



Combating Contractures: Improving Rehabilitation Treatment for Patients with Chronic Spinal Cord Injuries to Regain Functional Movement and Improve Quality of Life

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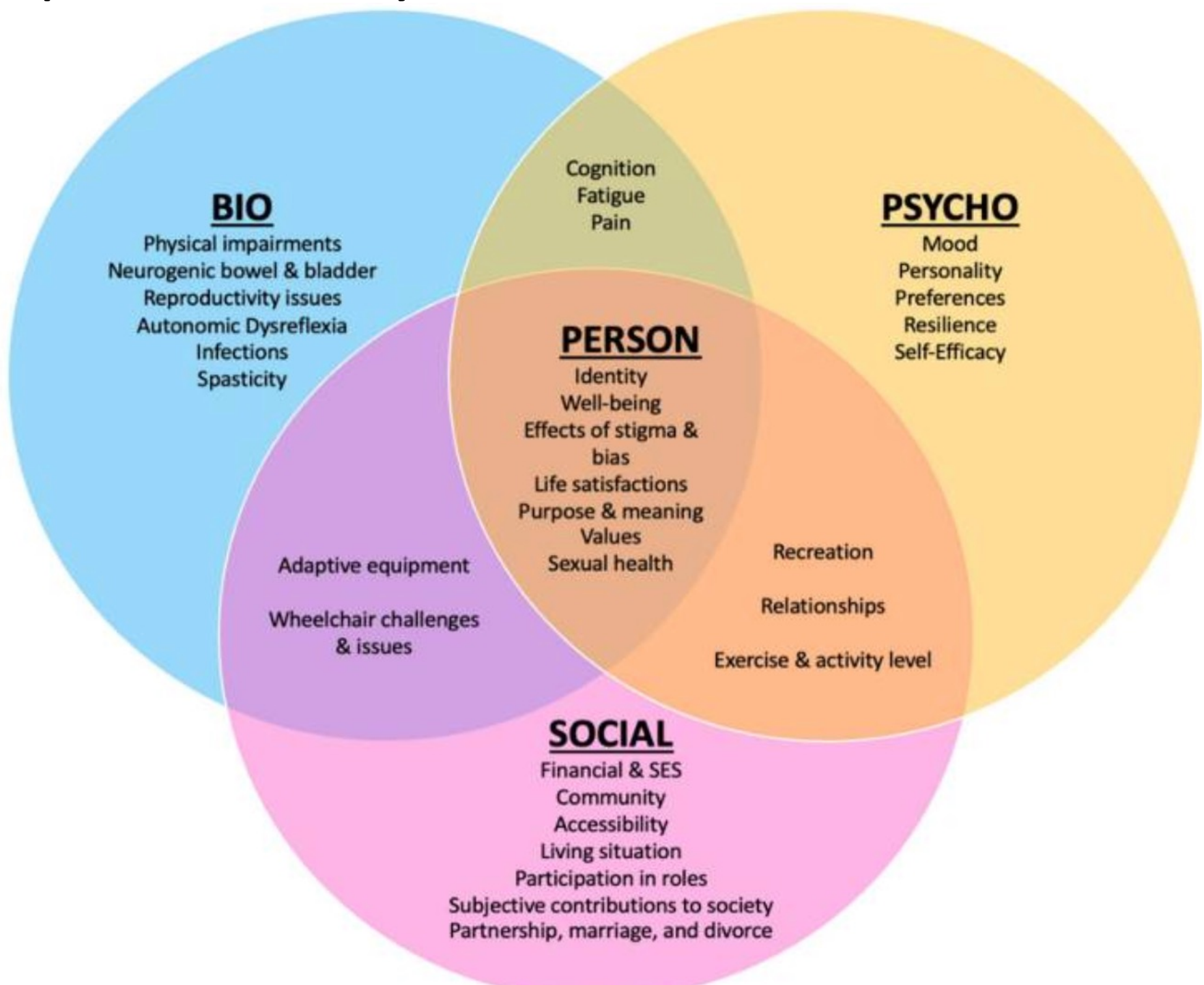
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Background

NSCIS Fast Facts

- ~17,810 people are diagnosed with spinal cord injuries (SCI) every year, 78% in men since 2015
- Most commonly caused by vehicular crashes, falls, acts of violence and sports

SCI Impact on Daily Life



Biopsychosocial model of interacting factors for persons with SCI (2022).

