

## **A NOVEL AMBULANT MONITORING SYSTEM FOR LOWER EXTREMITY LOADING DURING FRACTURE HEALING**

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Weight bearing stimulates fracture healing by micromotion in axial direction [1]. After osteosynthesis of a lower limb fracture, partial weight bearing is instructed in many patients for biomechanical reasons. Physical therapists instruct patients how to perform daily activities independently and safely with partial weight bearing, such as transfers from a bed or chair and walking. During instruction, a standard bathroom scale is often used to show the amount of weight loading. However, after instruction, patient compliance is low and overloading or underloading can occur. This limits patient safety and mechanotransduction in the bone, respectively. Current loading measurement techniques are inaccurate, only applicable when the patient is standing still or can only measure for a short period of time. Long-term monitoring of weight bearing during dynamic conditions with direct feedback to the patient could improve the rehabilitation. A device was developed to measure weight bearing in an ambulant setting and provide feedback to both patients and healthcare providers. The first prototype of our SensiStep device consisted of an insole sensor with a cable to electronics at the belt of the patient. In a feasibility study in 20 patients, clear differences were found between the early and late rehabilitation phase as well as between patients. Wearing the system was experienced as rather cumbersome. Recent developments incorporated wireless data communication from the insole to a feedback device and mobile phone application (app). Ambulant monitoring and online feedback were achieved. The complete SensiStep system consists of a sensor, sandals, app and feedback device. The feedback device can be worn on the wrist or mounted on the walking frame of the patient. Physical therapists can analyse data and

monitor patients directly via an app. The SensiStep batteries allow eight days of continuous monitoring. Technical and clinical validation measurements will be discussed.

1. Claes, L.E., et al., *Effects of Mechanical Factors on the Fracture Healing Process*. *Clinical Orthopaedics and Related Research*, 1998. **355**: p. S132-S147.