Dynamic Air Exchange prosthesis slips less despite greater perspiration

Lower Limb Prosthesis Adherence and Perspiration while Walking in a Hot and Humid Environment

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Background

Activity in hot and humid environments can result in loss of prosthesis adherence due to perspiration inside the prosthesis

Objective

Compare prosthesis designed to unobtrusively expel perspiration with standard-of-care

Dynamic Air Exchange Prosthesis

An innovative suspension, a pump and vacuum-triggered solenoid to induce dynamic air exchange through a custom sock worn between the liner and the residuum, allowing distal port expulsion of perspiration

Methods

Within-subject experiment (random order)

- Patellar tendon bearing hybrid socket with distal pin lock suspension
- Dynamic Air Exchange prosthesis that expels perspiration

Subjects (n=12) seated rest (30 min) then walk (30 min) on treadmill at 50% relative humidity and 20° and 35° C (random order), then seated rest (30 min) at 50% relative humidity and 20° C

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Participants

- All provided informed consent
- All moderately active community ambulators
- All male transtibial
- Mass: 92±18 kg, height: 1.81±0.07 m, age: 50±13 years, etiology: 8 trauma, 2 diabetes, 2 infection

Liner Slippage: Mark skin at prosthesis proximal border and measure change in position pre- and post-protocol

Liner Slippage (mm)	20° C	35° C
# of subjects	11	10
PIN	5 ± 4	24 ± 18
DAE	5 ± 12	12 ± 20

Perspiration: Measure change in prosthesis mass pre- and post-protocol

Perspiration (g)	20° C	35° C
# of subjects	11	12
Accumulated in PIN	0.1±0.2	0.9±1.6
Accumulated in DAE	0.3±0.9	2.9±5.0
Expelled by DAE	0.3±0.3	0.9±1.5

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