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IMPROVING THE POSTURAL BALANCE OF PERSONS WITH LOCOMOTOR IMPAIRMENTS

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Abstract
The purpose of this paper is to identify strategies for improving balance in paraplegia by using specific means of physical education and sport.
Materials and methods. For the present study we selected 30 subjects, people diagnosed with paraplegia, aged 20-47 years. Evaluation of postural balance of participating subjects was performed using Functional Test extent of upper limb (Updated) - The Modified Functional Reach Test (mRFT).
Results. The analysis and processing can be seen that in terms of postural balance of subjects included in the study notes appear differentiated between the 2 tests (initial and final testing), so that an increase in the average values of 15, 37 to 30.90 units. Applied to functional recovery programs had significant results in terms of improved postural balance.
Conclusions. Any disruption of receptor-way transmission circuit-central nervous mechanisms affecting providing static and dynamic balance of the body. Paraplegia is one of many pathological conditions that are responsible for changes in balance.
Keywords. Balance, exercise, paraplegia

Introduction

Recent studies show that over the last 4 decades the life expectancy of the patients with locomotors disabilities has significantly increased due to continuous improvement of the treatment methods.

Thus, the apriori/theoretical knowledge and the practical experience comprised in the scientific works of the last years have outlined few strategies which can be applied in chronic diseases including spinal injuries. As general rule, the disability`s alleviating depends especially on technics which are giving to the patient the possibility to achieve a maximum independence despite the pathology`s presence:

- preventing and correcting the secondary pathology- through exercises for muscle toning and stretching to improve the physical parts needed for an independent motion; through techniques for reducing the contact between the desensitized bone surfaces in order to prevent eschars, ulcers etc
- increasing the functional capacity of the other systems that were not affected by the pathology- through progressive resistance exercises for upper body in order to facilitate the movement from one position to another;
- increasing the functional capacity of the systems that are affected by the pathology- through progressive resistance exercises for the muscle groups shortages to increase muscular fitness;
- using adaptive equipment to execute different fundamental skills – through training for using manual wheelchair, crutches, canes or braces and frame in order to achieve the motion;
- accessibility of spaces, access roads, etc
- using psychological techniques for emotional support- through group therapy, psychosomatic relaxation techniques etc.

Having as main premise the fact that all subjects with neuromotor and motor deficiencies can take advantage of the effects of the physical education and adapted sport according to the degree of their disability, the motility education, interests, educational objects etc, the programs including adapted physical exercises will be structured in three main directions: **handling various objects, postural adjustment, locomotion skills.**

a. The gestural activity reffers mostly to the hands executing prehension and manipulation of objects for which the subject need strength, amplitude and direction. Practicing to enhance strength will balance the agonist-antagonist muscles, depending on the deficit. Practising for the amplitude of movement will be subordinated to the precision and coordination. Practising for steering control involves limiting visual sense, the one that contributes the most to the precise execution of motor action in space and stimulating kinesthetic sense.
b. Postural adjustments are based on contractions of the trunk and lower limbs to support the work of gestural and includes static reactions (these opposing

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forces unbalanced) and dynamic reactions (they trigger reflex).

c. The locomotive skills are mastered after executing the postural adjustments and developing the capability of independent motion

The ability to maintain body balance requires a certain rebalancing its footing and following some high amplitude displacements and stresses. Loss of balance control is due to pain / problems that interfere peripheral proprioceptive sensory system and / or exteroceptive.

Paraplegia is the reduction or loss of motor and / or sensory lower limb resulting from a spinal injury. The spinal cord damage causes malfunction of the sensory and voluntary muscle activity of paraplegics, and this leads to an imbalance in the muscle groups responsible for controlling posture in sitting

Sitting balance is a person's ability to maintain control posture while bending the trunk, without losing balance. Ability to balance plays an extremely important role in the daily activities and especially in the paraplegics` locomotion. Most paraplegic people are wheelchair users, and this requires a very good control seated posture.

Postural balance body provides stability being provided by several components somato-sensory-sensory. Training these systems can be achieved during rehabilitation programs balance.

The purpose of this lecture is to identify strategies for improving balance in paraplegia by using specific means of physical education and sport.

Hypothesis: Systematic complex recovery programs will lead to an improvement in motor control and postural balance in individuals with paraplegia.

Material and methods. For the present study we selected 30 subjects, people diagnosed with paraplegia, aged 20-47 years. Evaluation of postural balance of the participating subjects was performed using Functional Test extent of upper limb (Updated) - The Modified Functional Reach Test (mRFT).

