Smith+Nephew

✚ Evidence in focus

Selection of therapeutic negative pressure levels for wound care: focus on clinical and patient factors in evidence-based recommendations

Key points

Clinical guidelines and consensus groups recommend therapeutic negative pressure levels of **-50 to -150mmHg** for wound care[1,2]

High or low negative pressure levels are advised depending on exudate levels, wound type and pain experienced by patients[1–3]

PICO® Single Use Negative Pressure Wound Therapy System (sNPWT) consistently delivers negative pressure at **-80mmHg**,[4] a level sufficient to manage most wounds with low to moderate exudate[3]

Is there a 'gold standard' negative pressure level for wound care?

Clinical guidelines and wound care experts recommend a therapeutic range for negative pressure wound therapy of between -50 and -150mmHg;[1–3] however, there is no single negative pressure value that is recommended for all wound types and patients.

The only published evidence-based clinical guidelines review mostly laboratory findings (*in vivo* studies) conducted using traditional negative pressure wound therapy systems.[1] The guidelines, which were published in 2011, state that pressure levels less than -40mmHg provide minimal benefit, whereas those beyond -200mmHg can be detrimental to healing and can increase pain levels for patients.[1]

Evidence base for use of appropriate therapeutic negative pressure levels

A non-systematic literature review was conducted in February 2022 to evaluate the evidence base on therapeutic negative pressure levels for wound care.[5] No limits were applied to search criteria (including date of publication) to help ensure that all studies were captured.

A total of 14 publications that discussed therapeutic negative pressure levels were identified, which are summarised in Figure 1.[5]

14 publications discussing therapeutic levels of negative pressure were identified

7 clinical studies involving 211 patients and 10 volunteers

Most publications summarise **individual clinical experience or expert opinion**

Figure 1. Findings from a non-systematic literature review on therapeutic negative pressure levels (no limits on searches)[5]

The identified publications supported the recommendations of clinical guidelines and expert groups that no 'gold standard' therapeutic negative pressure value can be used for all patients with wounds. A summary of the clinical factors and individual patient considerations for selection of therapeutic negative pressure levels in wound care that were reported in the identified publications is provided in Figure 2.

A therapeutic range for NPWT of **-50 to -150mmHg is recommended for most wounds**[1]
- A pressure range of -75 to -125mmHg may be optimal[2]

Low negative pressure values may be considered:[1–3]
- To help reduce pain for patients
- For specific wound types (eg, those with compromised vascularity, poorly perfused tissue or at risk of ischaemia)

A value of no higher than -80mmHg has been recommended for:
- Open abdomen wounds[6]
- Skin grafts[7]

Figure 2. Summary of recommendations for therapeutic negative pressure levels in wound care[1–3,6,7]

Evidence in focus

Clinical guidelines and expert opinion

The guidelines published by Birke-Sorensen H, *et al.*, included an in-depth analysis of studies evaluating the impact of negative pressure levels on clinical factors affecting wound healing.[1] Figure 3 summarizes how many studies were included in that analysis and whether they showed beneficial or detrimental effects on wound healing.

