Load feedback during partial weight bearing

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Introduction

Previous literature shows the positive effect of partial weight bearing and early mobilization on the healing process [1].

Introduction of partial weight bearing can be achieved in various ways. Training with a bathroom scale is the most commonly used method [2, 3]. However, it is difficult to transfer a partial weight bearing feedback from static training to dynamic walking [4]. Therefore the determined load on the affected leg is often exceeded by more than 100% during walking [5]. Inadequate adherence to prescribed load bearing protocols leads to premature overload on the affected leg and may result in pseudarthrosis or implant failure [6, 7]. Training methods for partial weight bearing, which provide a concurrent feedback regarding loads during walking would be beneficial for therapeutic treatment [8]. The aim of this study was to examine the effectiveness of training for partial weight bearing using a mobile insole system. Therefore the direct influence of the feedback and the retention effect after training were analyzed.

Figure 1: Conventional introduction via bathroom scale for getting familiar with partial weight bearing

[1] Meadows TH et al. 1990. J Bone Joint Surg (Am).

[2] Jöllenbeck T et al. 2013. DRV-Schriften.

[3] Hurkmans HL et al. 2012. Arch Phys Med Rehabil.

[4] Klöpfer-Krämer I et al. 2010. Trauma Berufskrankheiten.

[5] Vasarhelyi A et al. 2006. Gait & Posture.

[6] Sakka S et al. 2011. Med Oral Patol Oral Cir Bucal.

[7] Roberts TT et al. 2012. Organogenesis.

[8] Krause D et al. 2007. Arch Phys Med Rehabil.

Methods

Twelve healthy persons affixed with Pedoped soles (Novel, Munich) that provide feedback training (8♂, 4♀) were compared to twelve healthy controls (8♂, 4♀) who did not receive any intervention.

All participants had to complete a walking trial before the feedback training (baseline). Afterwards the test persons were randomized into intervention and control groups. The effect of the feedback training was analyzed while walking with direct feedback (T1) and walking without feedback immediately after the training (T2) as well as seven days after the training (T3).

The ground reaction force was measured with the insole system and following parameters were used for further analyses:

Overload: duration of exceeding 250 N (% of total time)

Maximum load: maximum load during the measurement (N)

Figure 2:
Pedoped® insole (Novel, Munich, Germany)

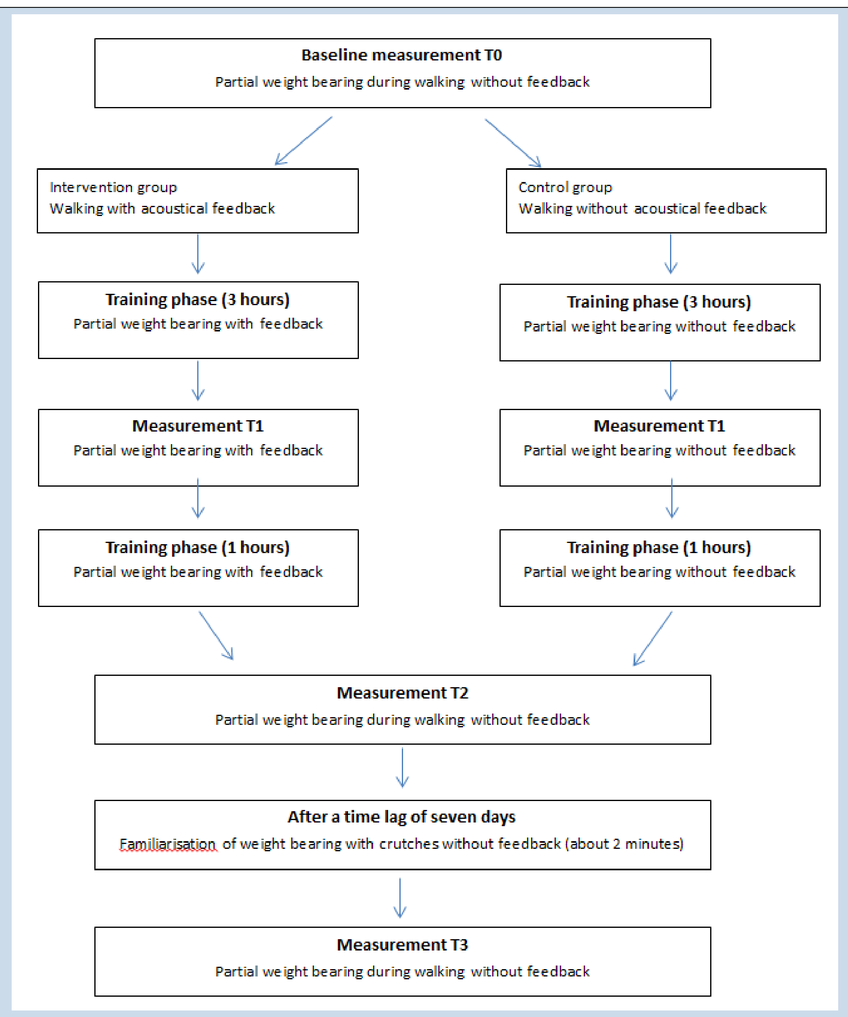

Figure 3: Study Design

Results

The results showed a significantly reduced time of overload and maximum load in the intervention group during walking with direct feedback compared to the controls (p≤0.001). While walking without feedback immediately after the training as well as seven days later, the intervention group had already showed an optimized way of partial weight bearing compared to the control group (p≤0.001).

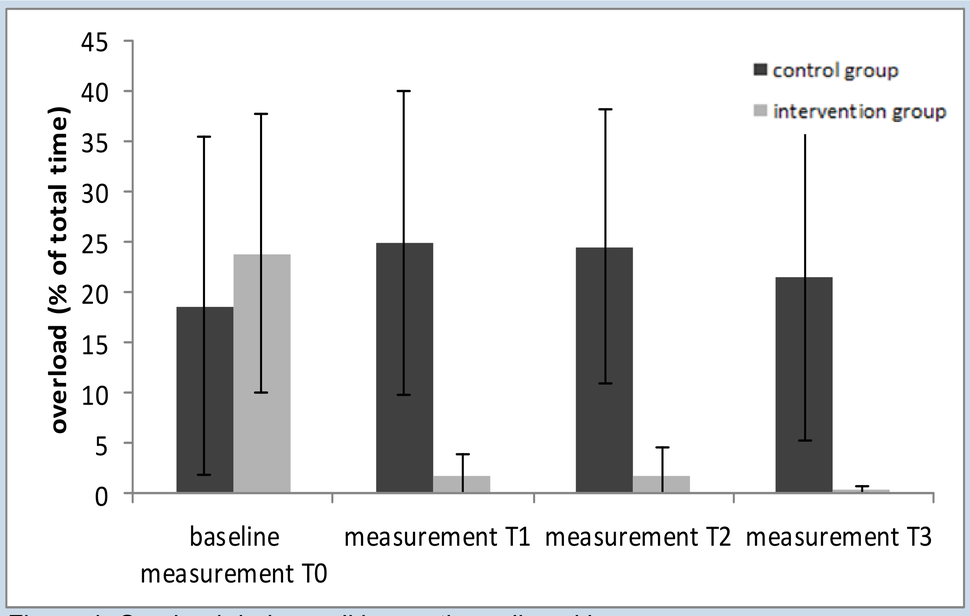

Figure 4: Overload during walking on the relieved leg

Conclusion

In conclusion, a feedback based insole system can optimize partial weight bearing prescriptions and support patients in an effort to not overload their affected leg. Additionally, dynamic partial weight bearing training with acoustical feedback provides a direct as well as an enduring retention effect.

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