Effect of holding a racket on propulsion technique of wheelchair tennis players

Sonja de Groot

Femke Bos
Jorine Koopman
Aldo Hoekstra
Riemer Vegter

university of groningen

Introduction

Reade
revalidatie | reumatologie

Wheelchair tennis vs. other wheelchair sports:

-> different propulsion

Optimize propulsion in wheelchair tennis ->

important to study the effect of holding a racket on propulsion technique

university of groningen

Introduction

Reade
revalidatie | reumatologie

Goosey-Tolfrey & Moss (2005):

Maximum velocity was reduced during the racket condition

Reduction in achieved velocity during the first three pushes

-> ineffective propulsion technique while holding a tennis racket?

Purpose

To investigate possible differences in propulsion technique between propelling the wheelchair with and without a racket in the hand.

university of groningen

Methods

Reade
revalidatie | reumatologie

Participants: 8 experienced wheelchair tennis players

Personal characteristics	
Men/Women (N)	4/4
Age (years)	23.0 (6.4)
Body mass (kg)	63.4 (15.2)
Height (m)	1.72 (0.09)
Disability	
Paraplegia	3
Spina Bifida	2
Short femur, hip deviation	1
Hip dysplasia	1
Spastic legs	1
Wheelchair tennis level	
International youth / adults	5/3

university of groningen

Methods

Reade
revalidatie | reumatologie

Design

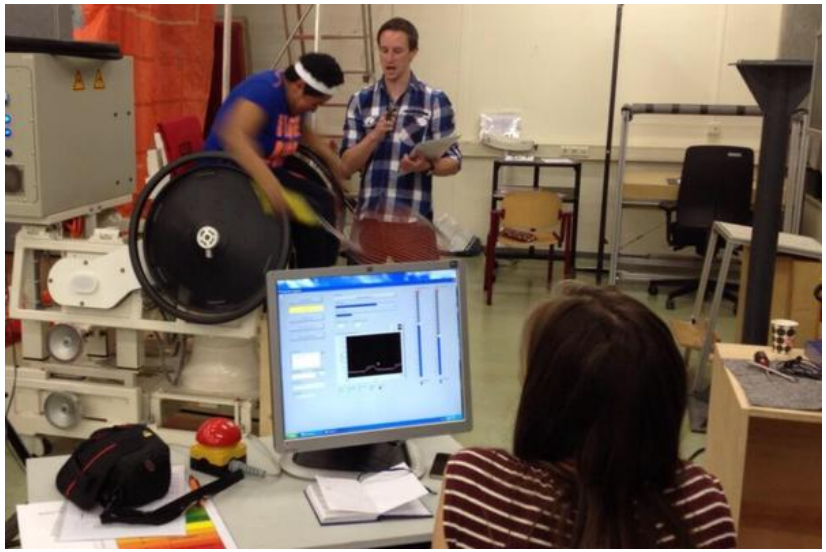
3 Submaximal exercise tests and 6 sprints on a wheelchair ergometer

Submaximal

1) 1.5 m/s on 0.15 W/kg without racket
2) 1.5 m/s on 0.15 W/kg with racket
3) 1.5 m/s on 0.25 W/kg with racket

