

A comparison between three different single-use NPWT pumps to detect differences in acoustic levels

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1/5

Introduction

- The benefits of negative pressure wound therapy (NPWT) on open wounds and closed incisions are well understood^{1,2}
- One of the areas currently under discussion is how the noise produced by NPWT pumps affects patient health and recovery
- This *in vitro* study compared the performance of the three pumps* with respect to sound levels during maintenance pumping

*Pump 1: Avelle™ (Convatec Ltd); Pump 2: PICO° 7 (Smith & Nephew); Pump 3: Prevena™ (KCI Medical)

References

1. Vig S, Dowsett C, Berg L, et al. *J Tissue Viability*. 2011;20 Suppl 1:S1-18; 2. Hyldig N, Birke-Sorensen H, Kruse M, et al. *Br J Surg*. 2016;103(5):477-486

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2/5

Materials and methods

- All three pumps were used in accordance with the Instructions For Use on the provided absorbent dressings
- Acoustic levels were measured at initial pump down (IPD) and maintenance pump down (MPD), respectively
- Each system was new (unused) prior to testing and all devices came from the same batch
- Testing was carried out at Element Materials Technology Ltd, South Orbital Trading Park, Hull, UK, in their fully anechoic chamber (internal dimension = 3m³)
- Readings were taken from each device over a maintenance pumping cycle of 60 seconds rather than initial pump down as this is considered to be the noise that the patient would be exposed to most of the day

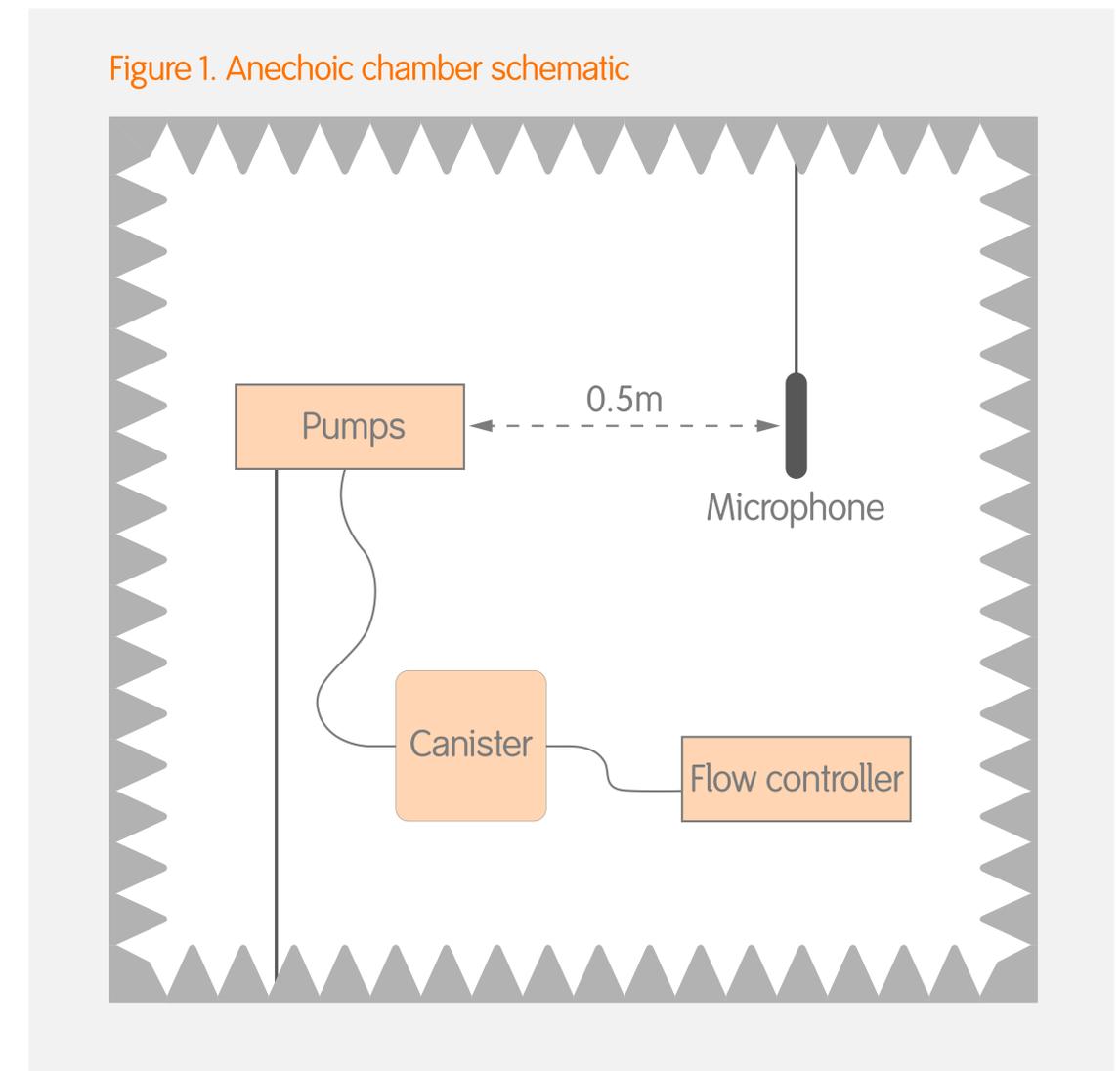
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3/5

