Promoting `Force to use it`- Strategies of the Hemiplegic Limbs of a Patient with Severely Impaired Motor Control Following Stroke: A Case Report

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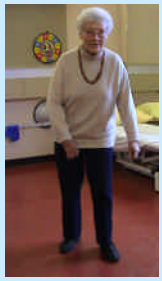
Background

Patients with severely impaired motor control as a result of stroke are often limited in their ability to use their paretic limbs. A number of studies have shown that forced-use or constraint-induced training promotes recovery of function for patients with mild hemiparesis (Taub et al., 1999) (1), but far less has been reported for patients with pronounced weakness (Feys et al., 2004) (2). We have found it possible to use inflatable air splints and positioning set-ups to design functional activities and exercises to suit the stage of motor recovery of strokes. This enable patients with severe hemiparesis to carry-out training within and outside formal therapy sessions autonomously. Johnstone (1995) (11) suggested in the 1970`s the usage of inflatable air splints and rocking devices for active training, but limited research has been carried out. These training set-ups can be organised to promote the quality and quantity of functional movements of the hemiparetic limbs while preventing detrimental movement compensations. This poster presents a case report to illustrate how inflatable air splints and supportive positioning can be used to promote autonomous practice and `force to use it`- training for functional rehabilitation of a patient with severely impaired motor control following stroke.

Subject



72 year-old woman who suffered a stroke 1 year previously. She has out-patient physiotherapy, speech therapy and occupational therapy in the home-setting, once weekly.

Pathology:
Left cerebrovascular insult (25.01.05), with right upper and lower limb hemiparesis, right sided neglect, apraxia and global aphasia.

Impairments:
Muscle Performance: Right-sided hemiparesis. Weakness and difficulty recruiting muscles selectively in the right upper and lower limbs. Trunk weakness also present.
Flexibility/Range of motion: Decreased dorsiflexion and finger extension due to tightness in the gastrocnemius and long finger flexors.
Motor Function: Slowness in all functional mobility, poor reciprocal limb movements in gait, excessive dependence on vision for balance and control of gait, asymmetrical body alignment. Patient ambulates safely in the home, can dress herself independently, limited in skills for household chores. Patient require assistance on stairs and for gait outside the home setting.

Participation: Patient is dependent on sister for all social activities. Current patient goals: Independent and safe walking with a device outside of her home; use of the right upper limb sufficient to hold a glass of water and drink with assistance.

Environmental Factors: Patient is cooperative and motivated, has a supportive sister that helps with ambulation on stairs, applying hip protector and ankle support.

Methods

a) Data Collected at Admission (6 days post-stroke), Discharge (4 months post-stroke) and Follow-up (9 months post-stroke)

- Chedoke McMaster Stroke Assessment (3)
- Berg Balance Test (5)
- Tinetti Balance and Mobility scale (4)
- The 3 Minute Walk Test, Olsson (6)

b) Characteristics of training:

Patient Group:	Aims:	Conditions:	Requisitions:
•Severely impaired motor control: •Motor recovery level according to the Chedoke McMaster Stroke Assessment 1-4 out of a total score of 7 •1 - Flaccid paralysis •2 - Spasticity present •3 - Spasticity marked •4 - Spasticity decreases/ weakness --- 5-Weakness, evident with rapid movement and at extremes of range 6- Coordination and patterns of movement near normal 7- Normal	•To give patients the opportunity to actively plan and carry through movements autonomously •To optimise the use of the paretic side •To strengthen muscle weakness •To minimise excessive movements •To prevent secondary impairments •To provide challenge in motor planning and execution •To create training of novel tasks in a safe environment •To increase motivation to train with the hemiplegic limbs	•Safe and autonomous •Integration of the hemiplegic limbs in unilateral and bimanual-movements •Practice of selective movements after removal of tools •Inclusion of a home program (maximum 3 exercises per week plus treatment log) •Continuous update of intervention based on the patients performance and goals	•Focuses on efficiency and efficacy of motor abilities in part-task practice •Includes stretching and strength training •Repetitions of 10–15 times with 3 sets per exercise(7) •Includes variability of rhythm, speed, coordination, dual task, change of inflatable air splints and tools, especially in a stationary environment

c) Examples of Therapeutic Interventions Focusing on Autonomous Practice and `Force to use it`- strategies of the Hemiplegic Limbs

Autonomous Practice:
Holding the hemiparetic upper extremity in space during a bimanual upper extremity activity.
` Force to use it`- strategy:
Stabilising the hemiparetic upper extremity in protraction and outward rotation.
Action: Roll the balloon from the shoulder to the hand.

