CASA Reade
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Effects of trunk muscle activation on trunk stability, arm power, and performance in wheelchair rugby players with a spinal cord injury

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"High performance, vital people"

Introduction

- Important aspects in wheelchair rugby (WR): quick turning, braking, acceleration from standstill, ball handling, and reaching.
- These largely depend on trunk stability and upper extremity power; often impaired in WR players
- Low blood pressure (BP) may additionally reduce performance

Introduction

- (Extreme) seat configuration , abdominal strapping , compression stockings often used to counteract problems
- May solve some problems but may also cause more problems: impaired reaching/RoM, wheelchair propulsion

Introduction

- Electrical stimulation of erector spinae and rectus abdominis muscles can increase trunk stiffness in AB (Vette et al. 2015)
- Implanted ES of trunk muscles can improve stability, reaching, and wheelchair propulsion in SCI (Triolo et al. 2009, 2013)

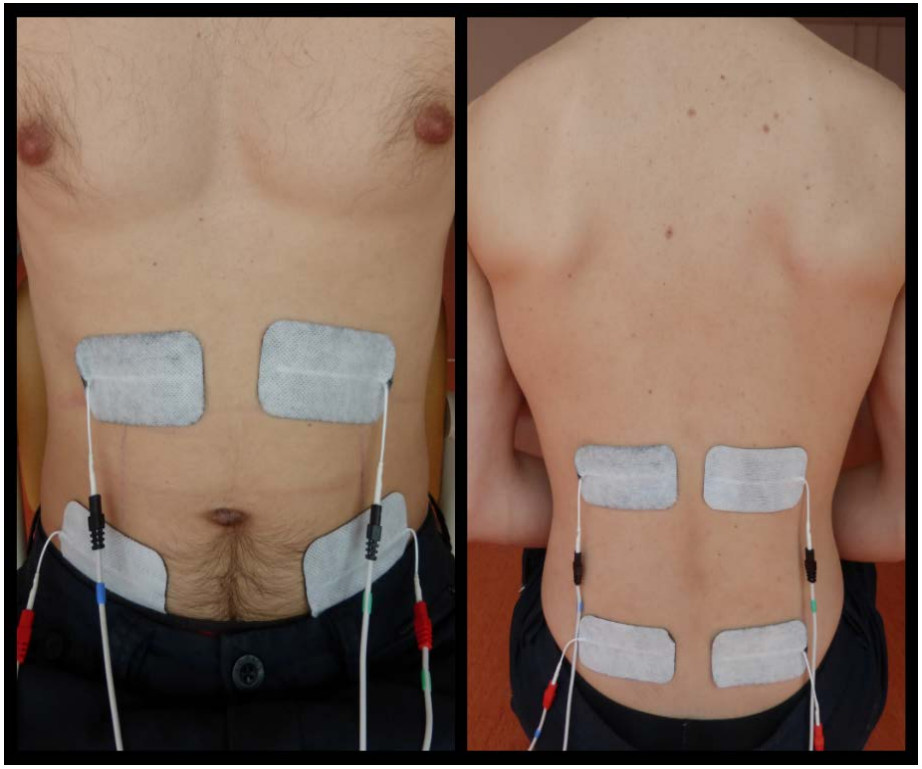
- Purpose: to assess the effects of ES activation of trunk muscles on WR performance in athletes with high SCI
  - Co-contraction abdominal and back muscles
    - increases stability, leading to more arm power
    - Increases abdominal and blood pressure
  - Leading to better WR performance

Methods: Participants

Participant	Age (yr)	Gender	Lesion Level	Motor Complete	Time Since Injury (yr)	Wheelchair Rugby Experience (yr)	Classification
1	47	M	C6	Complete	28	22	0,5
2	30	M	C4-5	Complete	8	5	0,5
3	29	M	C6	Incomplete	13	12	1
4	27	M	C6	Incomplete	4	1,5	1,5
5	33	M	C5-6	Incomplete	5	4	1,5
6	46	M	C6	Complete	17	15	1,5
7	60	M	C4-5	Incomplete	47	20	2
8	51	M	C7	Incomplete	34	22	2,5
9	45	F	C4	Incomplete	14	2	2,5
10	46	M	C7	Incomplete	13	12	3
11	44	M	C4	Incomplete	10	3	3

