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ROBOTICS IN THE FIELD OF COMPLEX REHABILITATION OF PEOPLE WITH SPINAL CORD INJURIES

Oleg Karpov, Roksolana Bubela

Lviv State University of Physical Culture named after Ivan Boberskyj, Lviv, Ukraine

Actuality. Number of people with spinal cord injury (SCI) continues to grow, annually about 2000–3000 victims in Ukraine are fixed. Therefore, modern technological development in biomedical sciences leads to new discoveries with the application of the robotized technique in rehabilitation process.

The purpose of the study is to characterize and identify the most effective working robotized systems for the rehabilitation of people with SCI.

Research methods: theoretical analysis and generalization, comparison method, documentary method and mathematical statistics.

Treatment of patients with SCI involves medication therapy, nutrition and psychotherapy, orthopedic means and physical rehabilitation. If rehabilitation measures are not taken in time, patients often have severe functional impairments such as decrease in the amplitude of movements, decrease in strength, loss of ability to travel and work. The second recovery period begins with the formation of primary bone adhesion in the place of the operated vertebral segment [1]. One of the most widely used robotic systems is Lokomat that consists of treadmill, body weight system (BWS), integrated motor orthosis and remote monitor. It is based on the phenomenon of neuroplasticity – the ability of CNS to reorganize due to structural modifications in the brain fluid.

During rehabilitation, it is also possible to use the Functional Electric Stimulation (FES), by stimulating the general peritoneal nerve during walking prevents the "fall of the foot" in gemiplegic patients, or it is used for SCI as a recovery of various movements, including walking [2]. Comparing robotic intervention with routine physical therapy, it is presented significant differences in the use of robotic care therapy in walking speed and balance improvement and also it is noted that robotics use is effective in improving the function of terrestrial walking (see Table 1)

Table 1

Exponent	Conventional		Experimental (Lokomat)	
Age	45–51			
Sex	8M	2F	4M	1F
AIS	D			
	First Week		Eighth Week	
WISCI	13–20(16,7)		14–21(17)	
BWS	23,8%		14,3%	
6MWT	223m		244m	
BBS	41		45	

It has been shown that increasing duration of training leads to improved walk-ing ability, the difference between the control and the experimental group in terms of WISCI, FIM–L, LEMS was noted (see Table 2)

Table 2

Exponent	Conventional		Experimental (Lokomat)	
Age	16–70			
Sex	62M	38F	63M	37F
AIS	C, D			
	First Week	3 Month	First Week	3 Month
WISCI	2,3–6	9	3–8	16
FIM–L	2–6	7	3–6	10
LEMS	30	35	33	40
BWS	60%	25%	60%	25%

The next LokoHelp device is an electromechanical device which consists of running track, body weight system (BWS), insertion of foot orthosis, parallel side bars and integral computer. Its purpose is to increase the strength of the lower back muscles, walking speed, increase the length of the step, improve the mobility of the joints, as well as decrease the spasticity of the affected limb [3]. It was researched that the use of this robotic system with different patients (Brain injury, Stroke) increased the FAC and Berg Balance Scale scores, while other Motricity Index indicators, RiverMead Mobility Index, did not show significant improvement. Also is noted that physical therapists were much less troublesome in the process of rehab and patients describe their condition as low-to-exhausting (see Table 3)

Table 3

Exponent	Conventional		Experimental (LokoHelp)	
Age	45–50			
Sex	–	–	4M	1F
AIS	D			
	First Week		Sixth Week	
FAC	1,6		2,1	
MISC	94		111	
BBS	20		25	

Conclusion. Summing up, the most effective robotic device is Lokomat. The majority of patients have the effective results in improving the 6MWT or 10MWT score, as well as the spasticity of the lower limb muscles. Robotized devices have great results in simulating training parameters, real-time motion analysis, providing long-term training and improving the development of walking. However, in spite of the presented research, it is necessary to take into account the differences in standardized methodological programs, health state of patients (stages and duration of pathological process) and the absence of further observation, which would confirm the preservation of the changes.

References

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