

Smallest detectable change in propulsion wheelchair tests on a wheelchair ergometer

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Introduction

The wheelchair ergometer (Lode Esseda) can be used to monitor propulsion variables of wheelchair users, for example to evaluate wheelchair adaptations.

In order to interpret the outcomes of the measurements and to support clinical decision making, it is important to distinguish real changes in propulsion technique and physiological outcomes from measurement errors.

Objective

To determine the smallest detectable change (SDC) of the measured physiological and propulsion technique outcomes.



Methods

- 19 able-bodied participants.
- Participants provided four trials on the wheelchair ergometer (2 handrim types were tested twice each).
- Each trial consisted of 30 seconds sprint and a four-minute submaximal duration test.
- Spirometry and kinematic data were collected.
- The ICC, SEM, SDC were calculated for 2 physiological and 11 propulsion technique outcomes.

Results

Table 1: Sprint test

	Mean (SD)	ICC	SEM	SDC
Distance after 10 sec (m)	21.40 (3.63)	.91	1.09	3.02
Distance after 20 sec (m)	45.90 (7.39)	.86	2.76	7.66
Maximum speed (m/s)	2.80 (.41)	.90	.13	.36
Mean speed (m/s)	2.30 (.37)	.82	.16	.44
Maximum Power (W)	275.20 (107.54)	.96	21.51	59.62
Mean Power (W)	59.40 (19.85)	.96	3.97	11.00
Asymmetry (% difference in attained distance between R/L after 10 sec sprint)	8.66 (8.35)	.60	5.28	14.64

Table 2: Duration test

	Mean (SD)	ICC	SEM	SDC
Push frequency (push/min)	62.40 (15.33)	.95	3.43	9.50
Mean cycle duration (s)	1.03 (.29)	.97	.05	.14
Mean contact time (s)	.21 (.04)	.89	.01	.04
Asymmetry (% difference in attained distance between R/L at the end of 4min duration test.)	2.86 (2.51)	.74	1.28	3.55
Heart Rate percentage (% Mean_HR _{test} /Mean_HR _{rest} *100)	152.10 (17.53)	.78	8.22	22.79
Gross Mechanical Efficiency (%)	5.90 (1.49)	.70	0.82	2.26

Discussion and Conclusion

Test-retest reliability is good to excellent for most outcomes.

The ICC, SEM and SDC can be further improved by using experienced wheelchair users, since unexperienced able-bodied participants are less consistent in their technique [1].

Also, the SEM and SDC will further improve by performing repeated trials and taking the average over these trials [2].

Clinical message

These results contribute to interpretation of the wheelchair ergometer data and define real changes from measurement errors due to wheelchair adaptations or interventions.

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