Methods: Electrical Stimulation

- Compex 3 Professional portable 4-ch stimulator
- Rectus abdominis, obliquus externus abdominis, and erector spinae muscle
- Continuous, biphasic, 30 Hz, 300 µs
- Current amplitude: 30-100 mA, individual comfortable level
- Blood pressure measured in rest and 2 min of ES.



Methods: Arm Force/Power

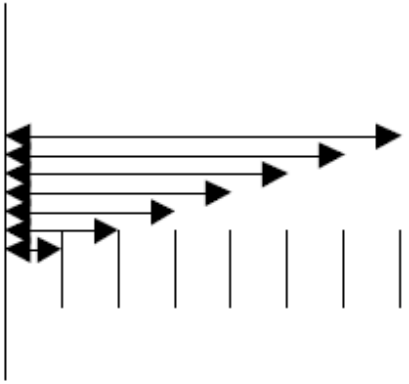
- N=5
- Closed-chain attachment
- Max. isokinetic push 24 cm/s, pull 61 cm/s
- 6 attempts per arm, with/without ES
- Peak force/power recorded and averaged

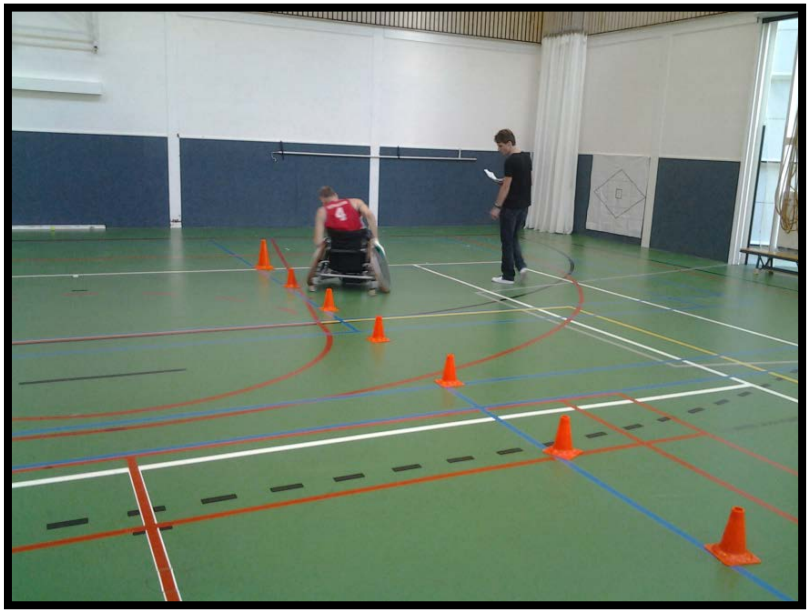
Methods: Trunk Stability

- Own daily wheelchair, no strappings; ES/No-ES
- Reaching **forward**, 2 arms 90° shoulder anteflexion
- **Lateral** (90°), **diagonal** (45°), dominant/non-dom. arm, other on chest
- Push away tube as far as possible **and** return to starting position