Sprint

1-3) With racket at 0.25 W/kg
4-6) Without racket at 0.25 W/kg



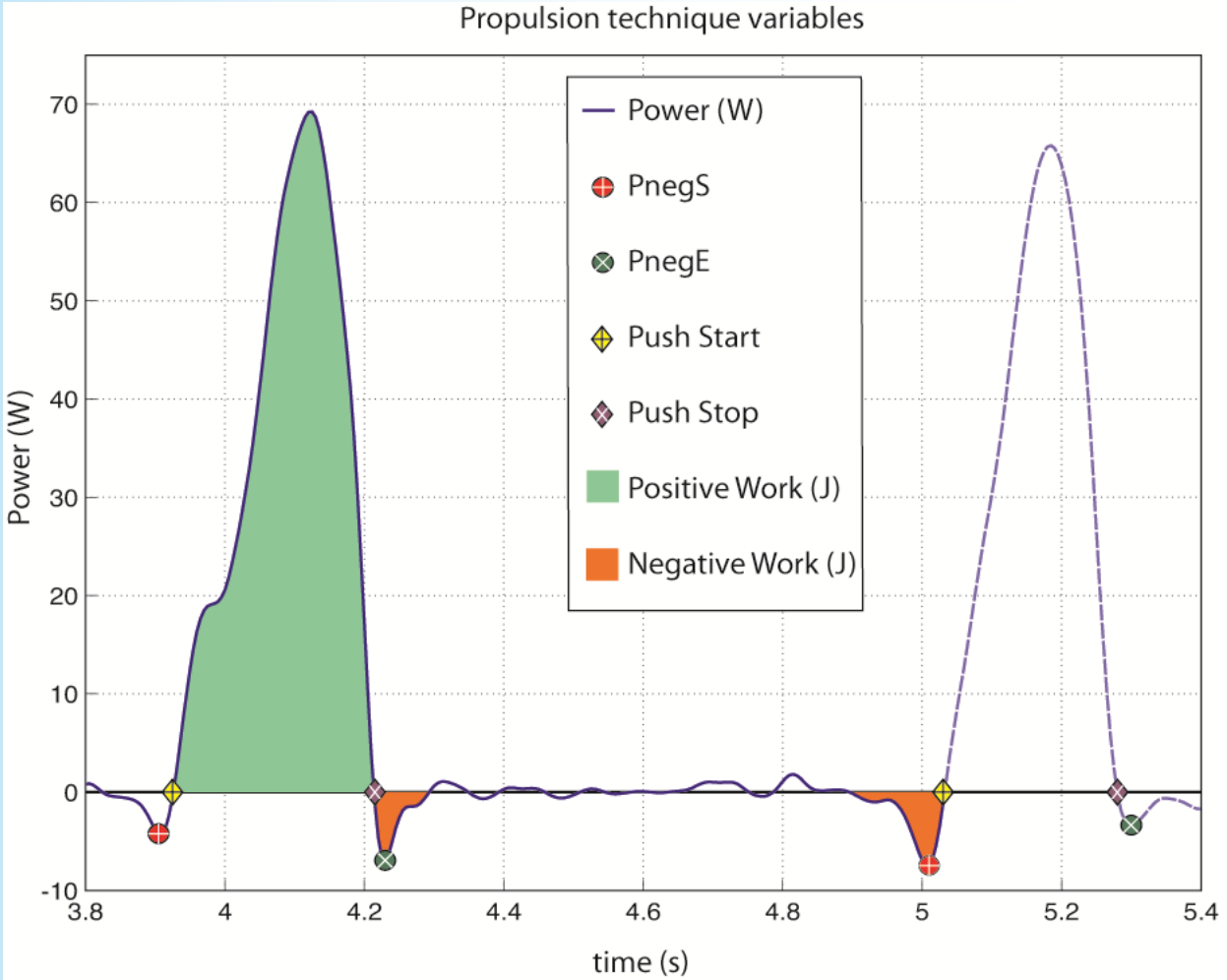
university of groningen

Methods

Reade
revalidatie | reumatologie

Data analysis

Propulsion technique out of torque and velocity signals



Push frequency

Push time

Power loss before push

Power loss after push

POpeak during push

POmean during push

Overall mean speed

Vegter et al., 2013

university of groningen

Methods

Reade
revalidatie | reumatologie

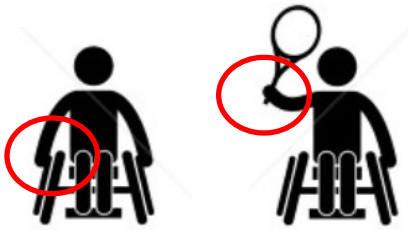
Statistics

Racket hand vs. non-racket hand during blocks with racket:

- Repeated measures ANOVA
- 2 within factors:
  - -racket vs. non-racket hand;
  - -exercise blocks 0.15 and 0.25 W/kg

Same hand, with and without racket during the 0.15 W/kg blocks:

