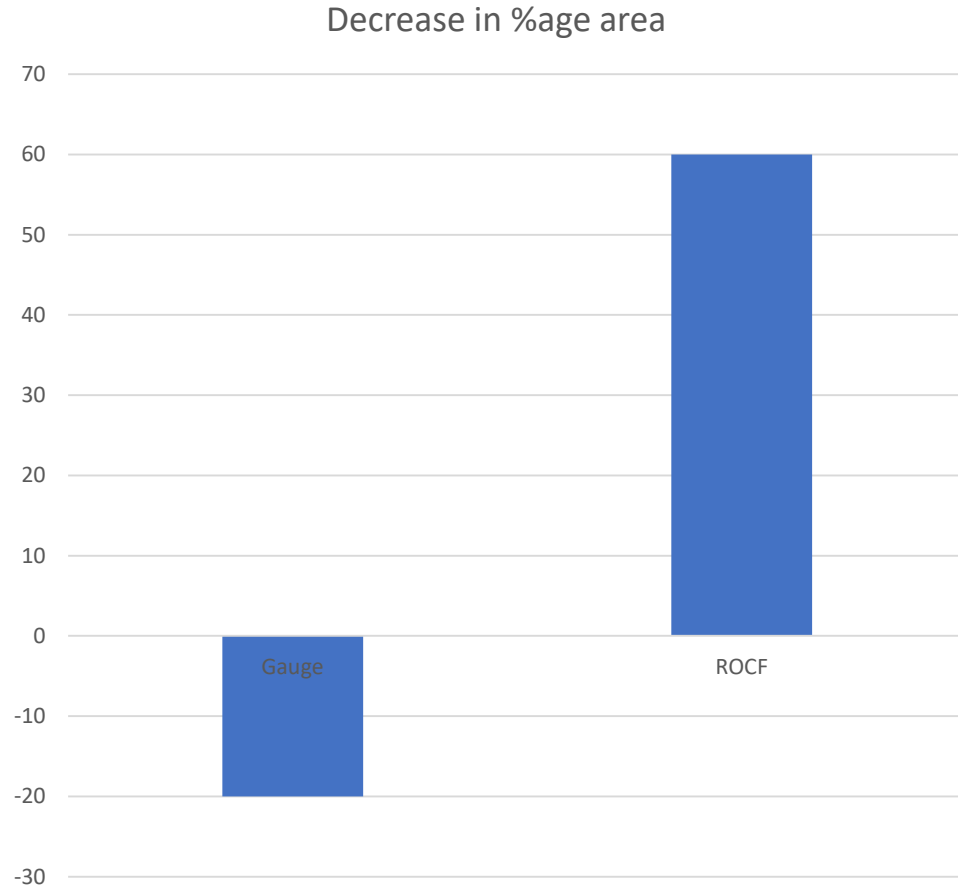
MICROSTRAIN

- Takes place at cellular level
- Cell stretching induced by CCNPWT open pore PU foam
- Encourages moist wound healing
- Promotes granulation tissue formation
- Increases cellular proliferation & migration
- Reduces oedema

NPWT EFFECT ON WOUND

- The effect of NPWT was demonstrated and published in, “ The Consistent Delivery of Negative Pressure to Wounds Using Reticulated, Open Cell Foam and Regulated Pressure Feedback” Amy McNulty, Ian Sprangers, James Courage, Jeff Greens, Robert Wilkes, and Anthony Rycerz (May 2010).
- For the pressure drop analysis, 4 units with 4 surrogate wound set-ups were run using V.A.C Therapy system. Two units were elevated to 36 inches and 18 inches above surrogate wounds to stimulate the height differential (to imitate foot wound).
- Three different gauge pieces were used in the set-up of only Gauze and ROCF simultaneously to render the **below results**.