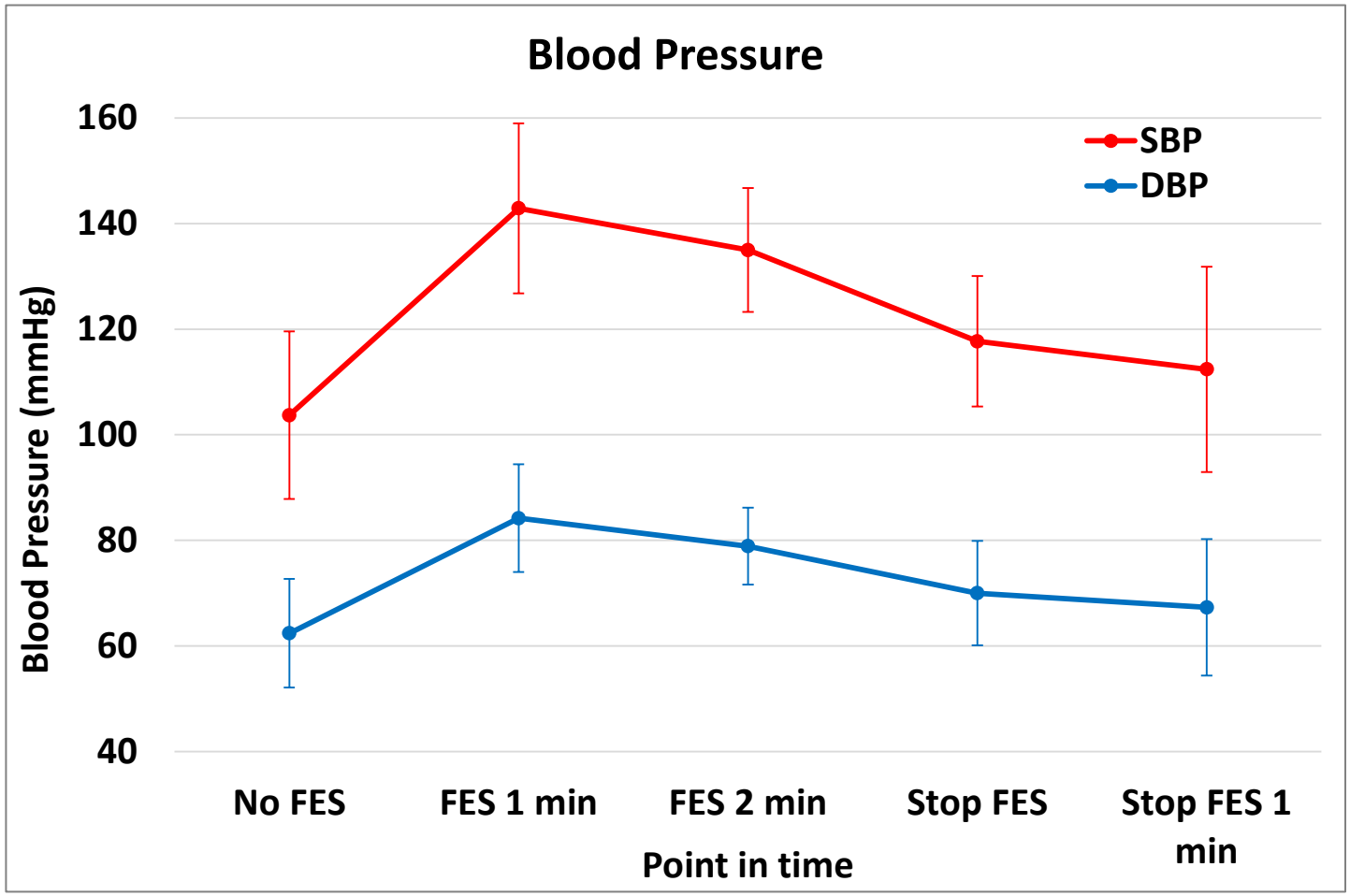
Methods: Rugby Performance

- N=7
- USA Wheelchair Rugby Skill Assessment
- 5 field tests: passing skill test, 20-m sprint, slalom, endurance sprint, ups-and-backs
- Own rugby wheelchair, with strapping, ES/No-ES