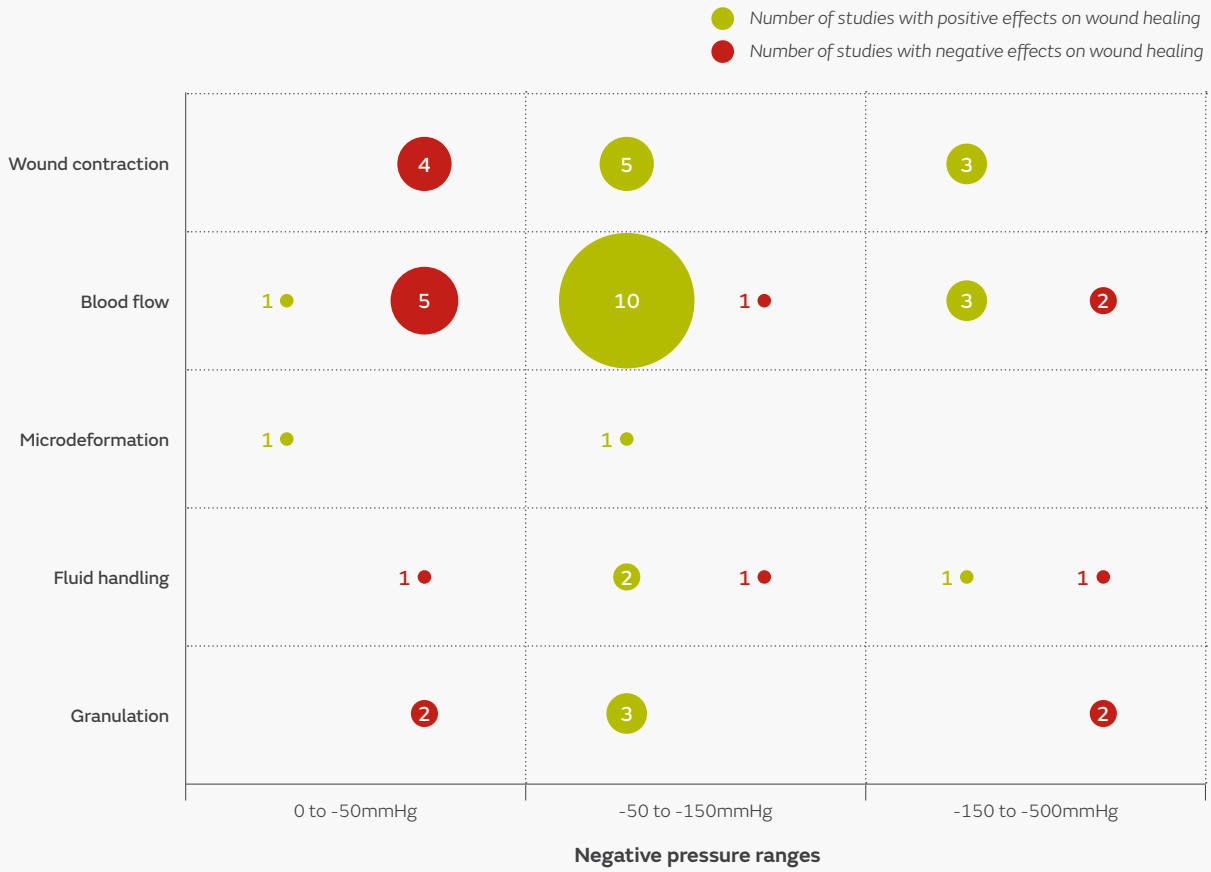

Figure 3. Summary of studies investigating the effects of different negative pressure levels on wound healing in terms of positive and negative effects (adapted from Birke-Sorensen H, et al. 2011).[1] Size of the circles increases according to the number of studies (not to scale)

The analysis showed that positive effects on wound healing (wound contraction, blood flow, microdeformation, fluid handling and granulation tissue) have been mostly reported at negative pressure levels within the range of -50 to -150mmHg.[1]

The authors proposed that use of low negative pressure levels (-40 to -80mmHg) within the recommended range of -50 to -150mmHg may be considered to manage patient factors, such as high pain levels, as well as for wounds with compromised vascularity or at risk of ischaemia.[1] They also advocated use of high negative pressure levels (-80 to -150mmHg), within the same therapeutic range, for wounds producing large volumes of exudate.[1]

Narrower therapeutic ranges for wound management have been recommended by the European Wound Management Association (-75 to -125mmHg)[2] and by the authors of a non-systematic literature review (-80 to -125mmHg).[3] Both publications supported the clinical and patient factors where higher or lower negative pressure levels may be appropriate in wound care[2,3] as identified in the clinical guidelines (Figure 2).[1]

