Portrait of the device as a young VAC: what's next as negative pressure wound therapy enters early adulthood?

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It will be 20 years ago this December that negative pressure wound therapy (NPWT) was first made commercially available following its development by Argenta, Morykwas and other forebears (Morykwas et al, 1997) (*Figure 1, page 62*). Before that, our approach to treating complex tissue loss with large deficits was either through tissue rotation/transfer via a free flap or rotational flap or to allow wounds to heal secondarily.

The effect of NPWT on tissue repair conceptually complements the endovascular revolution that has occurred in vascular surgery. Over that same period, we have collectively seen an 'endovascular first' option taken for many vascular lesions. Just as with NPWT and free flaps, endovascular surgery has not supplanted open surgery by any means, but most would agree it is a welcome choice in our collective armamentarium.

NPWT involves applying subatmospheric pressure across the surface of a defect (Isaac and Armstrong, 2013). This macro and microstrain across the wound stimulates angiogenesis and stimulates robust granulation tissue formation (Saxena et al, 2004). It also provides a moist wound environment, which is likely to be conducive to reorganisation of the wound matrix and cell migration.

If widespread commercial availability of NPWT was born 20 years ago, then the technology entered its pre-adolescence with early availability of evidence of its potential effectiveness. Randomised controlled trials conducted in the mid-2000s seemed to point to a technology that was useful for wound healing (Armstrong et al, 2005; Blume et al, 2008). Some of us who were authors or designers of these studies suggested that healing was probably not the ideal endpoint for NPWT — as its strength was in resolving deep defects and generating granulation tissue, rather than treatment until closure (Blume et al, 2008; Armstrong et al, 2009; Isaac and Armstrong, 2013; Pappalardo et al, 2013).

The next stage in the maturation of our protagonist was its growth through adolescence. Just as an adolescent may shed his or her skin and blossom into a early adulthood, so too did NPWT morph into a more nimble form, making them far more mobile, useful and portable. This created an opportunity for the first comparative effectiveness research in tissue repair devices, suggesting that these smaller models, given the right application, can behave at least as well (Armstrong et al, 2012). Additional technologies, borrowing from early works in fluid installation and 'wound chemotherapy', showed that NPWT might be a promising instrument for drug delivery (Fleischmann et al, 1998; Giovinco et al, 2010; Kim et al, 2014).

So what is next for our young device? Perhaps we can draw inspiration from the literary world. It will be 100 years ago this December that James Joyce published his first novel, *A Portrait of the Artist as a Young Man*. In it, Joyce's protagonist Stephen Dedalus is followed through his childhood and early adulthood (Joyce, 2007). We watch his perspective broadening as he gains experience. Perhaps NPWT will undergo a similar metamorphosis. Perhaps we will see the device used for completely novel applications, such as protecting tissue in patients in wound 'remission' (Armstrong and Mills, 2013; Miller et al, 2014). Perhaps the device will serve a theragnostic and diagnostic role, as well as a therapeutic role that many have proposed (Armstrong and Giovinco 2011; Dini et al, 2011; Armstrong et al, 2015).

I think we can collectively be proud of our pump progeny, but also equally excited about what the future holds. ■

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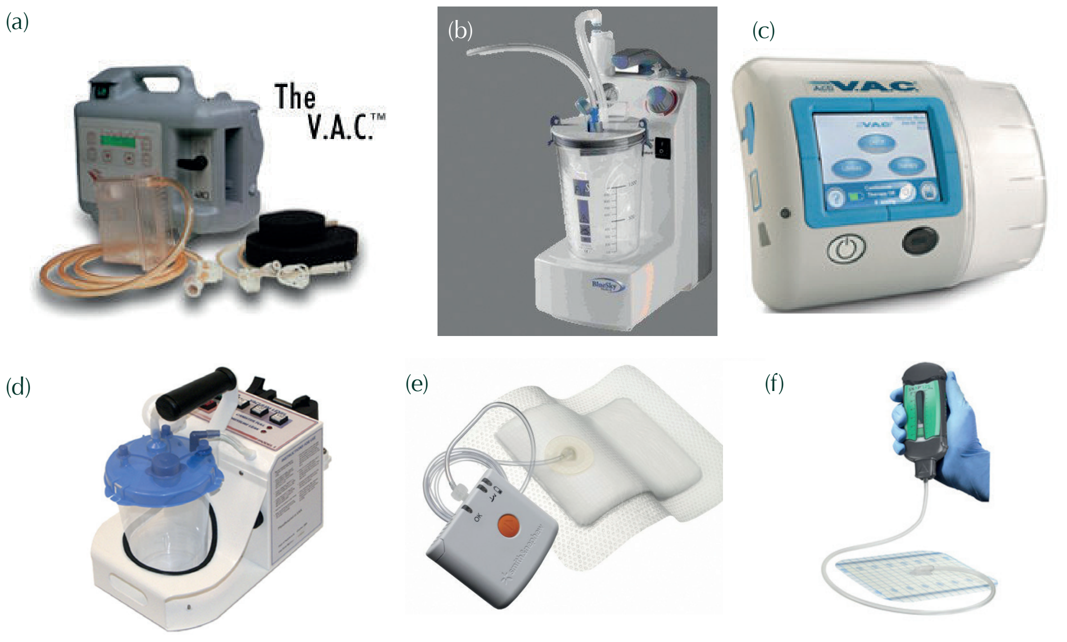

Figure 1. My, how you've changed… (a) 1996: KCI VAC NPWT first widely commercialised (b) 2000: Blue Sky device developed (c) 2005-6: First portable NPWT (d) 2007-8: Sved: First commercially available NPWT with built-in Infusion therapy (e) 2010-11: First non-electrically powered (aka "ultraportable" – SNaP) devices commercially developed and (f) small form factor technologies (PICO).