Importance of Rehabilitation

- Rehabilitation has proven to drastically improve the quality of life of SCI patients, however there is not a well-established standard of care.
- Rehabilitation of SCI is long, expensive, exhausting and can be further impacted by many secondary complications.
- Secondary complications are common including
 - Pneumonia
 - Bladder infections, UTI
 - Pressure ulcers
 - Deep vein thrombosis
 - Depressive disorders
 - **Spasticity, contractures, muscle atrophy**
- Complications are directly correlated with life expectancy and quality of life for patients with SCI.

Project Walk Boston and The Perfect Step

- Specialized paralysis recovery rehabilitation centers using innovative technology such as G-EO robotic walker
- Specialists at these facilities have identified muscle tone as a key limitation to their ability to progress patient rehabilitation treatments; preparing the body to move can often be the most cumbersome and time-consuming aspect of their sessions.



G-EO Robotic Walker at The Perfect Step in Pomona, CA.

Methods

- Literature Review among two databases: PubMed, Google Scholar
- Key Terms: SCI and rehabilitation, spasticity, contracture
- Data search was limited to publications after 1985, adults with chronic SCI.
- Initial title/abstract review with subsequent full text review was performed. Thirteen articles are included in this study.

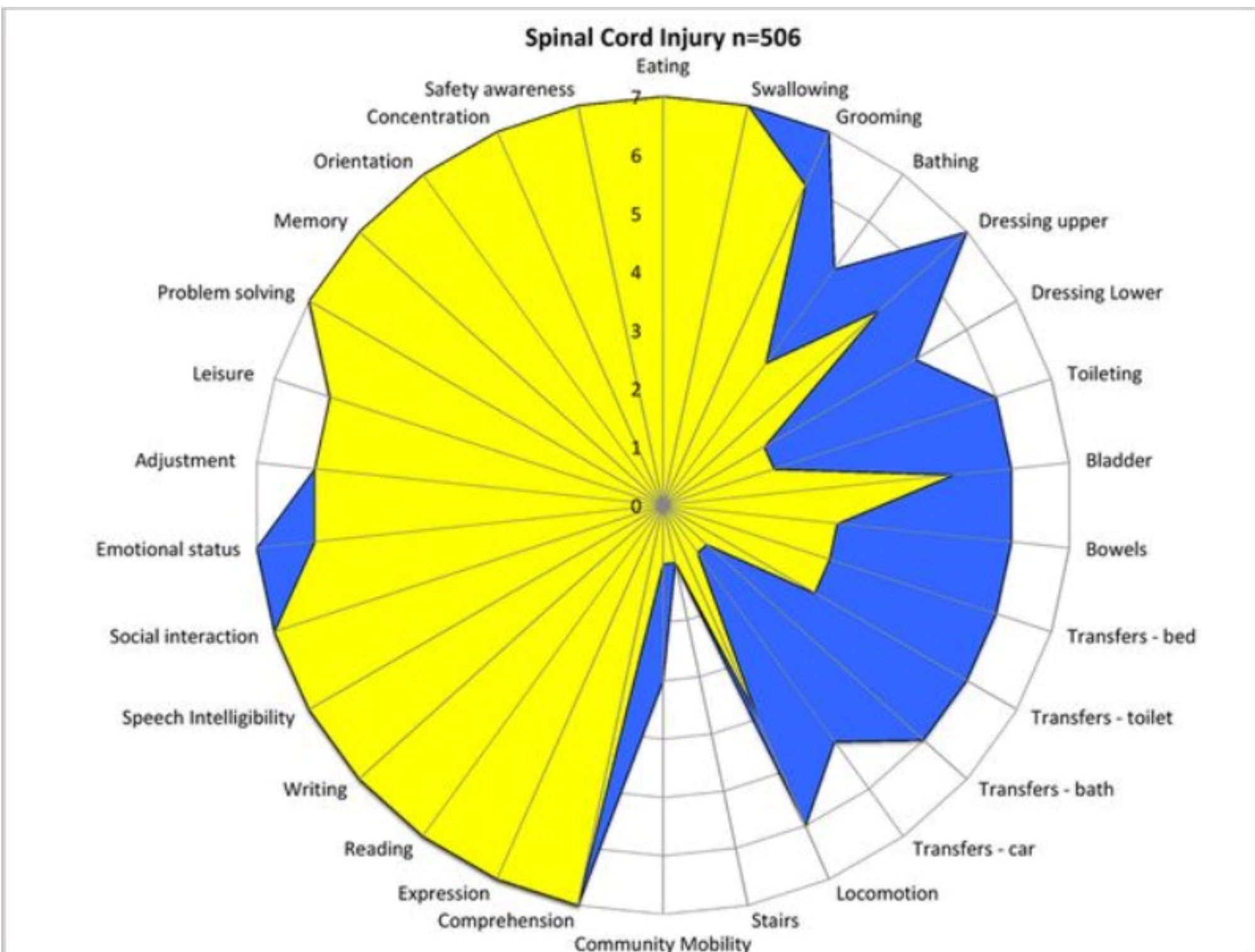
Purpose

- Understand current standard of care and cost of SCI rehab.
- Identify successful methodologies for completing scientific research in SCI rehabilitation.
- Develop new strategies to more successful prevent and treat contractures that develop in patients with SCI that could hinder their rehabilitation treatment progression.

Findings

Standard of Care in Rehabilitation

- No optimal standard of care due to extensive multidisciplinary teams creating necessarily individualized treatment plans