The upper limb functional extension test was designed to quantify the balance that allows the use of visual information but change body position. This test was modified in 1998 by S. Lynch and colleagues to assess the balance while sitting of the people with spinal cord injury. The test consists in making the subject to flex the trunk without losing balance;

<u>Applying the test:</u>

- Patient position: sitting on a stool, side wall with hips, knees and ankles positioned at 90 °, 5 cm space should be between the popliteal fossa and the edge of the chair, feet on the ground;
- Performed with a leveled yardstick that has been mounted on the wall at the height of the patient's acromion level in the non-affected arm while sitting in a chair
- The upper extremity from the side wall is 90 degrees of flexion;
- The patient makes a controlled flexion of the trunk;
- The distance between the initial and final position of the ulnar styloid process is measured;

The test for the functional extension of the upper limb (modified) was applied 3 times both initial testing and final testing, and the best result was considered.

It should be noted that, depending on the lesion, muscle flexion and extension of the trunk is limited. Thus, during the test, some patients succeded to execute a good stretch, but due to limitations of the back extensor muscles failed to return to its original position. The back and abdominal muscles strengthen process was one of the main goals of recovery in order to achieve an efficient retrieval of postural balance. The exercises in the rehabilitation program were conducted while training the 3 systems that provide postural balance: the sensory system, sensitive and vestibular system.

The training of the sensitive- sensory systems (visual system, somatosensory and vestibular):

- The training of the somato-sensitive information is achieved by disrupting sight, the individual standing on a stable surface;
- Training of the visual information is done by disturbing the somatosensory peripheral imput while maintaining stable vision (specifically directed)
- To train vestibular inputs must disturb the environment on the other 2-way information: visual and somatosensitive while vestibular information are stable (detecting head position) using unstable platforms while eyes are closed.

The ultimate objective of functional recovery is gaining the highest degree of independence, balance and control that the lesion is allowing so that paraplegics have personal autonomy to facilitate their socio-professional integration.

Presentation of the recovery of balance

Exercise 1

Subject`s position: quadrupedia

Exercise: the subject raises an upper limb alternately transferring weight from one side to the other.

Dosage: 4 sets x 4 reps on the left, the same on the right.

Exercise 2

Subject`s position: quadrupedia

Exercise: subject tries to transfer weight from one side to the other of the body and therapist resistance to hips

Dosage: 4 sets x 4 reps on the left, the same on the right.

Exercise 3

Subject`s position: quadrupedia

Exercise: subject tries to maintain balance while the therapist is applying unbalanced pulses in anterior-posterior and lateral plan;

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Dosage: 4 sets x 4 reps on the left, the same on the right.

Exercise 4

Subject`s position: quadrupedia, on a bench in front of a mirror

Exercise: subject performs a lifting upper limb before, its basin is supported by the physical therapist;

Dosage: 4 sets x 4 reps on each member.

Exercise 5

Subject`s position: seated, facing the mirror, knees bent at the edge of the table, upper limbs flexed 90 ° with a stick attached to the ends;

Exercise: subject leads baton overhead and running a slight flexion of the trunk, the therapist supports basin subject

Dosage: 4 sets x 4 reps.

Exercise 6

Subject`s position: sitting on Physioball, with feet on the ground, hands on knees;

Exercise: patient is doing pelvis swings, its legs are held by physical therapist knee

Dosage: 4 sets x 4 reps.

Exercise 7

Subject`s position: sitting on Physioball, with feet on the ground, hands on the side of the ball;

Exercise: patient is doing pelvis swings in anterior-posterior direction while on the lateral the physical therapist stabilizes his trunk

Dosage: 4 sets x 4 reps.

Exercise 8

Subject`s position: seated, facing the mirror, knees bent at the edge of the table with a ball in hand;

Exercise: subject is throwing the ball to the therapist and he is back passing him in different directions: left and right side, down or overhead

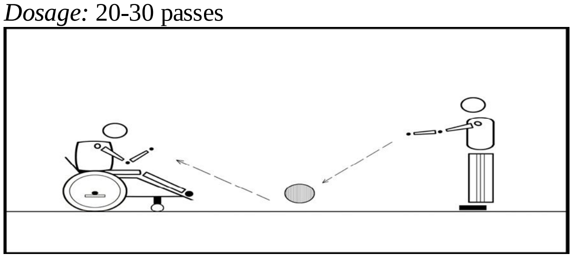
Dosage: 20-30 passes

Exercise 9

Subject`s position: seated in a wheelchair;

Exercise: Subject stands before physiotherapist at a distance of 2-3 meters, he passes the ball with both hands, the ball touches the ground and then is caught by both hands of the person in the wheelchair.

