Silcare Breathe Locking

Silcare Breathe was the first laser-drilled, perforated liner available on the prosthetic market. The liners use the same silicone as Blatchford's existing nonperforated liners but feature numerous laser-drilled holes that form channels between the inside and outside of the liner.

The design addresses a problem that is becoming more and more prevalent with the increased use of prosthetic liners; that of excessive sweating. If sweat from the residual limb is trapped against the skin and cannot escape, it can cause numerous problems that can have serious implications for the health and safety of the user. The perforations allow sweat to escape from the skin to the outside the liner, helping to keep the residual limb dry and healthy, and reducing the detrimental effect on the user.

Silcare Breathe Locking uses a pin-lock attachment and so does not require a suspension sleeve. This means the liner is more open to the environment to allow cooling and there is less restriction on knee flexion. The distal perforations are covered by a valve. During weight bearing, the distal valve opens to allow sweat expulsion. When the limb is lifted, during swing phase, the distal valve closes, creating a passive vacuum around the distal end of the residual limb. The passive vacuum distributes the force on the residual limb over a greater area than the pin-lock alone, mitigating the risk of localised loading.

Clinical Outcomes using Sweat Management liners

Improvement in **RESIDUAL LIMB HEALTH**

- Improvements in residual limb health problems and wound healing[1,2]
- Fewer residual skin issues[2]
- Reduction in pain in residual and phantom limb[2]
- Improved heat dissipation compared to other temperature regulation solutions[3]
- Removes sweat from skin interface[1,2,4]
- Perforations do not damage the skin[4]

Improvement in **USER SATISFACTION**

- Patients reported a preference for their perforated liners[1,4]
- Reduces the need to remove prosthesis throughout the day to dry residual limb[4]

Clinical Outcomes using Silicone liners

There are two published literature reviews that discuss different aspects of lower limb prosthetic liner technology[5,6].

- The main purpose of prosthetic liners is to cushion the transfer of loads from the prosthetic socket to the residual limb[5].
- Based on load-displacement data from the compressive stiffness tests, silicone was one of three materials that were recommended for situations where it is desirable for the liner to maintain thickness and volume since these materials had the least non-recovered strain[5,7].
- Under cyclic compressive loading, silicone was one of two materials that had the greatest cycles to failure under compressive loading, while the Pedilin and

polyurethane samples lasted orders of magnitude less[5,8].

- Prosthetic liners and sockets are highly resistive to heat conduction and could be a major contributor to elevated skin temperatures[5,9].
- There are reduced residual limb pressures with the silicone liner compared to other conditions (no liner; soft inserts) suggesting that silicone has an ability to distribute pressure evenly to the residual limb[4,10].
- In terms of patient outcomes, there was no clear preference between silicone and Pelite liners[5,11].

References

1. McGrath M, McCarthy J, Gallego A, et al. The influence of perforated prosthetic liners on residual limb wound healing: a case report. Can Prosthet Orthot J 2019; 2(1)

2. Davies KC, McGrath M, Stenson A, Savage Z, Moser D, Zahedi S. Using perforated liners to combat the detrimental effects of excessive sweating in lower limb prosthesis users. Can Prosthet Orthot J. 2020;3(2).

3. Williams RJ, Washington ED, Miodownik M, et al. The effect of liner design and materials selection on prosthesis interface heat dissipation. Prosthet Orthot Int 2018; 42: 275–279.

4. Caldwell R, Fatone S. Technique for perforating a prosthetic liner to expel sweat. JPO J Prosthet Orthot 2017; 29: 145–147.

5. Klute GK, Glaister BC, Berge JS. Prosthetic liners for lower limb amputees: a review of the literature. Prosthet Orthot Int 2010; 34: 146–153.

6. Richardson A, Dillon MP. User experience of transtibial prosthetic liners: a systematic review. Prosthet Orthot Int 2017; 41: 6–18.

7. Sanders JE, Greve JM, Mitchell SB, et al. Material properties of commonly-used interface materials and their static coefficients of friction with skin and socks. J Rehabil Res Dev 1998; 35: 161–176.

8. Emrich R, Slater K. Comparative analysis of below-knee prosthetic socket liner materials. J Med Eng Technol 1998; 22: 94–98.

9. Klute GK, Rowe GI, Mamishev AV, et al. The thermal conductivity of prosthetic sockets and liners. Prosthet Orthot Int 2007; 31: 292–299.

10. Sonck WA, Cockrell JL, Koepke GH. Effect of liner materials on interface pressures in below-knee prostheses. Arch Phys Med Rehabil 1970; 51: 666.

11. Lee WC, Zhang M, Mak AF. Regional differences in pain threshold and tolerance of the transtibial residual limb: including the effects of age and interface material. Arch Phys Med Rehabil 2005; 86: 641–649.