Reliability of pelvic floor muscle electromyography during running in continent and stress urinary incontinent women

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Introduction

There is a large body of evidence about the beneficial effects of physical activity for the individual health. However, many women withdraw from participation in sports as running, due to the embarrassing condition of stress urinary incontinence (SUI). A high prevalence of 41% has been found in female elite athletes with the highest prevalence in sports involving impact activities.
Dynamic activity measurements of the pelvic floor muscles (PFMs) during whole body functional movements, such as running, contribute to better understand the pathophysiology of stress urinary incontinence [1]. Analysis of reliability is important in order to get information about the consistency of a measurement and whether a systematic measurement error affected the results [2]. Aspects of the intra-session reliability of PFM activity during running in a young and continent sample have been reported previously [3]. The authors recommended to further investigate reliability in an SUI population.

Objectives

The aim of this study was to determine the intra-session reliability of the temporal and magnitude components of EMG activity during running at three different speeds in continent (CON) and SUI-affected women.

Methods

Fifty women were included in this exploratory cross-sectional study (CON: n=28; SUI: n=22). SUI was diagnosed according to the ICIQ-UIsf questionnaire. Surface EMG activity from the PFMs during running on a treadmill was recorded with a vaginal probe, bandpass filtered (20-500 Hz) and parametrized by RMS values. EMG was measured during 10 steps at speeds of 7, 11 and 15 km/h. Data from 30 ms before to 150 ms after heel-strike were RMS-parameterized to 6 time-intervals of 30 ms. The reference value, set as 100% for EMG normalization, was calculated as the mean of the peak activity during two maximum voluntary contractions (MVC). Descriptive statistics, ICC (2,1), SEM, MD and ANOVA were computed for the EMG of the 6 time-intervals, amplitude (EMGmax) and time point (tEMGmax) of maximum EMG.

Results

All variables demonstrated no systematic error (ANOVA n. s.). Ranges of reliability indices of the seven EMG-variables (%MVC) are presented for CON and SUI and different speeds: (CON, 7 km/h: ICC = .535-.692, SEM = 12.3-22.0, MD = 8.8-15.4), (CON, 11 km/h: ICC = .581-.777, SEM = 16.0-33.9, MD = 9.7-19.3), (CON, 15 km/h: ICC = .699-.864, SEM = 20.3-37.1, MD = 11.9-15.5), (SUI, 7 km/h: ICC = .746-.915, SEM = 18.2-32.7, MD = 9.9-11.1), (SUI, 11 Km/h: ICC = .780-.926, SEM = 18.2-31.5, MD = 7.4-14.6), (SUI, 15 km/h: ICC = .750-.886, SEM = 27.6-47.2, MD = 14.0-20.0). Referring to the time variable (ms), ICCs ranged from .392-.585 in CON and .380-.623 in SUI, SEM ranged from 369.4-441.0 in CON and 507.6-511.9 in SUI and MD from 357.3-387.9 in CON and 389.9-499.5 in SUI.

Conclusions

ICC values of the EMG variables (as relative reliability measures of pre-activation and reflex activation of the PFMs) indicate a moderate to good reliability. SEM and MD values - as a measure of absolute reliability - show moderate reliability.

A tendency of higher reliability with increasing speeds can be observed, which may be interpreted as less variation in the running performance with higher speed.

The low reliability of the time variables reported in the present study is consistent with previously published results (3) and may imply that temporal function varies more across the strides.

Contrary to the low reliability seen in the temporal component of muscle activity, the magnitude components of muscle activity (%MVC) were more reliable.

The analysis of reliability showed that there was no systematic error of measurement. Yet, the random error does not seem to be negligible and therefore prospective efforts for the evaluation of PFMs EMG should aim to improve reliability. Future studies could consider inter-session reliability and whether the average of 20-30 steps might yield better reliability indices.

References

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Keywords

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