Acceleration Profile during 20-m Sprints in Elite Wheelchair Tennis Players

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Movement patterns in wheelchair tennis:
- intermittent,
- multidirectional and
- non-random

Movement around the tennis court is particularly complicated as players are required
to interface with the chair, and
react to the movement of the ball

Fundamental to wheelchair tennis is the ability
to accelerate from
- a stationary position (particularly when serving or changing direction) and
- rolling starts during match-play
Introduction (2)

- Speed and distance have been measured previously in wheelchair tennis matches (Goosey-Tolfrey et al. 2005; Sindall et al., 2013)
- An additional and important aspect in wheelchair court sports, including tennis, is the ability to accelerate
- Currently, little is known about the acceleration capabilities of elite wheelchair tennis players.
  - Mason et al. IJSM 2012, Sindall et al. (velocometer; Cooper, Pittsburgh); gyroscope, local GPS
Purpose

➢ To determine the acceleration profile of elite wheelchair tennis players during a 20-m sprint (and during doubles match play)
➢ To investigate whether acceleration is an important parameter of wheelchair tennis performance
  ➢ Differences between 3 divisions (Men, Women, Quads)
  ➢ Relation with ranking
  ➢ Relation with tournament results
Participants

- 32 elite wheelchair tennis players
  - 14 men (M)
  - 12 women (W)
  - 6 quads (Q; all men)
- Participants 2012 Invacare Doubles Masters, Amsterdam
Measuring Acceleration

- During match play (data not shown today):
  - Triaxial accelerometers (Delsys Trigno Wireless) on axle of wheelchair
- During 20-m sprints
  - Accelerometers
  - Timing (speed) gates
20-m Sprint Drill

- Timing over 2.5 and 5m: measure of speed off the mark, but also indication of functional strength
- Not often full-court sprint, but 20m sufficient to reach peak velocity
- The placement of the timing gates placed at intervals allows for the assessment of acceleration and changes in speed throughout each sprint
Results: Time

20m Sprint Times

- M > W > Q
  - all time points
- NR > R 2nd part
  - no interaction
Results: Speed

20m Sprint Speeds

- M > W > Q
  - all time points
- NR > R 2nd part
  - no interaction
Results: Acceleration

M > W and Q
W and Q overall not sign different; larger differences during first part
with racket, differences smaller

Maximal acceleration higher in M than in W and Q (17.8±3, 14.2±3, 14.0±2 m.s⁻²)
Results: Relation w Ranking

- **Men:**
  - doubles ranking - accel. 5-10m (r = -0.47; p = 0.088); 10-20m (r = -0.74; p = 0.003)

- **Women:**
  - doubles ranking - accel. 0-2.5m (r = -0.78; p = 0.003); 5-10m (r = -0.47; p = 0.042)

- **Quads:** no significant relations or tendencies found

![Graph showing acceleration 10-20m for men doubles ranking tournament. The equation is y = -0.0054x + 0.33, with R² = 0.54.]
Results: Relation w Tourny Results

- **Men:**
  - Tourny result - acceleration 5-10m ($r = -0.81$); 20-m time ($r = 0.65$)

- **Women:** no sig. relations

- **Quads:**
  - Tourny result - acceleration 0-2.5m ($r = -0.79$)
Discussion/Conclusions

- M accelerated faster than W and Q, and were faster at all distances during the 20-m sprint.
- W had a faster 20-m time than Q, predominantly due to a faster initial acceleration.
- Maximal acceleration was considerably higher in M than in W and Q, while there was no difference between W and Q.
- Player’s doubles ranking in M appears related to the acceleration during the latter part of the 20m, while in W the ranking is stronger related to the acceleration during the first part.
- Tournament results were significantly related to some acceleration parameters in M and Q, suggesting that acceleration capability is an important determinant of wheelchair tennis success.
- NB. Acceleration dependent on several factors: muscle function, propulsion technique, wheelchair drag.