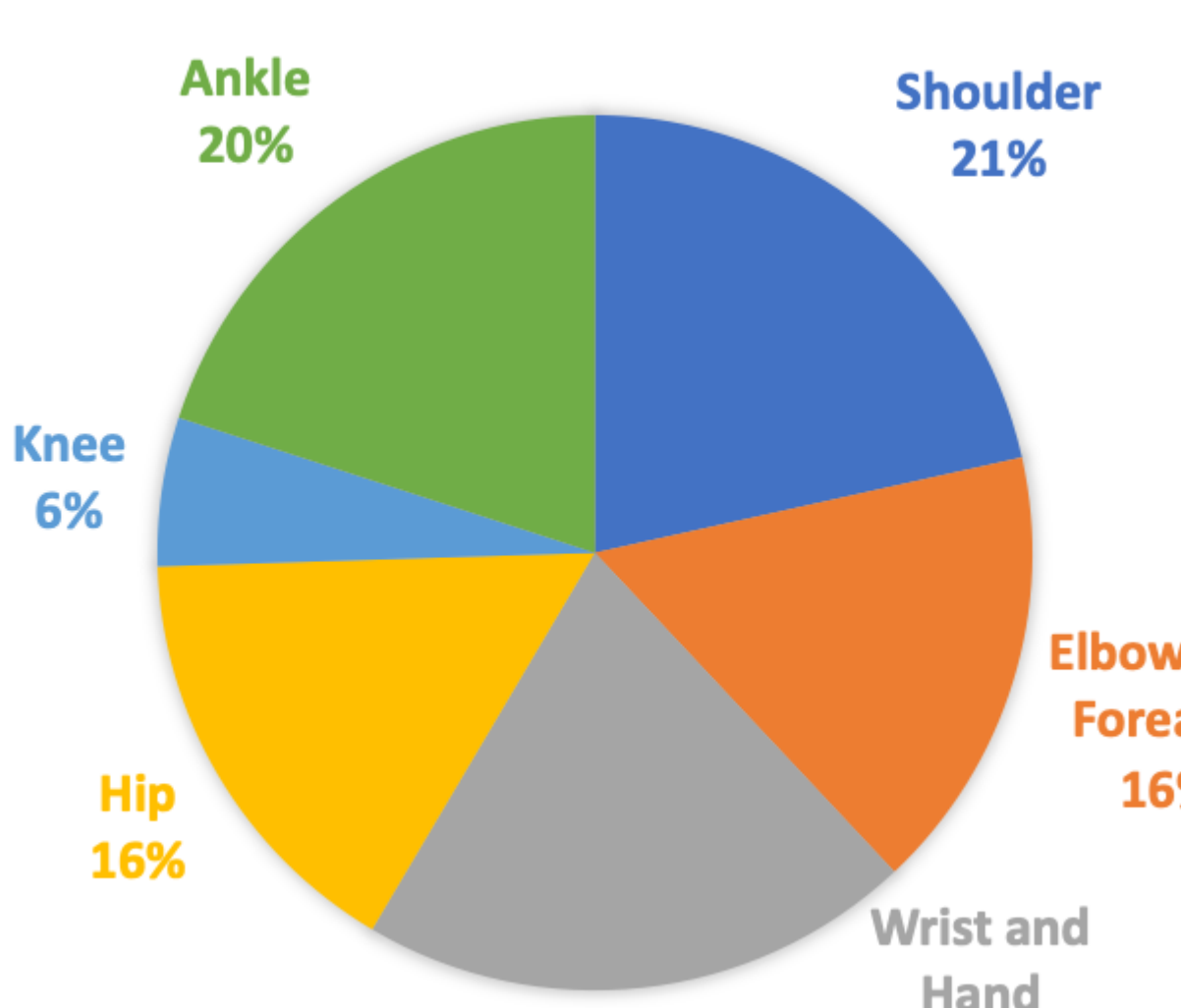
Dependence levels for patients with SCI before (yellow) and after (blue) rehabilitation with one being total dependence (Turner-Stokes et al 2017).

- Bilchak et al. (2021) found repetitive exercise improves motor function after SCI by promoting synaptic plasticity via increasing formation or maintaining damaged synapses
 - Recruiting sensory afferent and interneurons
 - Spared supraspinal neurons

Spasticity and Contractures

- Disruption of upper motor neuron inhibitory pathways can result in increased muscle tone, hyperactive reflexes, and rigidity which is termed spasticity.
- **Increased spasticity may result in decreased range of motion of a joint leading to contracture in that joint.**
- ~66% of SCI patients had at least one contracture within 1 year of injury (Diong et al. 2012).

INCIDENCE OF CONTRACTURE AT EACH JOINT



Pie chart generated from data presented by Diong et al. 2012.

- Contractures prevent patients' ability to be active during rehabilitation which is integral to its success and higher activity promotes plasticity and better motor recovery.
- In 1985, Yarkoney et al. found a statistically significant relationship (at $p < 0.01$) between time before rehabilitation admission and increased numbers of contractures per patient.

Research in Rehabilitation

- SCIREhab promotes a practice-based evidence methodology to identify most positive outcomes to improve clinical decision making and standard of care (Whiteneck et al 2009).