Dosage: 20-30 passes

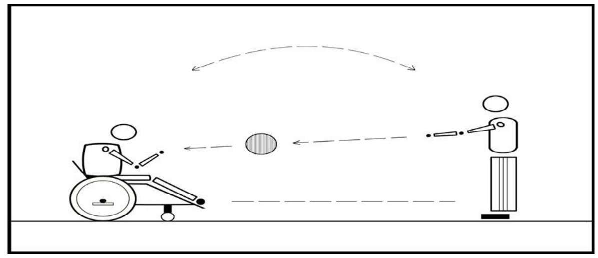


Exercise 10

Subject`s position: seated in a wheelchair;

Exercise: subject is positioned in front of the physiotherapist at a distance of 2-3 meters, he passes the ball with both hands on top

Dosage: 20-30 passes

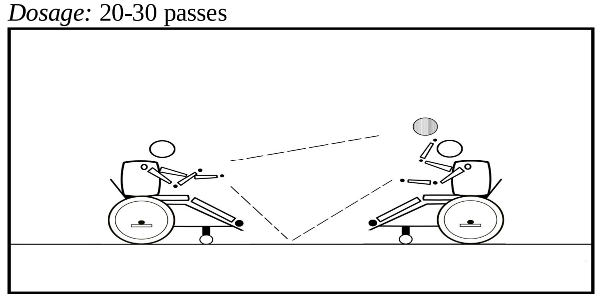


Exercise 11

Subject`s position: pairs, face to face;

Exercise: subjects stand at a distance of 1-2 meters, pass the ball with different methods from one to the other: two hands pass direct to the ground, overhead, pass with one hand on his shoulder;

Dosage: 20-30 passes

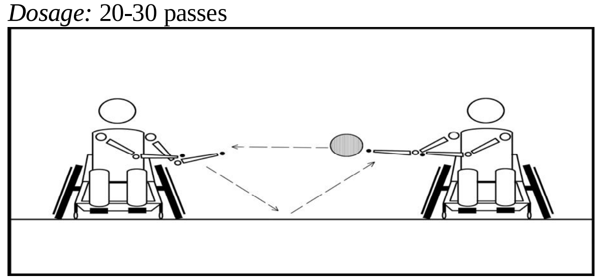


Exercise 12

Subject`s position: seated in a wheelchair;

Exercise: subjects are parallel placed at a distance of 2 meters from each other and move by executinh passes direct or earth from each other;

Dosage: 20-30 passes

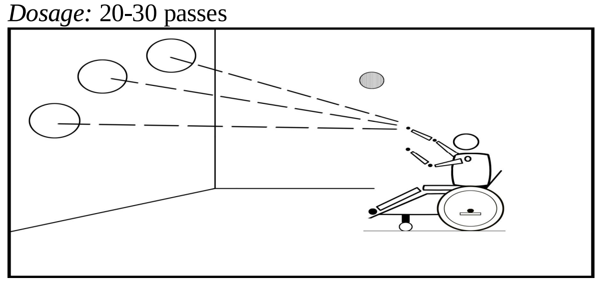


Exercise 13

Subject`s position: seated in a wheelchair;

Exercise: subject is facing the wall to a minimum of 2 feet, throw the ball towards targets (circles) attached at different heights

Dosage: 20-30 passes

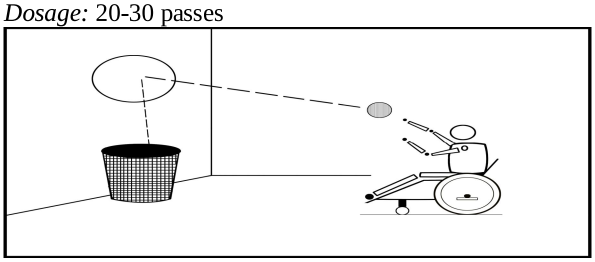


Exercise 14

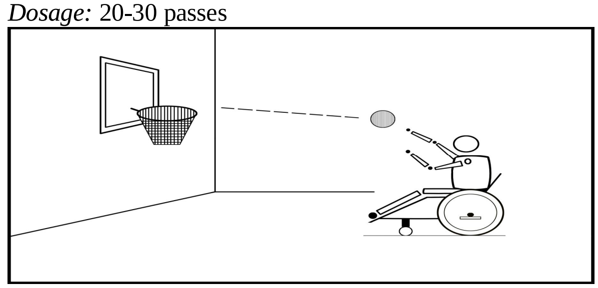
Subject`s position: seated in a wheelchair;

