How do 3 Negative Pressure Wound Therapy Systems Compare for Accurate Pressure Delivery and Efficient Fluid Removal?

Rey Paglinawan, MSc; Patrick Schwab, BS, MBA; and Kari Bechert, PT, MPT, CWS, CLT

In order to maximize the healing potential, Negative Pressure Wound Therapy (NPWT) systems must be able to accurately deliver the set level of negative pressure and maintain this set level during fluctuations in wound exudate volume and viscosity. Additionally, the European Wound Management Association (EWMA) International Consensus Review states that NPWT systems containing an electronically-controlled feedback loop ensure maintenance of set pressure, guarantee the effectiveness of therapy and provide higher patient safety.¹

While instrumental to effective NPWT delivery, not all NPWT systems have the technical capability to meet all these standards, which can potentially lead to complications in wound healing.

System A[‡]: Medela Invia[®] Liberty[™] NPWT System
System B[^]: 3M[™] V.A.C.[®] Ulta Therapy System
System C^a: Smith+Nephew Renasys[®] Touch Therapy Unit

Outcomes may not be indicative of clinical performance.

- 1. Apelqvis J, Willy C, Fagerdahl AM, et al. EWMA document: negative pressure wound therapy overview, challenges and perspectives. J Wound Care. 2017;26(Suppl 3):S1–S113.
- 2. Willy C. The Theory and Practice of Vacuum Therapy: Scientific Basis, Indication for Use, Case Reports, Practical Advice. Lindquist Publishing: 2006
- 3. https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPCD/classification.cfm?id=5942
- 4. Paglinawan R, Schwab P, Bechert K. Negative pressure wound therapy system Innovates standard of care via intelligent pressure control and dynamic exudate removal. Wounds. 2020;32(10):S1-S8.
- 5. Paglinawan R, Schwab P, Bechert K. Novel NPWT system with innovative technology provides more accurate pressure delivery and superior fluid handling. Wounds. 2021;33(11):S3-S1
- 6. Harding K, Carville K, Chadwick P, et al; Core Expert Working Group. WUWHS Consensus Document: wound exudate, effective assessment and management. *Wounds Int.* 2019. https://www.woundsinternational.com/resources/details/wuwhs-consensusdocument-wound-exudate-effective-assessment-and-management

Acknowledgments: The support of Medela AG (Laettichstrasse 4b, 6340 Baar, Switzerland) for this project is acknowledged.

Presented at the Annual Symposium on Advanced Wound Care (SAWC) Spring, April 7-9, 2022.

The authors are employees of Medela.

Medela wordmark and logo, and Invia are registered in the U.S. Patent and Trademark Office. Liberty is a trademark of Medela.

* Testing was conducted at an independent third party laboratory using a test protocol designed by the manufacturer of System A‡

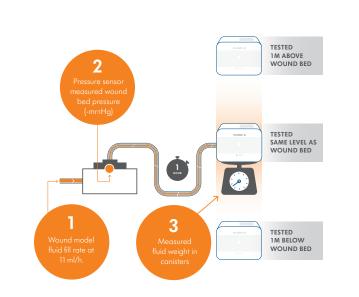
PURPOSE / METHODOLOGY

The objective of this study was to determine the ability of 3 NPWT systems 1- to maintain set pressure in a simulated wound bed when placed at different heights in relation to the wound and 2- to efficiently remove a simulated fluid bolus. System A[‡] is designed with a unique electronically controlled feedback system which dynamically responds to fluctuations in fluid volume and/or viscosity; System B[^] has an electronically controlled feedback system; System C^{\alpha} does not have an electronically controlled feedback system.

TEST METHOD #1:

Accurate Pressure Delivery to the Wound Bed

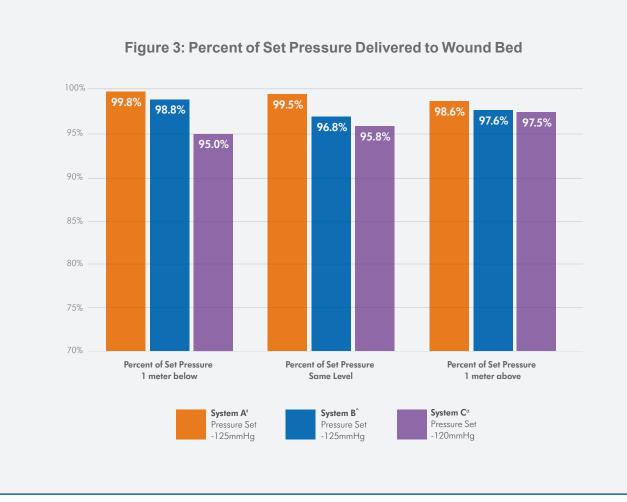
Test 1 was performed to assess the ability of each NPWT system to accurately deliver the set negative pressure (mmHg) to the wound while removing simulated wound fluid when positioned at 3 different heights in relation to the wound model (1 meter above, same level, and 1 meter below). Systems A^{\ddagger} and B^{\land} settings were –125 mmHg and –75 mmHg. System C^{α} settings were –120 mmHg and –70 mmHg. System C^{α} settings were different due to the limited prescribed pressure setting available on this device (**Figure 1**). The test method was repeated 3 times for each NPWT system at each height for two pressure settings.





