

Importance of motor rehabilitation (R.I.C) in medullary lesions in chronic phase

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Introduction

The RIC (Continuous and Personalized Intensive Motor Rehabilitation) is a rehabilitative method which, based on the plasticity of the CNS, requires to adequately stimulate the subject affected by spinal cord injury through personalized exercises of determined intensity, protracted over time [1,2] and suitable for all physiological postures (supine and prone lying down, lateral decubitus, quadrupedal position, kneeling position, semi-upright posture, standing erect and free standing), which allows, even in chronic phase, several years after the injury, the recovery of some lost features, the maintenance of the performances obtained and the prevention of secondary complications of the lesion itself.

The role of proper stimulation in inducing spinal neuroplasticity has been described by prestigious scientists like Gorio and Levi Montalcini. "... human beings seem capable of recovering motor and sensory functions even after injuries involving 90% of the marrow; therefore, these Patients are on the threshold of recovery since few axons or the improvement of conduction in some of them can take them beyond this threshold ..." [3]

"Regardless of specific pathologies, in the course of his life, man experiences the loss of a large part of the neuronal heritage he had at birth but, if properly stimulated, the surviving neurons show an increase in their dendritic trees, their proliferations synapses that are at the basis of maintaining, even in old age, lively interests and capacity for interaction" [4].

Case report

Patients and methods

We report two clinical cases who have drawn significant benefit from RIC method.

The first one is a 32-year-old man with C6 post-traumatic spinal cord injury dating back to 2008. After several years of conventional physiotherapy, in 2015 the patient underwent a course of treatment with Intensive and Continuous Rehabilitation (R.I.C.), alternating rehabilitation cycles carried out at the rehabilitation center and home therapy cycles for a total duration of about 3 years.

The R.I.C. method is a method of functional re-education which, through intense stimuli, such as stretching, joint mobilization, active exercises, electro-stimulation, and strong psychological motivation, maximally recruits the physiological resources of the patients to induce them to achieve individual progressively more effective motor performances and then transform them into functional movements useful in everyday life, up to walking at full load, where possible.

The ambulation target, which is always agreed upon with the subject in a realistic way and without illusions, also serves as a psychological stimulus to reach the set goals.

During the search for the achievement of this target, muscle strengthening, the recovery of lost abilities such as balance, coordination, control of the various postures in wheelchair, standing and walking, which will increase the patient's performance in daily life activities. The main complications of immobility, such as osteoporosis, constipation, pressure sores, muscle-tendon retractions, hypotrophy of the left ventricle will also be prevented.

At the entrance to the structure, the patient presented hypotonic-muscular trophism at the level of the elbow extensor muscles, abdominals, ileopsoas, tibialis anterior and biceps femoris, hypertonia to the adductors of the hip and to the scapulo-humeral girdle, and an important retraction of the flexors of the fingers of the hands, for which he was not able to independently carry out the transfers bed-wheelchair. The clinical course of the R.I.C. was monitored through the regular administration of validated assessment scales and a video documentation of the progress achieved. The main functional results are summarized in (Table 1).

Currently the patient walks for medium-length stretches with the Canadians and has resumed his work and social interactions.

From the analysis of the data collected, it appears that the rehabilitation approach with R.I.C method can allow the achievement of goals never taken into consideration. such as abandoning the use of the wheelchair.

The second clinical case regards Mr. E.G., male student, 26-years old, suffering from post-traumatic tetraplegia C6 ASIA B, traumatic brain injury and small splenic contusion, resulting from falling into the pool. On July 2012, the patient was subjected to bone marrow decompression and C5-C7 vertebral stabilization with bone transplantation. After the initial hospitalization from July 2012 to December 2012, E.G. has carried out various cycles of traditional rehabilitation, Indicated pharmacological therapy followed, including Ossibutinina, Baclofen, Pantorac, Idantoina In the period preceding the entry into treatment at our Center, the Patient had acquired: - Autonomy in transfers to and from the wheelchair with supervision

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- Ability to perform self- catheterization
- Autonomy in self-feeding with prepared food

Upon entering our Center on 14th January 2019, after 6 years and 6 months from the traumatic event, the Patient was assessed with the international evaluation Scales that gave the following scores (Table 2).

The muscle strength scale (MCR) was also administered, which is indispensable for the preparation of the RIC therapeutic program, of which we report in the left diagram the scores obtained on the initial administration on January 17th 2019 and those of the last evaluation on March 21st 2019 (Table 3).

During the first weeks of treatment, the patient could not tolerate the upright position, he could only maintain it for a few minutes due to orthostatic hypotension, nor assumed the kneeling and standing position to perform rehabilitation exercises and had never performed any type of walking.