Materials and methods (cont)

- The pumps were placed one at a time inside the anechoic chamber at 0.5m distance from the microphone (Figure 1)
- This was then converted mathematically to generate the sound produced at a distance of 1m
- The apparatus was set to ensure that the devices produced a representative sound level that would be a direct comparison to the noise produced in real life situations
- A length of 1.6mm internal diameter silicone tubing was used to connect the device to an air reservoir of 400ml to simulate a challenging volume wound
 - Using a separate valve a leak rate of 25ml/min was applied to this volume
- The devices were turned on and the phonometer was set to acquire LAF values (fast a-weighted sound level modality)
- Recordings were taken over initial pump down and then at 60 second time intervals



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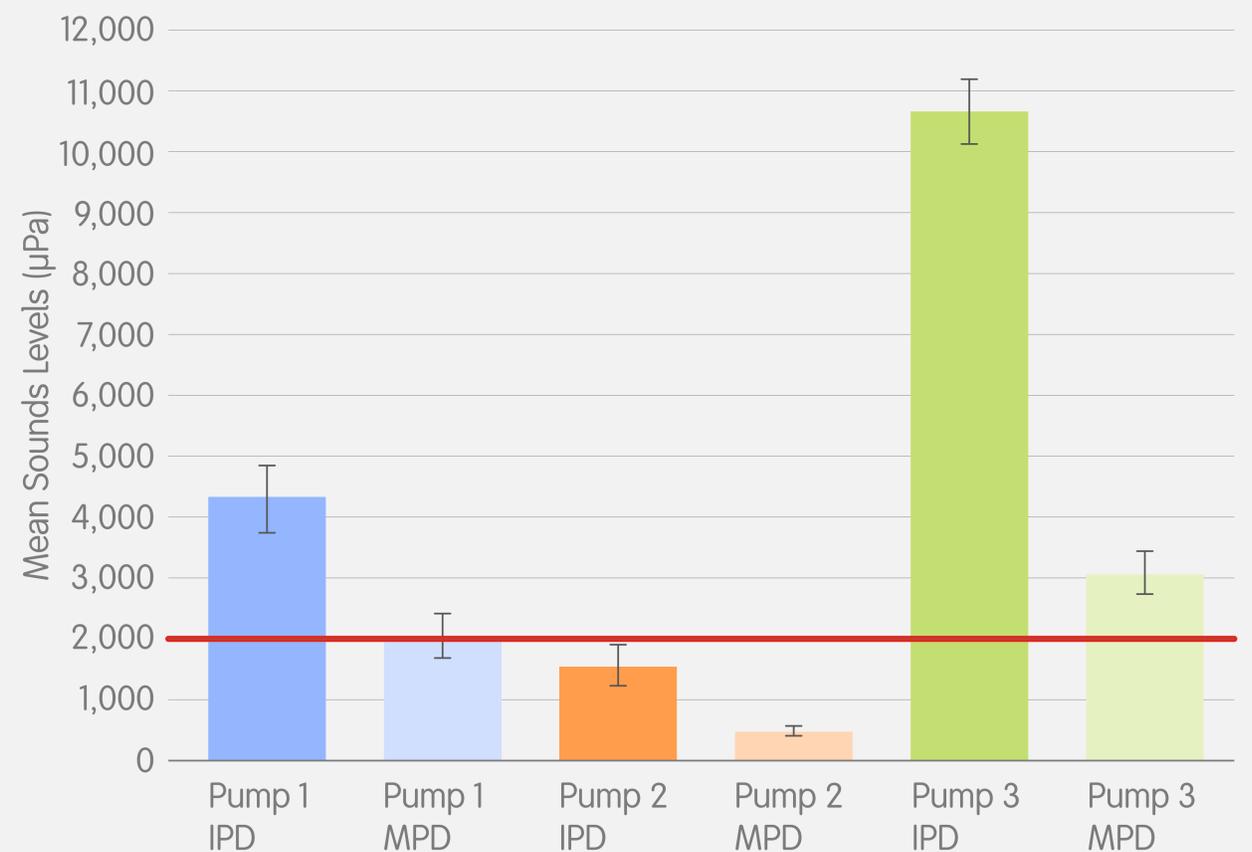
Results