- paired sample t-test



university of groningen

Results

Reade
revalidatie | reumatologie

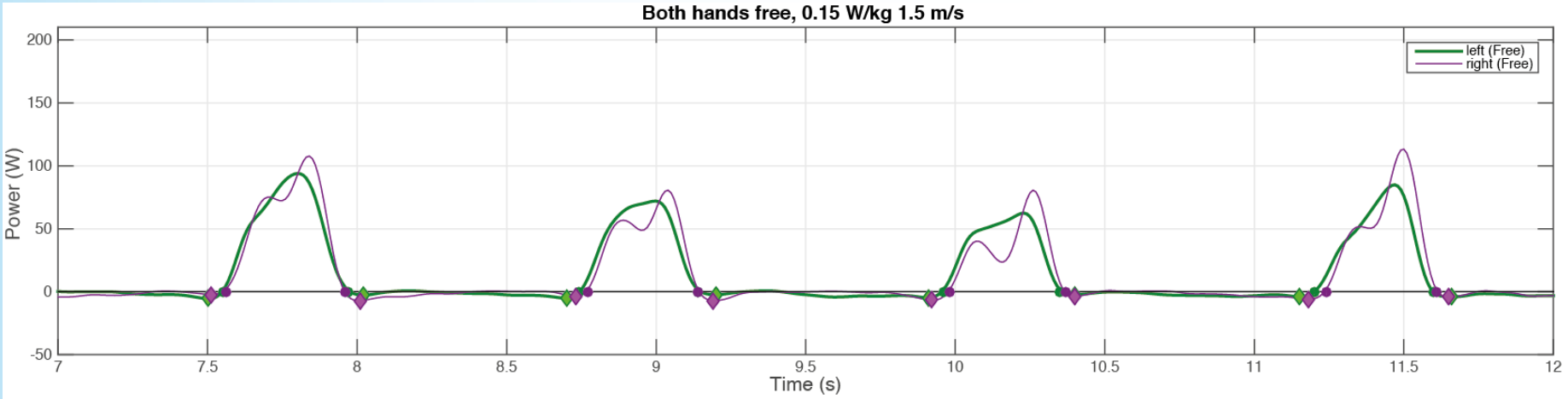
Propulsion technique	Racket side vs. non-racket side
Push frequency	=
Push time	↓
Power loss before push	↑
Power loss after push	↑
POpeak during push	↑
POmean during push	↑
Overall mean speed	↓

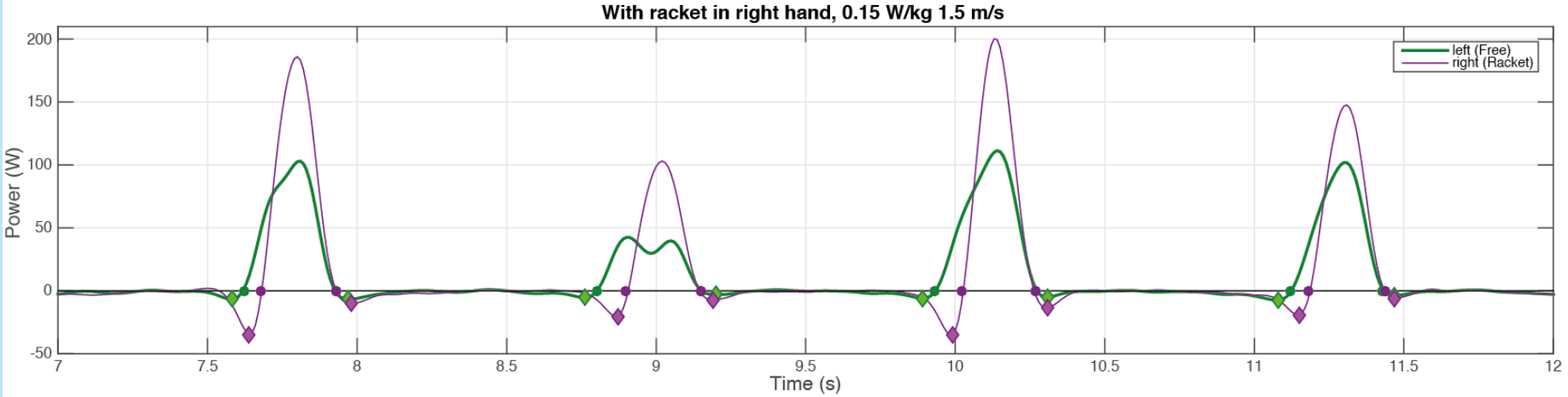
- Same hand compared when propelling with and without racket: similar significant differences, except for mean overall speed.
- 5s Sprint tests with and without racket showed also similar results

