ISPO 2013

HYDERABAD INDIA

4th - 7th February 2013

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**Feb 6 (14:00 - 14:30, 15:45 - 16:15, 17:30 - 18:00)**
**Feb 7 (14:00 - 14:30, 15:45 - 16:15)**
Exhibition Hall: **Posters 2 - Prosthetics : Lower Limb, Poster Board 24**
Abstract Number: **375**
Abstract Title: **A Movement Analysis Application To Analyze Energy Recovery In The Prosthetic Feet**
Authors: **C. Frigo, E. Pavan, P. Cecini, D. Bonacini**
Presenter: **C. Frigo**

A method has been developed to compute the amount of energy stored and restituted during walking by prosthetic feet. This approach can be used to compare different foot designs and the effect of different covering materials and shoes. A movement analysis system (Smart-E, BTS, Italy) with 8 TV cameras working at 60 Hz, and one force platform (Kistler 9286, Switzerland) were used to collect kinematic and kinetic data. Retroreflective markers were positioned over relevant bone prominences. At the amputated limb, markers were attached to the prosthetic pylon just above the deformable foot leaves. The ground reaction force (GRF), that was measured during the foot-ground contact, was transferred to a reduction point at the basis of the pylon, and the ground reaction moment (GRM) was computed in relation to this same reduction point. The translational and rotational velocities of the pylon were computed and multiplied by GRF and GRM respectively, so that the power flow between ground and pylon was quantified. Then, by time integration, the energy exchange was computed.

Two subjects with transtibial and one with transfemural amputation were analyzed. They wear their own prosthesis that was equipped with a newly designed multi-leaf foot (Roadrunnerfoot, Italy). Trials were performed barefoot and with covers of different materials: polyurethane, silicone and EVA.

Results have shown that energy wasted by the barefoot was about 5 J and did not increase significantly with covers (t-Student test, $p<0.05$) except for covers in polyurethane, for which the energy dissipated was about 8 J. The flow of energy was also obtained all along the stride cycle, so that the absorption- restitution mechanism could be analyzed with reference to relevant phases of the stride, like heel-strike, load acceptance, mid-stance, push-off. This can help improving the design of the structural components of the foot and their mechanical characteristics.