

SENSORY SUBSTITUTION DEVICE TO INITIATE NEW WALKING PATTERN

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INTRODUCTION

Augmented information can be referred as biofeedback when a biological process is measured electronically and about features of the movement that cannot ever be perceived directly. Biofeedback methods based on mechanical parameters showed beneficial effect in correcting complex abilities such as walking [1]. In a clinical context the biofeedback procedure aimed to replace an altered sensory feedback by concurrent artificial information. In the present study we aimed to compensate damage internal feedback using a sensory substitution device.

METHODS

The device called B.I.R.D (Baropodometric Information Return Device) is intended to cue the subjects to initiate a new walking strategy [1]. The principle of the device is to feedback in real time information relative to the distribution of the plantar pressure.

Eighteen healthy subjects without foot or gait abnormalities took part in this investigation. They first performed a walking test on the floor (100 consecutive steps) to record the peak plantar pressure (PP) distribution in a diagnostic condition. Then, subjects were told to relieve the first metatarsal head region (M1) with accuracy of the right foot only, during 100 other steps performed using the B.I.R.D system. When subjects relieve M1 by 5% to 20% of the PP reference, then the step is considered as a success. Each subject had to perform the foot relief under three conditions. The first condition (Control) corresponded to the no biofeedback condition. The second condition (Placebo) consisted to apply a placebo cream (Vita E) under the plantar surface of the foot. The third condition (Experimental) consisted to apply a topical local anaesthetic (EMLA 5%) to the entire sole of the feet. EMLA cream was selected as a treatment for effective topical anaesthesia and minimal side effect [2], his non-invasive technique and long term effect. From the recording, we computed the Pressure to Time Integral (PTI) at each of the 6-sensor locations for each foot

RESULTS AND DISCUSSION

The descriptive results showed that subjects in the control condition performed 21.6% of success steps while in the placebo and experimental condition the percentage were 57.5% and 58.2% respectively. These results indicated that in the two biofeedback conditions the unloading task was

easily performed. The cream effect did not negate the capacity of the subjects to relieve M1 with accuracy. The Figure 1 showed the PTI redistribution after the foot unloading. Results reported that a success step did not induce significant PTI repercussion under the contralateral foot and unloaded foot.

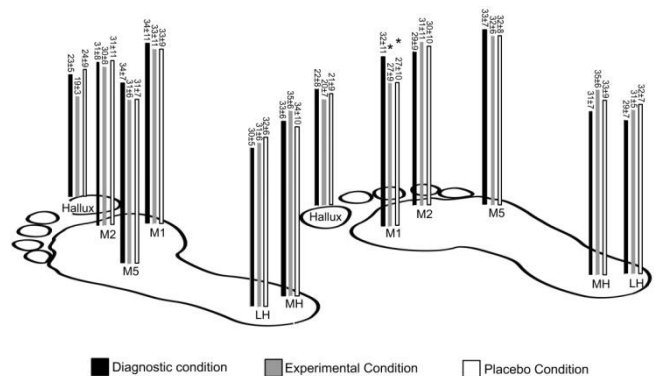


Figure 1: PTI redistribution after the foot unloading of right M1. Mean (SD), values are in kilopascal. *: significant differences with the diagnostic steps ($p < 0.05$). LH: lateral heel, MH: medial heel, M1,2,5: metatarsal heads 1,2,5 and the Hallux

CONCLUSIONS

From the descriptive results, the supplemental artificial information delivered by the biofeedback device is of interest to initiate new walking pattern. The artificial informations seemed to have compensated the reduced sensory feedback. The biofeedback procedure should be promising to modify gait strategies in pathological gait such as in diabetic population.

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