Outcomes of an aquatic therapy program after a capsular-thalamic stroke in the right hemisphere: a case study

Graça, M. MSc, PT[124] ; Henriques, A. MSc, PT[3]; Lambeck, J. PT[45]

[1] Physiotherapy Department, Francisco Zagalo Hospital, Avenida Dr. Nunes da Silva, 3880-113 Ovar
[2] Phd Student of Sports Faculty of Oporto University, Rua Dr. Plácido Costa, 91, 4200-450 Porto
[3] Private practice, Corpus Salut, CC Garrett, loja 16, 3880-123 Ovar
[4] IATF
[5] Free research associate KULeuven

Introduction

All movements start with a background of sensory information to the central nervous system about the surrounding space and about position of the body. As movement proceeds, this sensory information changes from moment to moment.
Modulation is the process of sensory information organized in series of operations whereby the information is transmitted from peripheral receptors to various neural networks in sensory parts in the central nervous system. This also includes the association areas with the vestibular -, visual - and somato-sensory subsystems. Regulation of posture involves feedback from these three sensory subsystems about the position of the body and the features of the environment as movement proceeds (Afifi, 2005).
Their role in movement is organized through the thalamus where the ordered maps of all the sensorial information are located.
The thalamus is essentially a sensitive core. With the exception of part of the temporal lobe, it can be said that all of the cerebral cortex receives afferent information from the thalamus.

Thalamus problems:
Motor, sensory and limbic systems
Processing sensory information that reaches the cerebral cortex
Projects painful sensations in the frontal cortex
Resulting in:
Fully affected sensitivity and pain unless modified
Disorders of emotional reactivity, such as changes of character and attention.

Affected functions:
Inability to the sequence Sit to Standing (STS) and in Standing (S) because of hyperactivity on the right side with a pushing behaviour from the right lower limb leading to increased flexion of left lower limb resulting in difficulty maintaining foot contact with the floor.

Patient Identified Problems (PIP's):
Poor postural alignment
No neuromuscular activity
No antigravity activity
Disturbance of afferent information
Poor body scheme
Lack of interaction with the base of support APA's and reactive strategies
No stability limits
No selective movements
A lot of pain

Aquatic therapy offers a rich ambience to develop recovery through core stability and changes in the proximal key points through a proper handling during movement (Brody, 2009).

Material &Methods

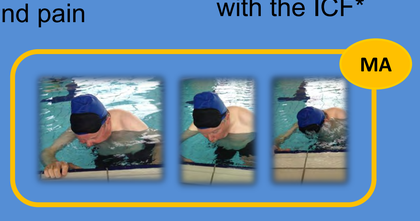
Patient aim: Walking with cane

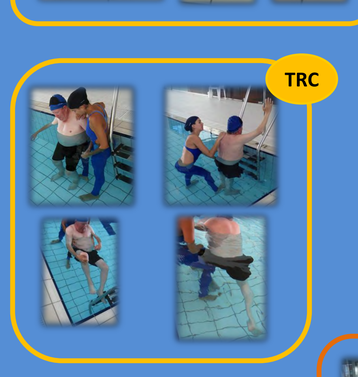
The study concerns a male person aged 63.
The patient suffered the stroke in 2010, with the left thalamus and capsule affected.
Prior to the stroke he had a very active professional life: poet author, singer, musician, animator at parties and retired.
He had fallen at 2nd month recovery. After the fall he never again collaborated with STS.
At 24 months post-stroke starts aquatic therapy in a sports pool (30º).
He did not swim before the stroke.

STRATEGY
The aquatic therapy programme was twice a week in combination with land therapy three times a week.
The goals were: improve axial control in water, facilitation of global movement control and pain decrease.

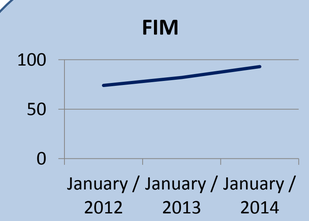
INTERVENTION PROTOCOL
Treatment was focused on a random combination of trunk activation in 3 planes, using principles of aquatic specific therapy. Using the five points of Halliwick: MA, SRC, TRC, LRC and BIS through the principles of massed practice using the best starting positions and progressive steps from disengagement of the PT and Aquatic Exercises (AE) to integrate the new patterns of movement always combined with constraints of the non-affected side. Massed practice: high doses of (graded) activities with relative short rests focused on static and dynamic stability of the trunk.

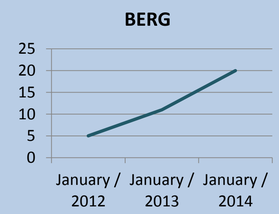
MEASUREMENTS
FIM
BERG Scale
SF-36 (V2)
Specific aquatic therapy assessment related with the ICF*

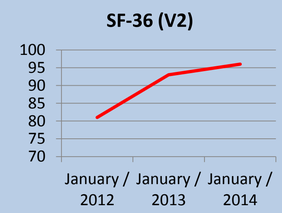




Results



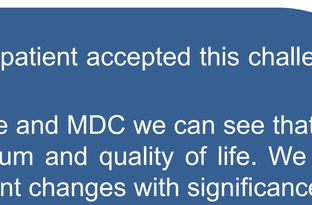




	Pre	Post	SD	MDC	MCID	MDC *	MCID *
MIF	74	93	9,5	-	15	Not established	22
Berg Scale	5	20	7,3	33	-	4,66	Not established
SF-36 (V2)	81	96	7,9	-	-	Not established	Not established
Aquatic Therapy Assessment	2	58	28,7	-	-	Not established	Not established

We can see the almost good MCID of MIF (15) and the very significant value of the MDC OF Berg Scale (33) referred to the Rehabilitation Measures Database. The SF-36 (V2) has no significance.

