Spasticity Management in Persons with Spinal Cord Injury: A Research Synthesis

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Introduction

A variety of approaches are used to treat the spasticity syndrome in persons with spinal cord injury (SCI): Pharmacological (e.g. Baclofen, Dantrolene); Physical and Occupational Therapy (e.g. prolonged stretching, casting/splinting, electrical stimulation, transcutaneous nerve stimulation (TENS));acupuncture; massage; surgical (e.g. cutting pathways in the nervous system). Despite the number of approaches, however, many persons with SCI continue to have problems related to spasticity. More than half of all persons surveyed with chronic SCI report symptoms of spasticity (Skold et al. 1999; Maynard et al. 1990) that interfere with their daily life.

Purpose

To evaluate all literature over the last ten years (2000-2010) related to *the management of spasticity after SCI* to determine which evidence may be meaningful to persons with SCI experiencing spasticity, and that may be related to any variety of spasticity a person may experience *(hyper-reflexia, increased resistance to passive stretch, velocity-dependent resistance to stretch, clonus).*

Methods

- The lead reviewer identified all articles related to the treatment of spasticity in persons with SCI
- Seven (7) trained reviewers evaluated each article for meaning and rigor, using guidelines set forth by Rogers and Farkas (2008).
- Any article that was meaningful and rigorous was considered for this summary

Results

- Only 3 of the 7 papers defined spasticity (Table 1)
- All papers included persons with chronic SCI; two included persons with acute injury (Chung &Chen 2009, Kumru et al 2010)
- Different interventions led to varying effects on the components of spasticity syndrome (Table 2)

Table 1: Definitions provided by the 3 of the 7 papers

Study	Definition of Spasticity provided	Aspect of spasticity measured
Bowden & Stokic 2008	"…a motor disorder characterized by a VD increase in tonic stretch reflex with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex, as one component of upper motor neuron syndrome"; "…include clonus, involuntary muscle contractions or spasms, and muscle co-contraction."	• Passive resistance to stretch • Spasm frequency & severity • Stretch reflex/hyperreflexia • Flexion withdrawal
Kumru, et al. 2010	"…a symptom of upper motor neuron syndrome, characterized by an exaggeration of the stretch reflex, spasms, and resistance to passive movement across a joint, secondary to hyperexcitability of spinal reflexes."	• VD resistance to stretch • Passive resistance to stretch • Clonus • Spasm frequency & severity • Stretch reflex/hyperreflexia • Stiffness
Ness &Field-Fote 2009	"…spastic hypertonia with increased reflex excitability and disordered motor output (i.e. spasticity, clonus, spastic gait patterns)…"	• Stretch reflex/quadriceps hyperreflexia

Table 2: Key outcomes

	n	AIS	Findings
TENS (Chung & Chen 2009) Randomized controlled trial (RCT)	18	A,B, C,D	Decreased : • Composite Spasticity Score (p=0.017) • Resistance to passive motion (p=0.024) • Clonus (p=0.023)
Repetitive TMS (Kumru et al. 2010) RCT	15	C,D	Decreased: • Modified Ashworth Scale (MAS) (p=0.006) • Penn Spasm Frequency Scale (PSFS) (p=0.01) • Spinal Cord Assessment Tool (SCAT) (p=0.04) Maintained at 1 week post-intervention
Intrathecal Baclofen (Bowden&Stokic 2008) Descriptive	1	D	• Dose dependent decease in spasticity (p=0.01) • Decreased strength (p=0.001) • Non-sign decreased flexion withdrawal reflex
Passive LE ergometry (Kakebeeke et al. 2005) Descriptive	10	A,B	• 6/10 reported subjective decrease in spasticity; no other changes
FES & Passive LE Ergometry (Krause et al. 2008) Descriptive	5	A	• Functional electrical stimulation greater improvement than passive movement • Decreased MAS (FES p=0.001; Passive p=0.05)
Whole body vibration (Ness & Field Fote 2009) Descriptive	16	C,D	Decreased • PSFS (p=0.005) • MAS (p=0.0117) • Maintained 6-8 weeks
Epidural stimulation (Pinter et al. 2000) Descriptive	8	A,B, C	• Decreased amplitude on EMG (p=0.004)

Conclusions

- Any stakeholder interested in the evidence related to the management of spasticity should first consider:
  - None of these studies used the same measures
  - Different aspects of spasticity may be affected by a given intervention, e.g., if spasms are the worse aspect of spasticity in a person with SCI, rTMS, SCS, or baclofen may be best choice;
- Electrical stimulation, whether applied centrally or peripherally, appears to decrease spasticity in persons with SCI;
- How each intervention affects spasticity in persons with different levels and completeness of injury is not clear from these studies;
- Effects on musculoskeletal consequences of spasticity not clear
- Neural changes without accompanying musculoskeletal changes may preclude functional improvements.