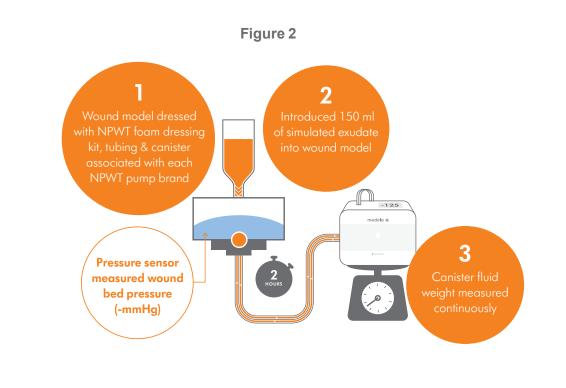
RESULTS

The experimental results supported that System A[‡] and System B[^] were able to consistently maintain the selected pressures (-125 & -75 mmHg) at the wound bed while simultaneously removing simulated wound fluid regardless of system height in relation to the wound. System C^α was less effective at maintaining target pressure (-120mmHg) as Systems A[‡] and System B[^]. (**Figure 3**)



TEST METHOD #2: Efficient Exudate Removal

Test 2 was performed to assess the ability of each NPWT system to maintain the set level of negative pressure and remove fluid after adding 150 mL of simulated wound exudate. The pressure at the wound bed and amount of simulated wound fluid removed to the canister were measured continuously for approximately 2 hours. Negative pressure levels were set at -125 mmHg for Systems A ‡ and B and -120 mmHg for System C $^{\alpha}$. The negative pressure settings used for System C $^{\alpha}$ were the closest pressure settings available on this device to the standardized settings on System A ‡ and B $^{\hat{}}$. Each device was at the same level as the wound model and repeated 3 times per system. (**Figure 2**).

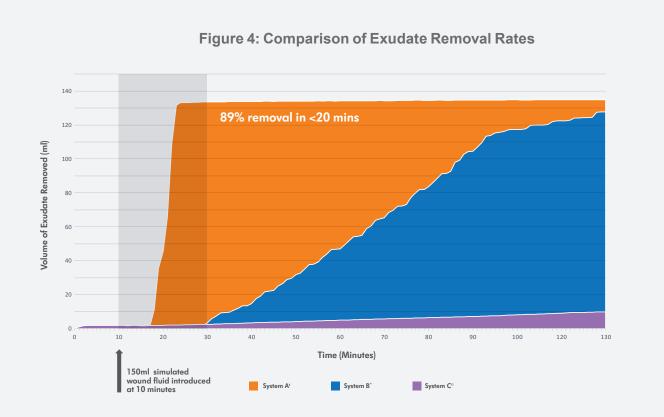


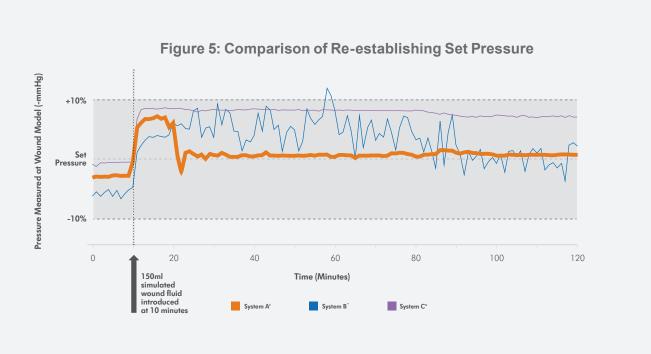
RESULTS

System A[‡] removed fluid more efficiently than System B[^]; evacuating 89% of the fluid in less than 20 minutes. System B[^] and System C[^] did not attain 89% fluid removal throughout the duration of the 2 hour experiment. System C[^] failed to remove >10 mL of simulated wound fluid.

System A[‡] re-established the set pressure of -125 mmHg in <20 minutes, returning to patency and delivering consistent levels of therapy at the wound bed for the duration of the experiment. System B[^] fluctuated widely from the set pressure with excursions that exceeded 10% of the set pressure. (Figure 4).

System C^α was also unable to maintain the set pressure at the wound with elevated readings that were well above the set pressure level for >70 minutes of the testing period. (Figure 5).





CONCLUSION

NPWT systems that cannot remove fluid efficiently nor maintain set pressure may negatively impact the therapy's effectiveness.⁶ System A[‡], with its electronically controlled feedback system that can dynamically sense and respond to changing fluid volumes and viscosities, more efficiently removes exudate and outperforms the other commercially available NPWT systems tested.