✚ Evidence in focus

Evidence in specific wound types

Two systematic literature reviews have proposed that low levels of negative pressure should be used for specific wound types.[6,7]

The first review provided recommendations that negative pressure values should not exceed -80mmHg for the management of open abdomen wounds because of an increased risk of bowel tissue ischaemia and reduced bowel blood flow.[6]

The second review evaluated effectiveness and safety studies of negative pressure at -80 and -125mmHg, and with conventional dressings, in patients requiring skin grafts.[7] There was no evidence of an increase in graft take with negative pressure levels of -125mmHg; therefore, the authors recommended that -80mmHg should be used for skin grafts.[7]

Overall, there is no single therapeutic negative pressure value that can be recommended for all wound types. The narrowest optimal proposed range is -75 to -125mmHg; however, there are some clinical scenarios where use of the lowest or highest values within the -50 to -150mmHg range should be considered.

Negative pressure delivery by PICO◊ sNPWT

PICO sNPWT can be used for patients with acute or chronic wounds with low to moderate exudate levels in the hospital and home care settings. It has been shown to consistently deliver negative pressure of -80mmHg in benchtop testing, a value within the recommended therapeutic range for managing wounds.[4]

Summary

- Clinical guidelines and expert opinion recommend a range of therapeutically effective negative pressure levels between -50 and -150mmHg for wound management[1–3]
  - An optimized range of between -75 and -125mmHg has been proposed[2]
  - Lower pressures are recommended for some wound types and to help manage pain during treatment[1–3]
  - Negative pressure levels more than -80mmHg are not required for most wounds,[3] except those with large amounts of exudate[1–3]
- PICO sNPWT delivers negative pressure at -80mmHg,[4] a level recommended as suitable for most wounds with low to moderate exudate and that may help to reduce pain experienced by patients[1–3]

For detailed product information, including indications for use, contraindications, precautions and warnings, please consult the product's applicable Instructions for Use (IFU) prior to use.

References

1. Birke-Sorensen H, Malmsjö M, Rome P, *et al*. Evidence-based recommendations for negative pressure wound therapy: treatment variables (pressure levels, wound filler and contact layer) – steps towards an international consensus. *J Plast Reconstr Aesthet Surg*. 2011;64 Suppl:S1–16. **2.** Apelqvist J, Willy C, Fagerdahl AM, *et al*. Negative pressure wound therapy – overview, challenges and perspectives. *J Wound Care*. 2017;26(3):S1–S113. **3.** Malmsjö M, Borgquist O. NPWT settings and dressing choices made easy. *Wounds International*. 2010;1(3):1–6. Available at: http://www.woundsinternational.com Last accessed April 2022. **4.** Casey C, Ambler G, Huddleston E. Consistent delivery of therapeutic negative pressure levels by a single use negative pressure wound therapy system (sNPWT) in a wound model. Poster presented at the European Wound Management Association annual meeting, June 5–7, 2019; Gothenburg, Sweden. **5.** Smith+Nephew, data on file EA/AWM/PICO/034/v1. A non-systematic review of the evidence on the effects of different negative pressure levels during negative pressure wound therapy. March 2022. **6.** Bruhin A, Ferreira F, Chariker M, Smith J, Runkel N. Systematic review and evidence based recommendations for the use of negative pressure wound therapy in the open abdomen. *Int J Surg*. 2014;12(10):1105–1114. **7.** Jiang ZY, Yu XT, Liao XC, *et al*. Negative-pressure wound therapy in skin grafts: A systematic review and meta-analysis of randomized controlled trials. *Burns*. 2021;47(4):747–755. **8.** Torbrand C, Anesäter E, Borgquist O, Malmsjö M. Mechanical effects of negative pressure wound therapy on abdominal wounds - effects of different pressures and wound fillers. *Int Wound J*. 2018;15(1):24–28.

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