The treatment plan began with a basic program with the main goal of strengthening the hypotonic muscles and recruitment of non-active musculature, with exercises proposed in prone and supine positions, gradually, compatibly with the increasing performance of the patient, were proposed exercises in the various postures, which had as their goal, in addition to strengthening, the reacquisition of skills such as balance and coordination. Gradually the static and dynamic standing station has been proposed in addition to the full-load walking with Toe - off braces, a Pacer walker adapted with various aids and three physiotherapists.

The rehabilitation plan, in addition to customized rehabilitation exercises divided into programs, in addition to total stretching and breathing exercises performed at the beginning of each treatment, consists, according to the needs of the patient, of two additional programs that include:

- Electrostimulation (Kotz currents 10 minutes per treated muscle district) on the muscles; rectus of the abdomen, tensor of the fascia lata, Tibialis anterior, adductors of the hip and bilateral buttocks.
- Totalrelaxing massage
- Specific exercises for the recovery of hand function and dorsal flexion of the foot
- Cycleergometer for the upper limbs

Table 1. Clinical-functional trend of the patient during the route with method R.I.C

International evaluation scales	September 2015	November 2016	November 2017	November 2018
ASIA motor	72	75	77	79
tactile sensory	76	78	97	96
Sensitive pain	80	83	77	90
F.I.M.	116	120	118	118
W.I.S.C.I.	13	16	16	16
Ashwort	2	1+	1+	1+

Table 2. Patient was assessed with the international evaluation scales that gave the scores

Functional scales	Score
A.S.I.A motor score	48
A.S.I.A sensitive score	112
A.S.I.A sensitive pain	74
F.I.M	108
W.I.S.C.I	0
Ashwort	2/3

Table 3. The muscle strength scale (MCR) was also administered, which is indispensable for the preparation of the RIC therapeutic program, of which we report in the left diagram the scores obtained on the initial administration on January 17th, 2019 and those of the last evaluation on March 21st, 2019

Date	Jan 17, 2019	March 21, 2019
Muscles	Score (0-5) (R= Right; L= Left)	
Scapula lift	5	5
Keystone	5	5
Forearm supinator	5	5
Round Pronator	5	5
Anterior deltoid	5	5
Cervical spine extender	4	5
Small breastplate	4	5
Great pectoral	4	5
Brachial biceps	5	5
Brachial	5	5
Front toothed	5	5
Finger extender	4	4
Wrist Extenders	5	5
Brachial triceps	5	5
Distal phalanx fingers flexors	3	R 3 L 4
Abductor V finger	3	3
Short extender of the thumb	3	4
Diaphragm	5	5
Rectus abdomen	2	2
External obliques	2	3
Transverse abdomen	2	2
Ileus psoas	R 1 L 0	R 1 L 1
Lata fascia tensor	R 0 L 1	R 1 L 1
Great adductor	R 1 L 1	R 1 L 1
Great Gluteus	R 1 L 1	R 1 L 1
Femoral quadriceps	R 0 L 0	R 1 L 0
Anterior Tibial	R 0 L 0	R 1 L 1
Long toe extender	R 1 L 3	R 1 L 4
Plantar flexor	R 0 L 0	R 0 L 0
Loins Multifido	2	3
Gluteus	R 1 L 1	R 1 L 1
Hamstring	R 0 L 1	R 1 L 1
TOTAL	101	114/115

- Cycleergometer for lower limbs
After 50 days of intensive daily treatment (6 hours of daily treatment from Monday to Friday), Mr. E.G. has acquired the possibility of:
 - keeping the standing static and dynamic station for about 2.5 hours without problems of orthostatic hypotension
 - Carrying out the transfers with greater ease, including the passage from the sitting to the standing position, both to standing and to the walker
 - walking for a distance of about 50 meters with a Pacer walker, Toe - off, in the absence of special supports, with the sole support of the hips to prevent falls and with minimal help from the physiotherapist.

By evaluating in both the patients the functional scales scores at the beginning and at the end of the treatment cycle, we can observe that even modest variation of the muscle strengthening can bring functional improvements detected by the F.I.M - W.I.S.C.I scales, and how the rehabilitation activity favors the decrease of spasticity on the Ashwort scale.

Conclusion

The functional re-education through intense stimuli, such as stretching, joint mobilization, active exercises, electro-stimulation, and strong psychological motivations, like the one represented by R.I.C. approach, can maximally recruit the physiological resources of the patients, inducing them to achieve individual progressively more effective motor performances and then transforming them in functional movements useful in everyday life, up to walking at full load, where possible.

Conflicts of interest

The authors declare that anybody has conflict of interest

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