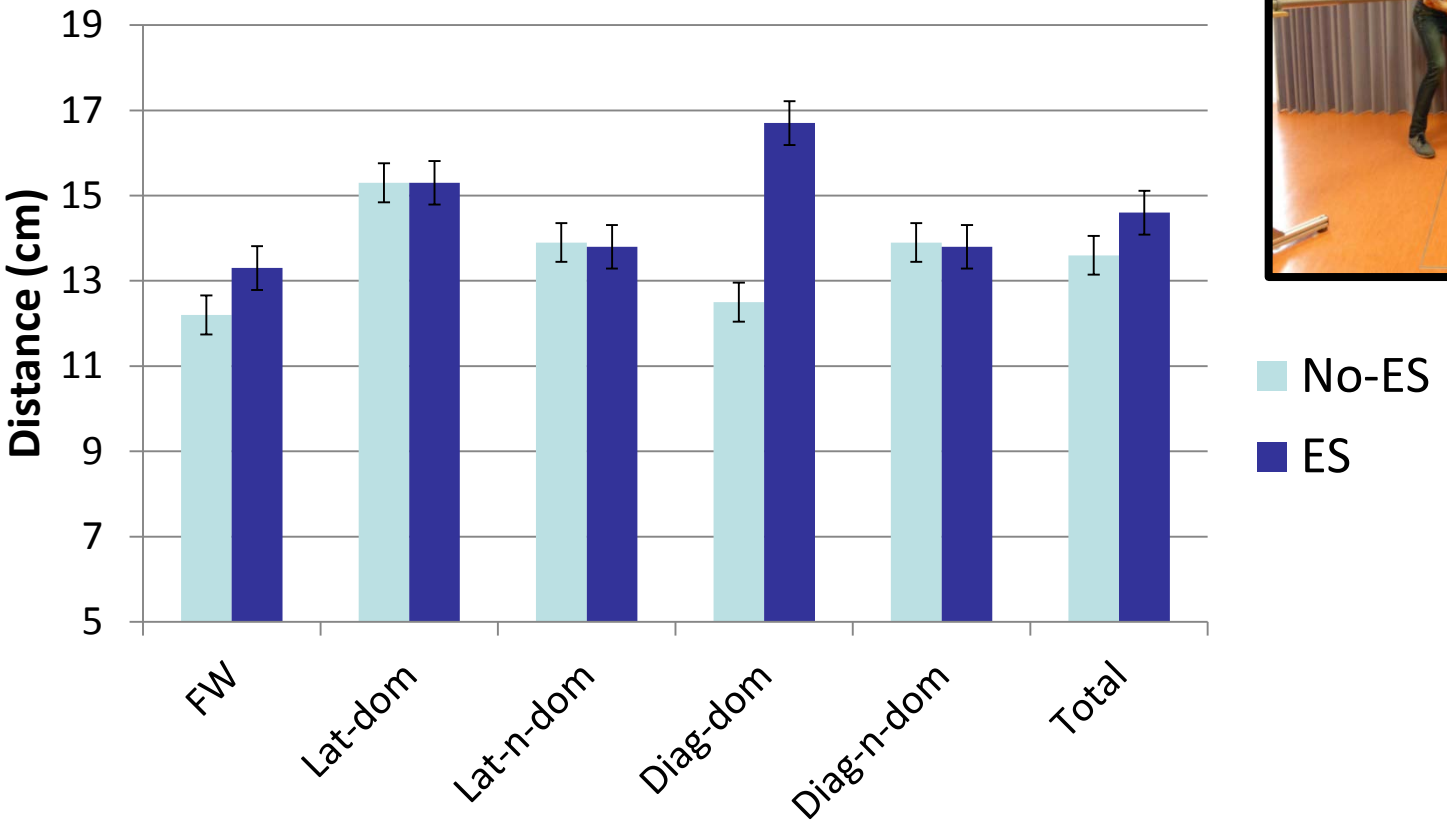




Results: Blood Pressure

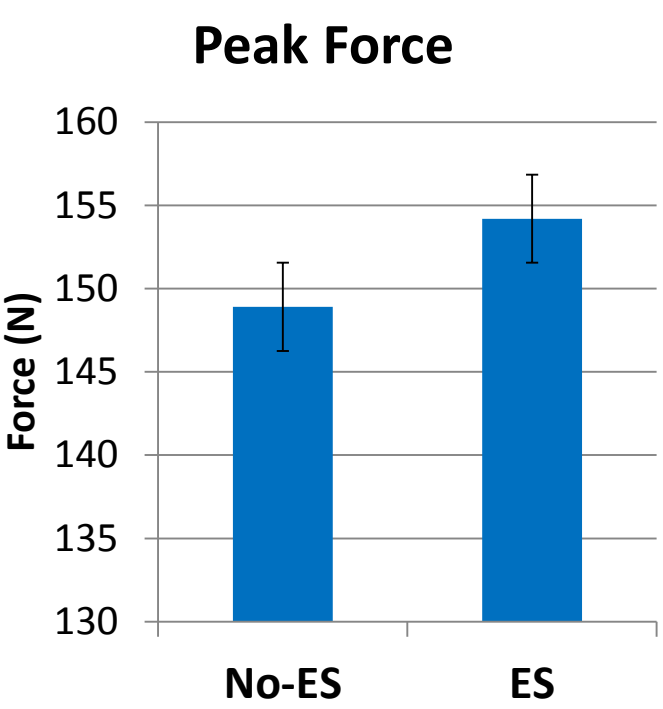


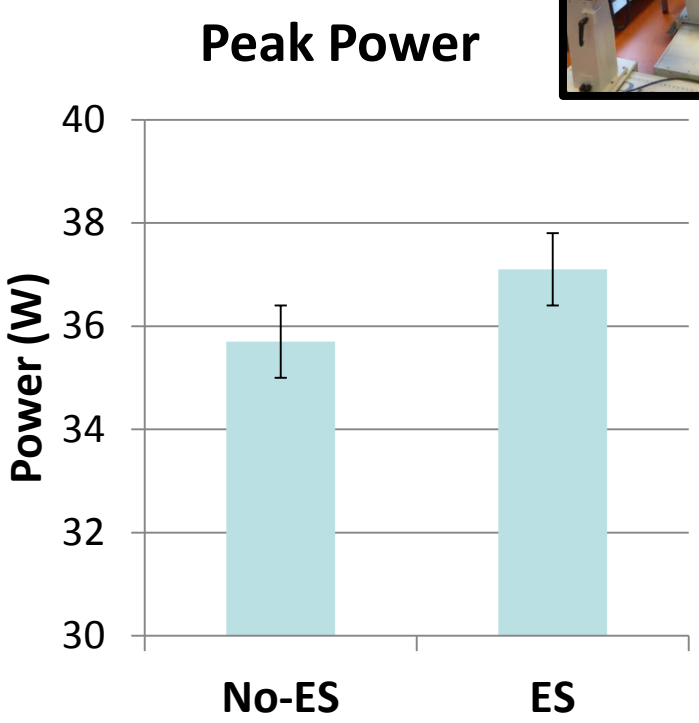
Results: Stability-Reaching



- Significant increase in reaching overall (+7.4%), especially due to diagonal on dominant side (+34%)
- No effects on lateral reaching; other activation necessary?