Exercise: subject is facing the wall to a minimum of 2 meters, throws the ball against the wall and try to hit

the circle (pasted on the wall) and then the ball fall into the cart;
Dosage: 20-30 passes



Exercise 15
Subject`s position: seated in a wheelchair;
Exercise: subject is facing the basketball panel 1-2 feet away, throws the ball to the basket with one hand or both hands
Dosage: 20-30 passes



The Analysis and the comparative interpretation of the results

Table 1. The extend of functional upper extremity – Statistical indicators

Statistical indicators	Calculeted values	
	Initial test	*Final test*
Arithmetic mean	15.37	30.90
Median	15.35	29.90
Standard deviation	3.32	3.06
Maximum value	20.60	38.90
Minimum value	9.60	25.40
Amplitude	11.00	13.50
Coefficient of variation (%)	21.62%	9.91%
Mean difference	-	15.53
Confidence level fixed(Cohen)	-	6.43

Table 2. The extend of functional upper extremity – Bilateral *t*- test

Confidence level fixed - α	α = 0,05
Null hypothesis H_0	m1 – m2 = 0
Alternaltiv hypothesis H_1	m1 – m2 ≠ 0
Number of subjects	n = 30
Critical t test	2. 05
Degrees of freedom	29

t test results	**Calculated t**	**P**

The results of THE FUNCTIONAL LENGTH of the upper limb were recorded for 30 patients in the two trials. There is an increase in mean values between the two tests, from 15.37 to 30.90. The difference between these values is 15.53 units. Depending on the values of standard deviation and coefficient of variation calculated, referring to THE FUNCTIONAL LENGTH of the upper limb, resulted that on the initial test the sample was homogeneous while on the final test the sample was homogeneous. Cohen size index indicating the effect of the differences between the results of two tests is large to very large. The analysis performed with the test revealed a bilateral t statistically significant difference between these environments, P = 0.000 is less than 0.05. The results indicate a positive development for patients as a result of the recovery programs, as can be seen from the graphs presented.

Conclusions

1. Sitting balance is a person's ability to maintain control posture while bending the trunk, without losing balance. Ability to balance plays an extremely important role in the daily activities and especially in paraplegics locomotion.
2. Most paraplegic people are wheelchair users, this requires a very good control of the seated posture.
3. The sitting balance recovery means on paraplegic persons are means of physical education and sport adapted to the lesion and their basic motric skills
4. People with spinal medullary lesions show a deficit of voluntary motor control and sensory control limiting the performance of the daily tasks and the overall effort.
5. In recent decades there is an increasing concern to policy makers in the health system, in promoting autonomy in everyday life by improving the quality of life and increased functional independence

6. It may be noted that in terms of postural balance of the subjects there are differentiated characteristics between the 2 tests (initial and final testing), so that an increase in the average values from 15.37 to 30.90 for units can be observed.

7. The programs used for functional recovery had significant results in terms of improving the balance at these patients and thus confirms the hypothesis.

References

Cordun, M., 2009, Kinantropometrie, Editura CD Press, Bucureşti

Cotoman, R., 2006,Kinetoterapie. Metodica desfăşurării activităţii practice, Editura Fundaţiei România, Bucureşti

Fallon, B., 1995, Moving Forward The guide to living with spinal cord injury, Editura SIA, Londra

Gordon, S., L., 1981, The sociology of sentiments and emotion, în Rosenberg, M.,, Turner, R.,H., (1981), „Social Psychology. Sociological Perspectives", Basic Books, New York, pp. 562-592.

Guttmann, L., 1976, Significance of sport in rehabilitation of spinal paraplegics and tetraplegics, Journal of American Medical Association, 236(2), 195 – 197;

Hutzler, Y., 2010, Adapted physical activity and Sport Rehabilitation. În International Encyclopedia of Rehabilitation. CIRRIE, New York

Linch, S., Leahy, P., Barker, S.P., 1998, Reliability of measurements obtained with a modified functional reach test in subjects with spinal cord injury, Physical Therapy, Volum 72, number 2

Jeesel M., Viel E., 1979, citat de Teodorescu S., Bota A., 2007, Educaţie fizică şi sport adaptat pentru persoane cu deficienţe motorii. Editura Printech, Bucureşti

Robănescu, N., 2001, Reeducare neuromotorie, Editura Medicală, București

Sbenghe T., 2002, Kinetologie, ştiinţa mişcării, Editura Medicală, Bucureşti