	Assessment in conjunction with the ICF	Halliwick point	No difficulty (3) High quality performance	MOderate difficulty (2) Medium quality	Severe difficulty (1) Low quality	Complete difficulty (0) Does not perform	Not applicable (0) Not assessed	Breath control included
Respiratory function b440	Mouth: bubbles (5 sec)	MA	F I		S			
	Nose: bubbles (3 sec)	MA	F I			S		
	Head under, blowing (5 sec)	MA		F	I	S		
	Rhythmic exhalation (with mouth, (6-9× / 1 min)	MA		F	I	S		
	Exhalation alternately (3×) through mouth and nose	MA		F	I	S		
d510 washing	"water over the head"	MA		F I		S		
Changing a basic body position d410	Shifting CG forward/backward (25 cm) in stand	TRC		F I		S		
	Shifting CG left/right(25cm)	SRC	F	I		S		
	Sitting down	TRC	F	I		S		
	Standing up	TRC		F I		S		
	Lying down	TRC		F I		S		
	Sitting up	TRC			F	I S		
	Rolling 360º over right	LRC				F I S		
	Rolling 360º over left	LRC				F I S		
	Turning and glide / with SRC or TRC	CRC		F I		S		
Maintaining a body position d415	Stand (30 sec)	BIS		F I		S		
	Sit (40 sec)	BIS			F I	S		
	Supine/oblique (15 sec)	BIS		F I		S		
	Floating up (5 sec)	MI		F		I S		
	Gliding supine (10 sec)	TG		F I		S		
	Gliding prone (5 sec)				F	I S		
Moving around, walking and transferring oneself d420, d450, d455	Walking (6 m or more)	MA	F I			S		
	Changing direction	RC	F I			S		
	Turning 360° (< 4 sec)	LRC		F	I	S		
	Jumping (+ blowing, 5×)	MA		F		I S		
	Swimming (15-25 m)	BM			F	I S		
	Swimming prone (15-25 m)				F	I S		
	Entry					F I S		
	Exit					F I S		
Use of hands, arms, legs or fine hand use d435, d440, d445	Legs: pushing, kicking				F	I S		
	Arms: pushing, pulling				F I	S		
	Arms: reaching				F	I S		
	Hands: passing an object				F	I S		
Carrying objects d430	Transport objects			F I		S		
Moving around using equipment d465 (= swimming)	Mask or goggles				F	I S		
	Snorkel				F	I S		
	Fins					F I S		
	Other						FIS	



Through ATA/ICF we see the improvement in disengagement and real plan of movement sequences and tasks as applied in massed therapy. He started with 2 and endeds with 52 points.

F – January 2014
I – January 2013
S – January 2012

Conclusion

We started with a very poor medical prognosis for walking. The patient accepted this challenge because he believed he will walk one day.
Through the changes in the measurements in terms of % change and MDC we can see that the therapy program had a high effect in the functionality, equilibrium and quality of life. We can conclude that the Aquatic Therapy scale also might show relevant changes with significance for the patient performance in treatment (Steiner, 2002).
The methods used like constraint-induced movement therapy and massed practice, with principles of aquatic therapy to reduce de non-used side of the body, was the key in order to achieve the main goal (walking) (Kwakkel, 2015).
Kwakkel et al (2015) reviewed constraint-induced movement therapy after stroke and concluded that improvements occur when use of the non-affected side decreases, despite the findings from kinematics in patient's improvements are rationed with the adaptations through learning to optimise the use of intact end-effectors in patients with some voluntary motor control after stroke.
Furnari et al (2014) found a strong relationship between the clinical features (such as paresis and spasticity) and dynamic parameters of gait analysis, because of the reduction in muscle tone, promoting the better co-ordination between upper and lower limb and consequently better deambulation and weight-bearing ability.
Through neuro rehabilitation's concepts, physiotherapy uses **specific aquatic therapy** goals to active patient's participation and with progressive steps from disengagement promote the skills on land (walking) (Brody, 2009).

References

Afifi, A., Bergman, R., *Functional Neuroanatomy: Text and Atlas*, 2nd edition, McGraw-Hill Companies Inc, http://books.google.com/book , 2005.
Becker B, Cole, A. *Comprehensive aquatic therapy*: Washington State University Publishing, 2010.
Brody LT and Geigle PR. *Aquatic exercise for rehabilitation and training*. Champaign, IL: Human Kinetics, 2009.
Furnari A, Calabro RS, et al. *Is hydrokinesitherapy effective on gait and balance in patients with stroke? A clinical and baropodometric investigation*. Brain injury 28: 1109-1114, 2014.
Kwakkel G, et al. *Constraint-induced movement therapy after stroke*. The Lancet Neurology 14: 224-234, 2015.
Steiner WA, et al. *Use of the ICF model as a clinical problem-solving tool in physical therapy and rehabilitation medicine*. Physical therapy 82: 1098-1107, 2002.