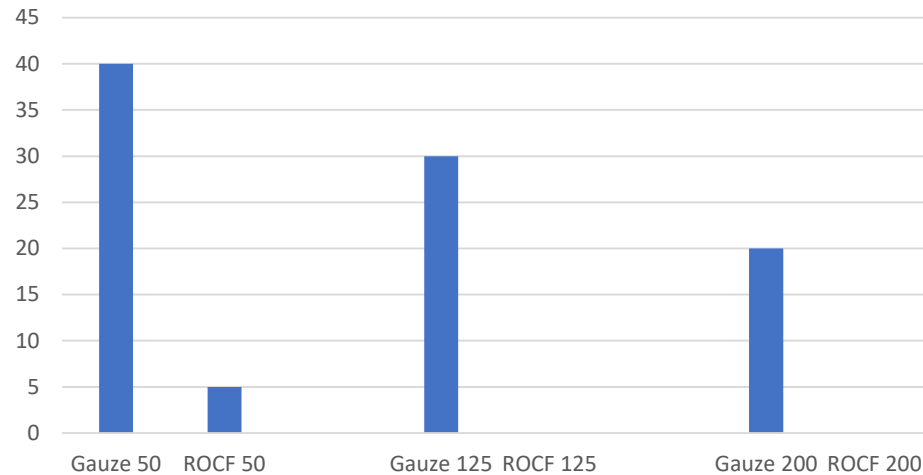
NPWT EFFECT ON WOUND



- In an, In-Vitro model, ROCF induced significantly greater microstrain than gauze demonstrating a 57% decrease in dressing surface area following negative pressure. The decrease measured was insignificant.
- The NPWT/ROCF/RPF system consistently delivered negative pressure to wound when compared to GUS or ROCF without RPF

