Use of platinum cured silicone for increased comfort, control and moisture management in prosthetics
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# Section Summary

## About Blatchford

- Amputee issues
- Anatomy of a liner
- Results
Our Heritage

Established in 1890 with over 125 years of expertise and innovation in mobility rehabilitation.
Company structure

Products

Lower Limb Prosthetics
Orthotics
Special Seating & Wheelchairs

Services

NHS & Government Run
Private Clinics
Veteran Rehabilitation
Section Summary

About Blatchford

Amputee issues

Anatomy of a liner

Results
Ongoing challenges: comfort

- Strong connection
- Conducive to good residuum health
- Good socket fit
Socket problems – connection

- Suspension techniques are susceptible to levels of “pistoning” and “bell-clapper” effect
- This is the relative movement of the residuum within the socket
- This movement needs to be minimised to give better control and proprioception of the prosthetic

*Not to scale*
Socket problems – volume loss

- Residuums are known to fluctuate in volume, affecting the socket fit quality
- Many amputees try to compensate with extra socks
- A desirable characteristic of a suspension method is to reduce or adapt to volume changes
- **Consistency of fit** is very important

*Not to scale*
Socket problems – interface stress

- If the stresses on the residuum are too high, the user won’t wear their prosthesis
- High stresses can lead to tissue damage and skin irritation
- Scar tissue, not used to loading
Energy demand and body surface area

- Trans-tibial amputees expend 20-40% more effort to walk
- Surface area reduced by 10-15% reduces cooling capacity


by Douglas G. Smith, MD, ACA Medical Director
Issue: SWEAT
Prosthetic sockets

• The amputee’s residuum is held in a socket
• Amputees will commonly wear prosthetic liners to cushion the interface

• Liner acts as an Interface between the skin and hard socket
• Disperses peak pressures
• Absorbs shear forces created in the socket
• Provide secure suspension
Liner problems

- Skin
- Suspension Sleeve (to create vacuum seat)
- Socket
- Liner (impermeable)
Insulating materials

• Thermal conductivity of liner materials:
  – Sockets: Carbon Fibre and Thermoplastics: 0.148 and 0.150 W/m.K
  – Silicone/PU/TPE liners: 0.181 – 0.266 W/m.K.
  – Closed cell foam (i.e. Pelite): 0.085 W/m.K

The thermal conductivity of prosthetic sockets and liners.
Klute GK, Rowe GI, Mamishev AV, Ledoux WR.
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Silcare Breathe Liner - Anatomy

- Silicone moulding
  - Platinum cure system
  - Shore 00

- Reinforcing fabric cover
  - 2 zone stretch

- Anti-friction coating
  - Reduced shear forces between stump and the silicone

- Distal cap
  - Platinum cure system
  - Shore A

- Umbrella
  - Nylon 6,6
  - Mechanical attachment

- Vacuum functional valve
  - LSR
  - Shore A

- Silicone adhesive
  - Platinum cure
Silcare Breathe Anatomy - Inner surface

Silicone moulding
- Platinum cure system
- Shore 00

Reduced friction compared to the original surface finish.

ISO 8295
Silcare Breathe Anatomy – Fabric cover

- Integrated matrix with no longitudinal stretch at the distal end resists pistoning of the prosthesis
- Proximally bi-directional stretch allows comfortable knee flexion
- Continuous knitting technology allows easier donning due to the smooth transition
Silcare Breathe Anatomy – Fabric/Silicone interface

Fabric
- Polyamide + Elastane

Silicone adhesive
- Platinum cure

Silicone moulding
- Platinum cure
Silcare Breathe Anatomy – Umbrella
Umbrella

- Easier donning/doffing
- Eliminates trapped air
- Conforms better to stump / reduces shear stresses:
  - Better pressure distribution
Silcare Breathe Anatomy – Distal cap

Distal cap
- Platinum cure
- Shore A
Silcare Breathe Anatomy – Sweat Management

Perforations
Silcare Breathe Anatomy – Moisture management
Silcare Breathe Anatomy – Moisture management
Silcare Breathe Anatomy – Functional valve
Sweat management
Results

Perspiration ‘escapes’ through the holes

Perspiration remains (and pools) inside the liner. Reduces proprioception and forces the user to stop activity to empty and dry stump.
Patient feedback – sweating

- Patient’s self-perception similar to the observations of their prosthetists

Does heat or sweating in your prosthetic leg ever stop you wearing it?

- Prosthesis disuse due to sweating was eliminated completely after 3-4 months
Prosthetist feedback – vacuum

• Does vacuum hold?
  – Consistently over 76%

• How effective is the seal at maintaining sufficient vacuum?
  – Average rating across all responses