Received: 22 July 2021 | Accepted: 17 August 2021

DOI: 10.1111/iwj.13677

IWJ WILEY

LETTER TO THE EDITOR

Comment on "Novel imaging methods reveal positive impact of topical negative pressure application on tissue perfusion in an in vivo skin model"

Dear Editors,

To this day, the mechanism of action of negative-pressure wound therapy (NPWT) continues to elude us.[1,2] Whether NPWT increases or reduces tissue pressure during suction and how this affects perfusion are the most basic, yet critically important, physiological concepts that need to be clearly elucidated. In this regard, we would like to put forward three concerns regarding the interesting article by Muller-Seubert et al.[1]

We applaud the authors on a well-conducted study. However, we have concerns regarding their conclusion. They placed NPWT dressings on intact human skin and found that, after removal, perfusion was increased. They therefore concluded that perfusion during NPWT is increased.

This extrapolation seems counter-intuitive. Arriving at such a conclusion is akin to concluding that a tourniquet or pressure dressing increases perfusion because there is a reactive hyperaemia when it is removed. Their study merely implies that perfusion is increased when the NPWT dressing is removed.

In fact, based on recent research, it appears that perfusion beneath or directly adjacent to an NPWT dressing is actually reduced during suction.[3-6] With this in mind and continuing with the analogy of the tourniquet or pressure dressing, one could possibly argue that Muller-Seubert et al, should have arrived at the very opposite conclusion, namely that perfusion was probably reduced during NPWT, resulting in the reactive hyperaemia when the dressing was removed.

Our second concern relates to their likening of an NPWT dressing to a suction cup. It is our opinion that a common reason for the controversy about perfusion beneath NPWT is the continued misconception that NPWT dressings behave in a similar fashion to a suction cup device. While rigid devices, such as suction cups, reduce tissue pressure and increase perfusion,[7] the same cannot be said for NPWT dressings, as they are non-rigid (collapsible).[8]

A thesis on "The Biomechanics of Negative-pressure Wound Therapy"[2] demonstrated that NPWT increases tissue pressure[9,10] and reduces perfusion[5] (in contrast to the suction cup principle), and these findings have been supported by others.[8,11-13]

Another reason for the controversy about perfusion is the large body of historical evidence demonstrating that NPWT increases perfusion, with the most frequently cited paper being the seminal study of Morykwas et al.[14] Morykwas and most other authors studying perfusion used laser Doppler to measure perfusion, which brings us to our third and last concern on Muller-Seubert's article.

They quoted one of our studies, titled, "The flaws of laser Doppler in negative-pressure wound therapy research",[15] as indicating that perfusion was increased in some anatomical regions and reduced in others. Unfortunately, this finding was taken out of context, without mentioning the purpose of that study and its actual conclusion, which was that laser Doppler cannot be used to measure perfusion on tissues undergoing NPWT, as it yields similar readings to those when tissues are manually compressed with weights. Most would agree that compressed tissues should not be expected to demonstrate increased perfusion. This conclusion, which was not mentioned in Muller-Seubert's paper, appears to explain why there are prior studies (that used laser Doppler) that supported the theory that NPWT increases perfusion.

If we are to understand the mechanism of action of NPWT, it behoves us to ensure that the basic biomechanical properties of NPWT are agreed upon first. Yet, when it comes to the effects of NPWT on tissue pressure and perfusion, there appear to be expert opinions that are not only divergent but also polar opposites. Reaching a consensus on these basic principles is not only important in understanding the mechanism of

action of NPWT but influences indications and contra-indications for its use.

ACKNOWLEDGEMENTS

None.

CONFLICT OF INTEREST

Nicolas Kairinos has received third party funding for scientific research on Cellutome (Kinetic Concepts Incorporated [KCI]) and has also served on KCI's Continental Scientific Advisory Board. He has also received honorariums from Smith and Nephew for lectures given on Versajet (Smith and Nephew) hydrodebridement. The other authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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