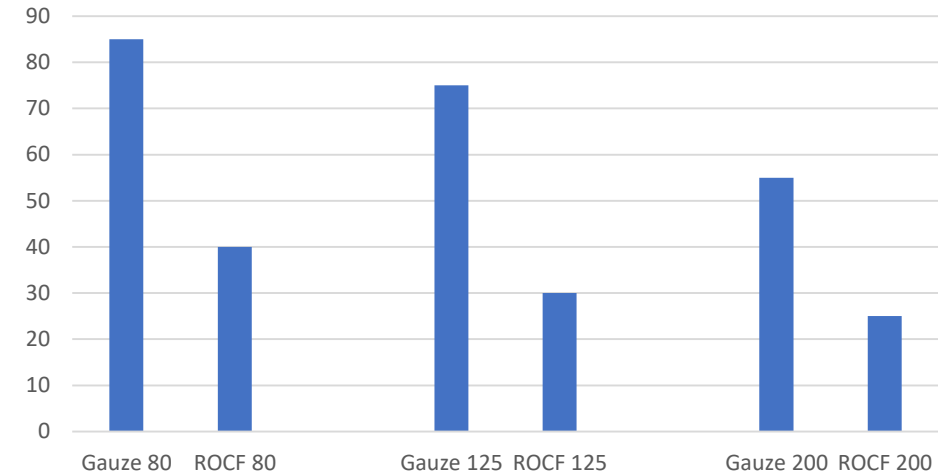
NPWT EFFECT ON WOUND

%age horizontal pressure drop



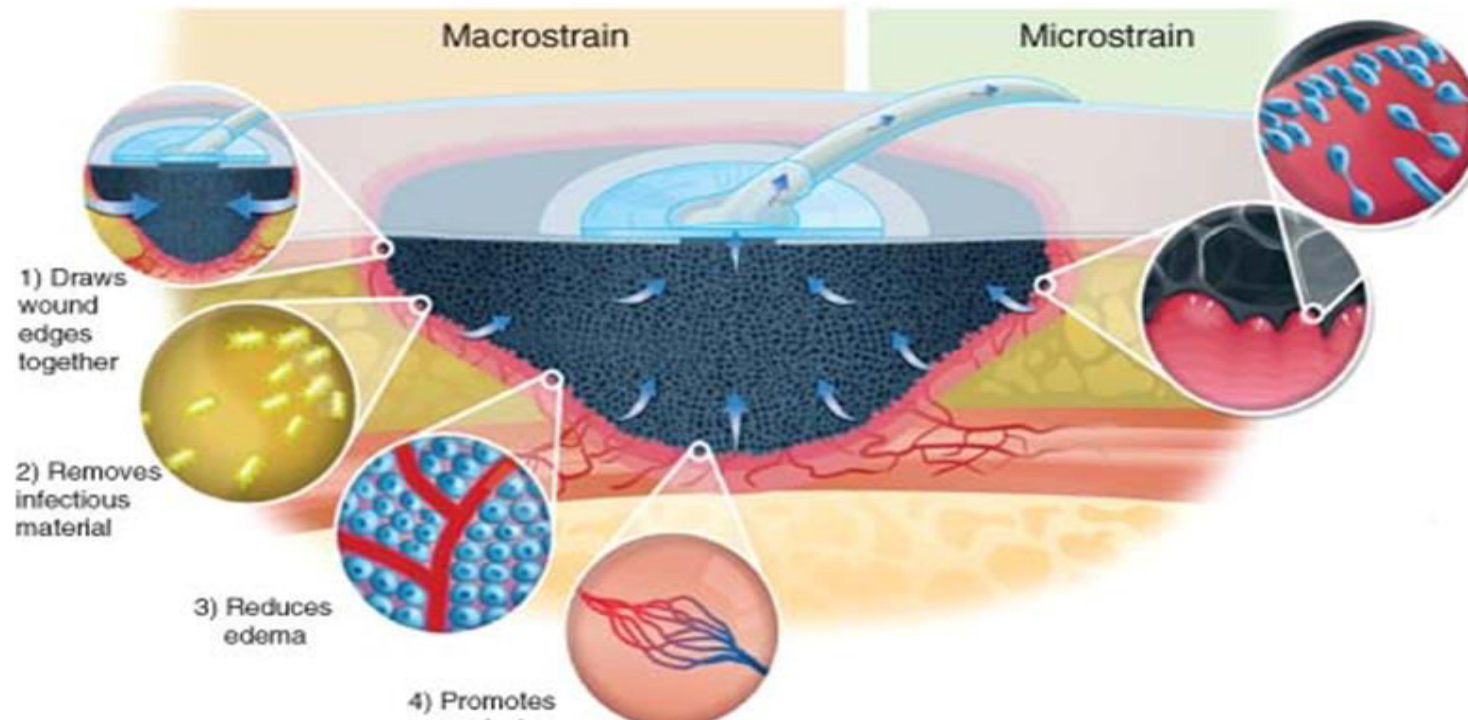
- Percentage horizontal pressure drop occurring 3.6 cm from the negative pressure source.
- For NPWT/ROCF the horizontal pressure drop at 3.6 cms from vacuum was between 2.9% and 5.3%.
- The pressure drop for gauze under suction was generally 7-10 times higher than NPWT/ROCF

%age vertical pressure drop



- Percentage vertical pressure drop occurring between therapy unit set pressure and pressure transferred to surrogate wound model.
- At all pressure tested, the percent pressure drop was 2 times greater for gauze under suction than the NPWT/ ROCF.

Mechanism of Action



6) *In vitro* studies show that cell stretch under negative pressure stimulates cellular activity that results in granulation tissue formation

5) *In vitro / in vivo* studies show that foam contact with tissue under negative pressure creates tissue micro-deformation that leads to cell stretch

NPWT: INDICATIONS

Chronic wounds

Acute wounds

Traumatic wounds

Partial-thickness wounds

Dehisced wounds

Flaps & skin grafts

Diabetic ulcers

Venous ulcers

Pressure ulcers

Burn wounds

Wounds with large amounts of drainage

Surgical and acute wounds at high risk for infection

NPWT: CONTRAINDICATIONS

Malignancy in wound

Necrotic tissue with eschar

Untreated osteomyelitis

Fistulas to organs or body cavities

Do not place NPWT dressing over exposed arteries or veins

NPWT PRECAUTIONS

- Active bleeding or patient on anticoagulant therapy
- Proximity of blood vessels, organs muscle, and fascia requiring protection.
- Irradiated vessels and tissue
- Bony fragments
- Untreated malnutrition
- Non-compliant or combative behaviour

NPWT: BENEFITS

Non-invasive treatment

Reduction of dressing changes

Reduced nursing time

Reduced infection risks (patient & hospital)

Concurrent rehabilitation

Better patient tolerance

Cost benefits

Faster wound healing

Improved patient quality life

Sterile healing environment

CONCLUSION

NPWT is a wound healing procedure that has been widely used to speed up healing, enhance wound healing rates, and prepare the wound bed for surgery. Based on the evidence currently available, it is still unknown if negative-pressure therapy is clinically effective.

There are few randomized controlled trials with conflicting results, despite case reports and retrospective research showing that acute/traumatic wounds, chronic wounds, infected wounds, wounds caused by diabetes mellitus, sternal wounds, and wounds on the lower limb heal faster.

SUGGESTIONS

NPWT therapy is not well known in India except for Plastic Surgeons it is not widely accepted so marketing strategies should be developed to educate people.

Conducting Seminars on NPWT and its effectiveness on wounds for Doctors.

Making General Public aware about the benefits of NPWT

THANK YOU