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Title

Which rehabilitation process for an innovative lower limb prosthesis? A multi-player approach.

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Summary

To overcome current difficulties for LLA to walk on uneven terrain, an innovative knee-ankle-foot medical device was designed. All the actors of the rehabilitation process met and developed a dedicated tool detailing the re-education steps, to optimize the “patient – prosthesis” couple.

Introduction/ basics

Being able to rewalk is a real challenge for lower limb amputees (LLA). The target of a multidisciplinary team is to propose a re-education program specific to the patient and to the medical devices (MD) of the prosthesis. One objective of the APSIC project, that evaluated the walking deviations of LLA in adverse circumstances, was to propose an innovative prosthetic solution. A new knee-ankle-foot synergetic system was designed to limit walking deviations of above-knee amputees (AKA) on any terrain. The objective of this research is to propose a special rehabilitation process, dedicated to well use this MD, understanding how it works.

Material method; implementation/ process

R&D Engineers met several times Physical Therapists (PT), Certified Prosthetist & Orthotist (CPO) and Physical Medicine and Rehabilitation (PM&R) physicians from rehabilitation centers. The detailed functioning of the MD was explained by the engineers. Visual analysis of the gait cycle of LLA, a tool approaching the three planes of space, was explained by the PTs. This tool was adapted to the new MD. The new MD, with its embedded sensors, can detect the gait cycle phases and the environment (incline, decline, side slope, stairs) to adapt. The knee and ankle joints work in synergy and are monitored by a microprocessor.

Results

Rehabilitation process takes into account new possible movements with this innovative leg prosthesis; it is supported by exteroceptive, proprioceptive and kinesthetic sensibilities of the patient during the various phases of the gait cycle. Feeling the foot coming flat to the ground is first fulfilled with small steps on flat ground, then walking backwards, forwards and sideways; finally walking on a downward slope. The ankle dorsiflexion joined to the knee flexion in stance is brought with the stand-to-sit transition, 50/50% weight on each leg, both feet at the same level. Then going downstairs with the foot flat on the step is tested. The ankle dorsiflexion in swing phase is easily perceived when walking upward a slope, finally on flat ground.

Discussion/ conclusion; conclusion for the practice

Designing this specific rehabilitation process emphasizes the importance of understanding how the device works, and synchronizing all the sensibilities to the gait cycle, to optimize the “patient – prosthesis” couple. Re-education steps are different from classical ones. These steps check the prosthesis is well aligned and assembly instructions well followed; it enables fine-tuning each setting independently.

References

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