- Although differences in acoustic levels for each NPWT device measured using decibels appeared small, the logarithmic scale means that these differences are substantial
- From the data it is evident that noise levels were lowest with Pump 2 for both IPD and MPD (Table 1)
- Mean sound levels for Pumps 1, 2 and 3 are shown in Figure 2

Table 1. Results for IPD and MPD for all three pumps* tested

Device	IPD (dB)	MPD (dB)	IPD (μPa)	MPD (μPa)
Pump 1	46.48 \pm 2.1	40.00 \pm 1.8	4,321.0 \pm 1064.1	2,047.1 \pm 472.4
Pump 2	37.10 \pm 3.4	27.60 \pm 2.2	1,557.0 \pm 713.4	493.8 \pm 127.1
Pump 3	54.50 \pm 0.8	43.60 \pm 2.1	10,660.0 \pm 1026.4	3,084.7 \pm 681.9

Figure 2. Mean acoustic levels of three NPWT pumps* at IPD and MPD



WHO Europe suggested maximum level of noise ($L_{\text{night, outside}}$): 40dB (2000 μPa)¹
(See red line —)

*Pump 1: Avelle™ (ConvaTec Ltd); Pump 2: PICO° 7 (Smith & Nephew); Pump 3: Prevena™ (KCI Medical)

References

1. World Health Organization Europe. Night noise guidelines for Europe (2009). Available at: http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf. Accessed 19 April 2018

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5/5

Conclusions

- Although all products tested* were battery powered NPWT devices, there were significant differences between the acoustic decibel levels produced by the pumps
- Due to the decibel scale being non-linear small differences in scale are noticeably different when heard by the human ear; therefore, the results were converted to micro-Pascals to facilitate comparisons
- The World Health Organization (WHO) Europe suggests that average sound levels should not exceed 40 dB (2000 μ Pa) overnight;¹ Pumps 1 and 3 both surpassed this for both IPD and MPD readings
- This suggests that there could be more disruption to sleep or well-being when patients treated with Pumps 1 or 3 compared to Pump 2,* although further studies would be required to verify this hypothesis

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.

* Pump 1: Avelle™ (ConvaTec Ltd); Pump 2: PICO° 7 (Smith & Nephew); Pump 3: Prevena™ (KCI Medical)

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1. World Health Organization Europe. Night noise guidelines for Europe (2009). Available at: http://www.euro.who.int/__data/assets/pdf_file/0017/43316/E92845.pdf. Accessed 19 April 2018