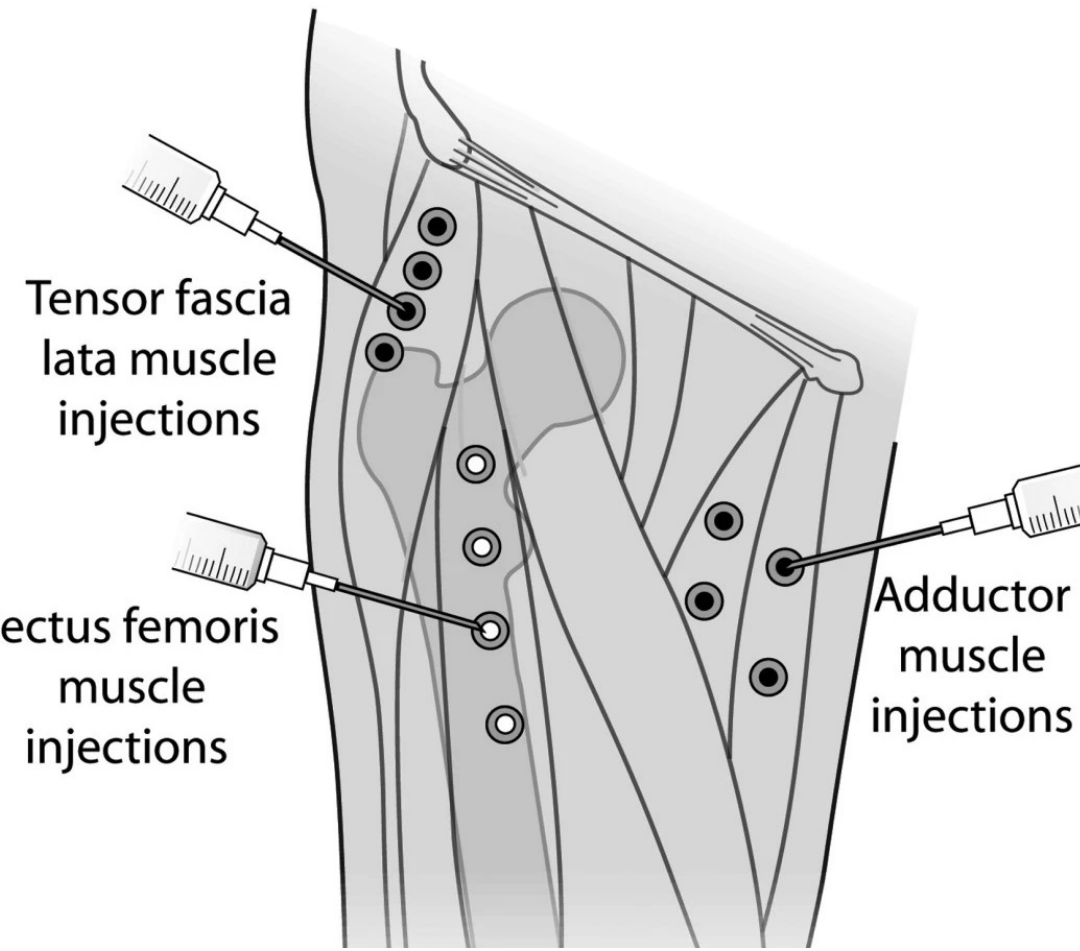
Future Directions

Educating Caregivers

- **Early identification and treatment of spasticity and contracture**
- Teaching SCI caregivers how to actively stretch their patients to ensure they do not lose range of motion or develop contracture.

Botulinum Toxin Injections

- Early identification of spasticity treated with Botox injections in affected muscles
- Temporarily paralyze the muscle preventing development of contracture from spasticity and inhibit further loss of range of motion.



Injection Sites for Botulinum Toxin for Muscle Tightness After Hip Arthroplasty (Bhave et al. 2009).

Osteopathic Neuromusculoskeletal Medicine

- Utilize osteopathic manipulative treatment (OMT) to move patient's muscles and joints with
 - Stretching
 - Gentle pressure
 - Resistance
 - Alignment
- **Identify ideal manipulative techniques for treatment of contractures and improving range of motion**

Current and Future Research

- Case study with Project Walk Boston
- Studies exploring improved quality of life using retrospective analysis and surveys
- **Proposal for studies to measure neutrophins in clients at these specialized paralysis recovery centers** which promote neurogenesis, neuroregulation, synaptic regeneration, neuroprotection, and neuronal survival.

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