Understanding the causes of SL changes after repeated exposure to a split-belt treadmill gait protocol post-stroke: a pilot study

Martina Betschart, Ph.D. Bradford J. McFadyen, Ph.D. and Sylvie Nadeau, Ph.D.

Corresponding authors: Sylvie Nadeau: sylvie.nadeau@umontreal.ca
Martina Betschart: mbetschart42@gmail.com
**BACKGROUND AND PURPOSE**

Stroke

**Deficits in gait**

| Gait speed, endurance (e.g., Ada, 2013, Dunn, 2015) | Step length asymmetry (e.g., Patterson, 2008, 2010) |

**RESISTANT TO CONVENTIONAL APPROACHES**

e.g.: 14% (n=5/35) reduced step length asymmetry vs 30% who improved speed and 62% for balance (Patterson, 2015).

**NEW APPROACH (error-augmentation based principle)**

- Video

Healthy subjects: Induces asymmetry in step length

**CURRENT KNOWLEDGE:**

Split-belt treadmill walking with a error-augmentation based protocol:

- Neurophysiological mechanisms (healthy and post-stroke)
  - ✔
- Improvements in SL symmetry
  - Short-term (some steps)  ✔
  - Long-term (4 weeks)  ✔
- Transfer of effects on the floor  ✔
- Effects of speed adjustment among sessions on gait parameters  ❌
- Effects on gait
  - Speed  ✔
  - Endurance  ❌
- Effects on joint biomechanics and muscle activity  ❌
  - Long-term effects (4 weeks)  ❌
  - During walking over the ground  ❌
- Effects of speed adjustment among sessions  ❌

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<td>SLOW</td>
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If shorter step on faster belt

(i.e.: Reisman et al, 2007; Lauzière et al, Betschart et al, 2017)
**METHODS**

**Study Protocol – Training intervention in a clinical setting**

- Heart rate and blood pressure
- Modified Borg Scale (<5)
- 20 minutes of walking at a 2:1 speed ratio

2 Groups:
- Paretic FAST
- Non-paretic FAST

* 2x speed of slow belt

* Tested prior to each session

Modified when compared to Reisman et al. (2013) with the aim to improve speed and endurance in addition to symmetry

**Outcome Parameters**

- 3D motion analysis (Optotrk)
- Ground reaction forces (GRF)
- Bilateral EMG (12 muscles)
  - **Distal**: Tibialis anterior, Gastrocnemius lateralis,
  - **Proximal**: Vastus lateralis, Rectus femoris, Semitendinosus, Gluteus Medius
  - Band-pass filter (20-450 Hz)
  - RMS (amplitude and signal duration)
  - Amplitude normalization with peak reference value from walking over ground

IEK = International Society of Electrophysiology and Kinesiology

**Gait parameters**
- Step length (SL) and SL symmetry;
- Walking speed (10 meter Walking Test);
- Functional mobility (Timed Up & Go Test);
- Endurance (6 Minute Walking Test)

**Biomechanical parameters and muscle activity**
- Lower limb net joint moments
- Muscle activity (six lower limb muscles)

**Statistical Analysis**

- Repeated measures ANOVAs and *Wilcoxon-signed rank tests*
- Level of significance: $p = 0.05$ adjusted with post-hoc Bonferroni correction.
Effects on gait

- Speed IMPROVEMENTS
- Endurance NO EFFECT

Effects on joint biomechanics and muscle activity

- Long-term effects (4 weeks) effects at the FOLLOW UP > compared to POST-TRAINING
- During walking over the ground: particularly SIDE trained on the FAST BELT PLANTARFLEXORS seem main contributor to symmetry changes


REFERENCES

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