university of groningen

Results

Reade
revalidatie | reumatologie



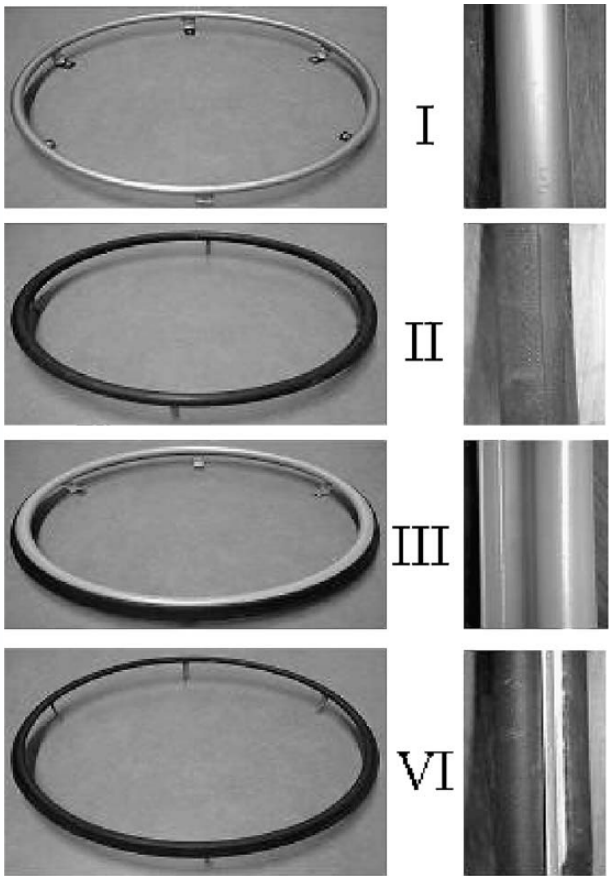


Discussion

How to avoid high power loss when coupling the hand/racket to the rim?

Change in grip of the racket?

- Shape
- Material



Change in hand rim?

university of groningen

Discussion

Reade
revalidatie | reumatologie

Injuries:
Ineffectiveness in propulsion technique (higher peak forces at same workload) caused by the racket might be related to injuries of the upper extremity.

Future studies:

- Monitoring upper-extremity injuries in wheelchair athletes
- Evaluate load on the shoulder with musculoskeletal modelling

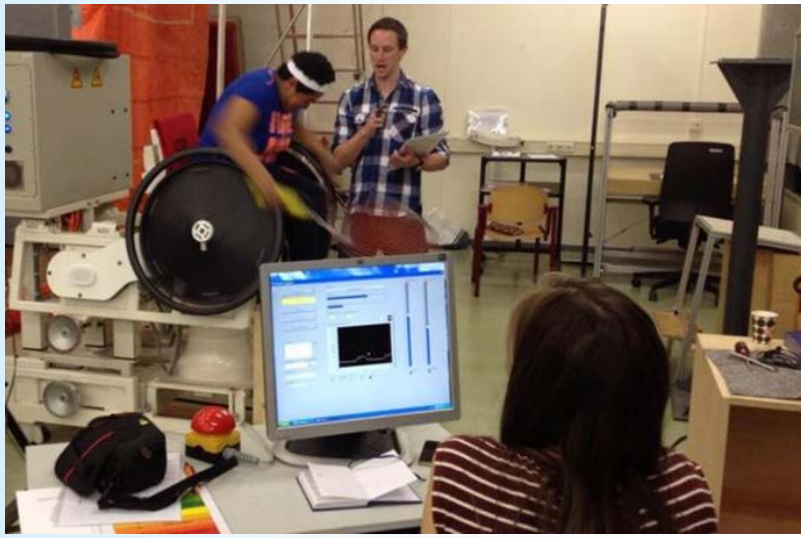
university of groningen

Discussion

Reade
revalidatie | reumatologie

Limitations:

- Stationary wheelchair ergometer
- Steady-state wheelchair propulsion, e.g. no braking, maneuvering



university of groningen

Conclusion

Reade
revalidatie | reumatologie

- Propelling the wheelchair while holding a racket has negative effects on the propulsion technique.

- On the long term the ineffectiveness in propulsion technique caused by the racket might be related to injuries of the upper extremity, since the racket arm has to endure higher peak forces at the same workload compared to the free hand.

university of groningen

VU UNIVERSITY AMSTERDAM

DE HAAGSE HOGESCHOOL

KNLTB NLTennis

Reade revalidatie | reumatologie

Thank you for your attention!