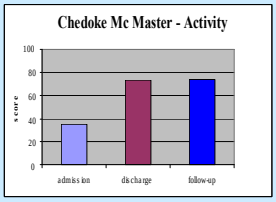
Autonomous Practice:
Rhythmic generation of an extension force through the hemiparetic upper extremity; dorsiflexion forces in the hemiparetic ankle.
` Force to use it`- strategy:
Rhythmical protraction of the hemiparetic scapula with loading forces through the entire hemiparetic upper extremity; rhythmical dorsiflexion through the hemiparetic ankle.
Action: Rock the chair by pushing forward on the hand and pushing from the heel.

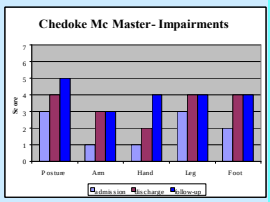
Autonomous Practice:
Dynamic stabilisation of the hemiparetic upper extremity and active dorsi- and plantar flexion of the hemiparetic ankle
` Force to use it`-strategy:
Weight-bearing through an extended hemiparetic upper extremity with the shoulder in outward rotation; active dorsi- and plantar flexion through the hemiparetic ankle against resistance.
Action: Keeping the back straight and weight bearing through the heel of the hand, pushing the heel of the foot forwards and back.

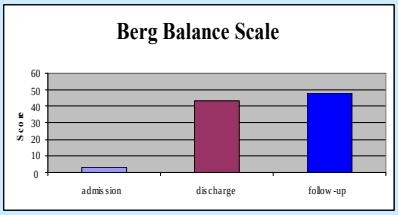
Autonomous Practice:
Reaching with the hemiparetic upper extremity to a target requiring > 60° shoulder flexion; weight-bearing through the hemiparetic lower extremity.
`Force to use it`- strategy :
Reaching with the hemiparetic upper extremity in full extension, with the shoulder in outward rotation; symmetrical weight-bearing and co-contraction through the lower extremities.
Action:
Press forwards to a target on the wall.

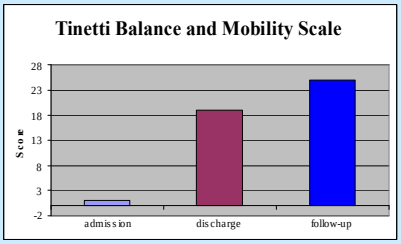
Results

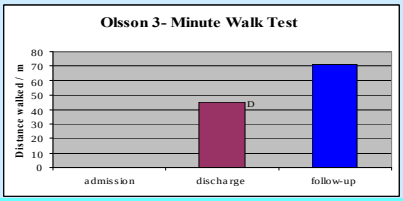
Improvements occurred in motor recovery, reaching and grasping, standing balance, and gait at both discharge and 9 months post-stroke, evidenced by improved scores on the Chedoke McMaster Stroke Assessment (impairments), Tinetti Balance and Mobility Scale, the 3 Minute Walk Test (Olsson) and the Berg Balance Test.











Conclusion

Although the prognosis for patients with extended severe motor impairments following stroke is generally poor, this case study showed that some patients are able to improve their motor control and function. The patient presented in this case study received an intervention that promoted autonomous practice and `force to use it` – strategies in addition to traditional therapeutic approaches. The use of inflatable air splints, rocking devices and other environmental adaptations reinforced the use of the hemiparetic limbs and provided a means for autonomous practice outside of formal therapy sessions. This may have strongly contributed to the improvements this patient achieved.

The careful set-up used in our interventions helped to minimise detrimental movements during therapeutic activities, promoted strengthening of hemiparetic muscles, helped to maintain muscle flexibility, and promoted sensory stimulation of the hemiparetic extremities through weight-bearing and limb-loading. In addition, the judicious use of supportive equipment helped to reduce the complexity of multi-joint movements during training, and enhanced self-controlled and selective motor control within meaningful activities. The promotion of autonomous practice and `force to use it`-strategies in the early and chronic phases of stroke could potentially enhance the effectiveness and efficiency of rehabilitation. Studies with suitable clinical trials are recommended.

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