

RELIABILITY ASPECTS OF SENSORY MEASUREMENTS

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INTRODUCTION

The foot as a sensory organ is discussed since several years. It has been shown that somatosensory input information from the foot has a major influence in the control of human balance [1, 2]. Furthermore, e.g. in Parkinson's Disease – that is associated with impaired balance control – the sensitivity of the plantar foot is dramatically reduced in comparison to healthy, age matched subjects [3]. Moreover, it is well accepted that sensory input plays an important role in the perception of comfort and fit of shoes [4]. Nevertheless, only few studies have been published regarding methodological aspects of sensory measurements. Overall, statistical aspects as reliability of sensory measurements have to be analyzed considering the quality of sensory data. Therefore, the purpose of this paper is to discuss reliability aspects of sensory measurements.

METHODS

Inter-day (ID) and inter-tester (IT) reliability were tested in different sensory measurement protocols - 2-point touch (2PT), vibration and touch thresholds. All data were collected by two different testers and on two following days for each subject.

For the 2-point-touch threshold measurements 30 subjects (age: 25,8±4,1 years, height: 177,0±8,7 cm, weight: 72,1±11,1 kg) participated in the study. 2PT were measured at four anatomical locations of the dominant foot: plantar aspect of the Hallux (PH); dorsal aspect of Metatarsal head I (D MetI); medial aspect of Met I (M MetI); lateral aspect of Metatarsal head V (L MetV). A modified digital vernier calliper (Technologiezentrum W-tec, Wuppertal, Germany) equipped with a customized force transducer has been used. The procedure of the protocol for the 2PT and touch threshold measurements has been described by [4]. 2PT and touch threshold data were collected in supine position under constant foot and room temperature.

For the vibration and touch measurements a second population of 19 subjects (age: 26,3±4,1 years, height: 178,8±9,1 cm, weight: 72,3±7,5 kg) participated in the study. Vibration thresholds were measured with a vibration exciter (200Hz) at three anatomical locations of the right plantar foot: Heel, 1st. Metatarsal Head (MET I) and Hallux. Vibration thresholds were collected with subjects seated and under constant temperature conditions. Vibration amplitude was raised from zero until the amplitude that subjects could perceive (vibration perception threshold). Five repetitive trials were performed for each location. Measurement locations were randomized within and between subjects. For data analysis the lowest CoV of at least three trials was used to select the most homogeneous measurements. Means and standard deviations were calculated from these trials. To analyse the reliability, all data were evaluated by the Bland & Altman procedures [5, 6].

RESULTS AND DISCUSSION

The statistical analyses revealed good results for the inter-day and inter-tester reliability of touch and vibration thresholds (table 1).

For 2 PT, good inter-day reliability for all analyzed foot locations could be determined. 95% of the data are located within the limits of agreement (RMSEx1.96). Only sufficient data were evaluated for the inter-tester reliability.

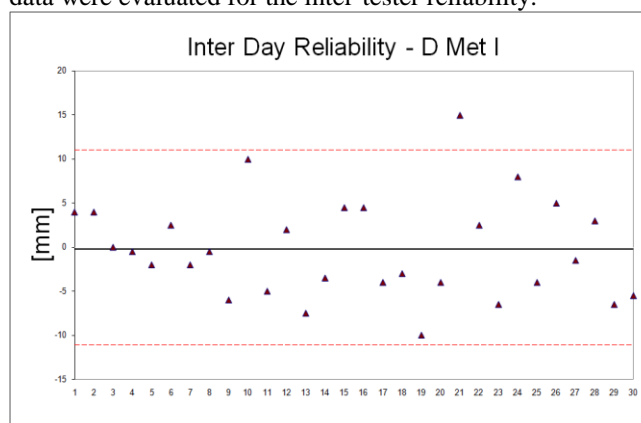


Figure 1: 2PT inter-day reliability of D Met I

Large differences of repeatability (RMSEx2.77) [6] were found in different foot locations (table 1) for the 2PT - data.

Location	Heel	MetI	Hallux	
Touch [g] ID	0,86	1.03	0,80	
Vib [µm] ID	4,57	4,42	4,40	
Touch [g] IT	0,33	0,94	0,46	
Vib [µm] IT	5,60	4,21	5,65	
Location	D MetI	M MetI	L MetI	Hallux
2PT [mm] ID	10,87	6,53	4,81	4,53
2PT [mm] IT	9,23	8,17	6,98	5,78

Table 1: repeatability for 2PT, touch & vibration

CONCLUSIONS

Inter-day and inter-tester reliability of 2PT, vibration and touch threshold were found to fulfill statistical demands on scientific protocols. Especially for the protocol of intervention studies these findings may be helpful to interpret the power of the results.

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