

Material Fatigue in the Prosthetic SACH foot: Effects on Mechanical Characteristics and Gait

Jody Van Rooyen

Bachelor of Prosthetics and Orthotics (Honours)

National Centre for Prosthetics and Orthotics
School of Human Biosciences
Faculty of Health Sciences

La Trobe University
Melbourne, Australia

November 1997

The Kingsley Prosthetic Feet Type KO51

Delamination of the foam rubber from the wooden keel was observed in the three test samples at the first inspection, after 5,000 cycles. Premature failure occurred after 20,000 cycles for two of the test samples. The mode of failure appeared to be shearing forces at the heel bumper which caused the material at the heel region to be forced proximally at heelstrike, as the wooden keel experienced an opposing downward force, eventually causing deep cracks medially and inferiorly (Figure 4.3).

The three Kingsley test samples had a piece of pelite attached to fill the back of the shoe. Tape had been wound round the prosthetic feet, near the inferior surface (similar to the placement where cracks had occurred), to attach this pelite. It was initially thought that this tape could have had an effect on the breakdown observed. Therefore a control test sample, Kingsley number 5, was fatigued without the pelite insert attached directly to the prosthetic foot, however the same mode of failure occurred after 20,000 cycles.

The untimely failure of the Kingsley SACH feet prompted the investigators to fatigue a test sample, Kingsley number 4, once the subject gait tests were completed, with an interface plate attached. The interface plate, a piece of polyethylene, 4.1 mm in height, was attached between the superior surface of the foot and the pyramid adapter (Figure 4.4). (Due to the compressibility of the plastic material, the ankle bolt was torqued to 30 Nm.) This test sample withstood 20,000 cycles, with no noticeable delamination around the wooden keel. Only a small crack was noticed on the inferior surface of the prosthetic foot, medial to the ankle bolt. Table 4.1 summarises the number of cycles completed by each individual test sample.



Figure 4.3. Kingsley SACH - 20,000 cycles.
(Note deep cracks medially)



Figure 4.4. Interface plate attached to Kingsley SACH