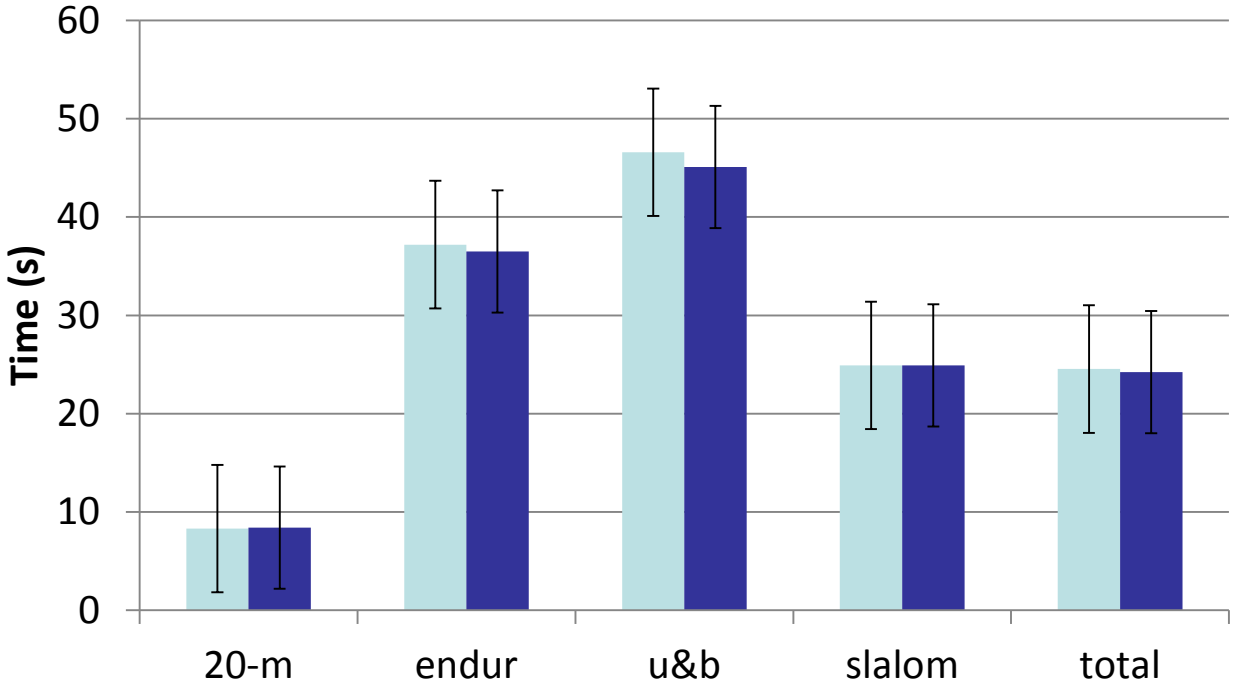
Results: Arm Force-Power

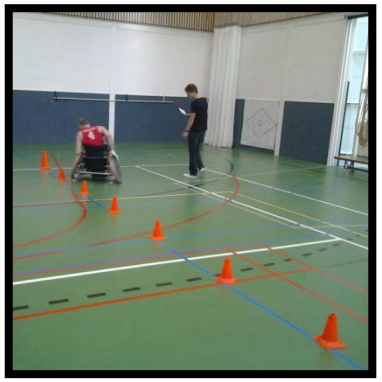




- Significant increase in peak force (+3.5%) and peak power (+3.9%)

Results: Rugby Skills Performance





- No significant changes in propulsion tasks performance
- No sign. change in passing skill performance (No-ES 13.4 , ES 14.4)

Discussion

- Trunk stability can be improved with ES, especially in oblique/diagonal direction.
  - More force-power can be produced
  - Useful for rugby performance?
  - Other ES configurations possible: effects?
- Can seat configuration be changed when using ES: better propulsion and reaching?
- Increase in BP; initial rise; can it be maintained? Does it affect performance (exercise performance, decision making)
- No sign. effect on rugby performance. Overshadowing effect of strapping, seat configuration? Other ES protocols, e.g. dynamic related to movement?
- Fatigue may have occurred. Effect of training?
- Number of participants low
- Rules around using ES during matches?

Conclusions

- ES-induced trunk muscle activation positively affects trunk stability, blood pressure, and arm force/power.
- No effects were found in wheelchair rugby skills, probably due to abdominal strapping (and seat configuration)
- More research is needed to assess different ES (training) protocols, to compare the effects of abdominal strapping with ES application, and to evaluate if seat configuration can be changed (improved) if trunk muscles are activated

Keynote speakers (confirmed)
John Buckley
Mindy Levin
Kathleen Martin Ginis
Brett Smith
Walter Thompson

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