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THE EFFECTIVENESS OF MOTOR CONTROL TRAINING IN TREATING PATIENTS WITH CHRONIC LOW BACK PAIN

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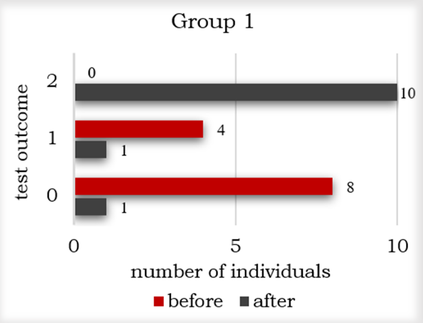
INTRODUCTION

In case of chronic low back pain, changes occur at the central nervous system level. It leads to motor control impairments and numerous patients movement restrictions.
A comprehensive therapy plan requires a global perspective and an analysis of the patient's movement and functional efficiency.

The aim of the study was to determine the effectiveness of developed motor training program on improving motor control skills, quality and technique of performing functional patterns and increasing the functional efficiency of the participants and pain levels of the subjects.

MATERIAL AND METHODS

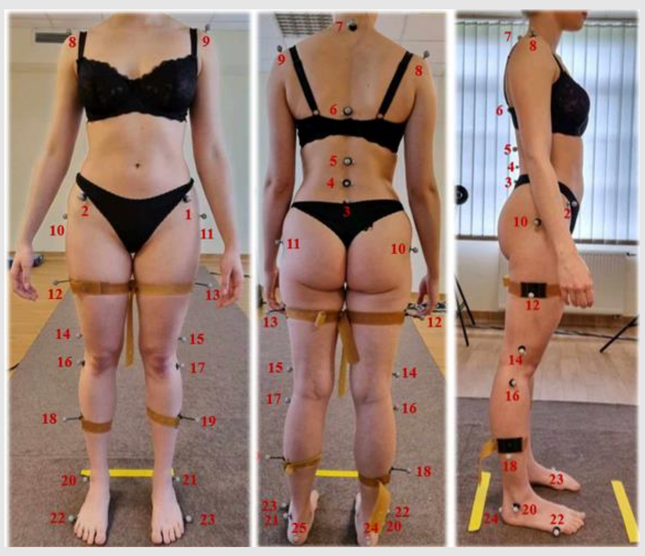
- 24 women in age 20-24 with reported low back pain
- Group 1(G1 n=12) participated in 12-weeks functional, Lumbo-Pelvic-Hip Complex training program
- Group 2 (G2 n=12) was the control group, without form of intervention
- All measurements were conducted twice, before and after 12 weeks
- To identify deficits in movement control, a research protocol FTP_{KCMSI} was developed
- To assess functional efficiency, the FMS screening test which evaluates seven fundamental movement patterns was used
- Three-dimensional motion analysis system BTS SMART-D allowed for a quantitative assessment of forward trunk flexion movement technique by determining changes in angular relationships over time
- Pain levels were evaluated using the VAS Scale. Due to the nature of the variables, for statistical analysis were used both parametric and non-parametric significance tests. Statistical significance was assumed at p<0,05. Results were also interpreted based on percentage calculations



Intragroup comparison of Test 1 results: lumbar flexion and forward bending before and after 12 weeks

first and last name	TEST 1 lumbar flexion and forward bending		TEST 2 UCM flexion: knee extension test		TEST 3 UCM extension: lower extremity lowering test		TEST 4 UCM extension: hip extension test	TEST 5 UCM rotation (closed kinetic chain): single-leg bridge test with extended contralateral leg	
before									
after									
first and last name	TEST 6 UCM rotation (opened kinetic chain): bent knee outward drop test		TEST 7 UCM hip flexion: 1/4 single leg squat with trunk upright		TEST 8 modified Thomas test		TEST 9 knee flexion in prone position	TEST 10 m. gluteus medius and minimus (internal range maintenance)	
before	R:	L:	R:	L:	R:	L:		R:	L:
after	R:	L:	R:	L:	R:	L:		R:	L:
first and last name	TEST 11 m. external oblique		TEST 12 m. hamstring (passively)		TEST 13 m. iliopsoas		TEST 14 m. gluteus maximus	TEST 15 assessment of abdominal muscles functionality- transition from supine to sitting position	
before			R:	L:					
after			R:	L:					

FTP_{KCMSI} Functional testing protocol based on the concepts of Kinetic Control and Movement System Impairment



Placement of BTS markers: front view, rear view, side view

MOTOR CONTROL TRAINING

Functional training program for the lumbopelvic-hip complex, including motor control, muscle strengthening, and stretching exercises

$\delta_{RHnaLA180}$ and $\delta_{LHnaLA180}$ defining the extent of movement that occurred in the hip joints before flattening of the lumbar lordosis occurred in the spine

$\zeta_{aLAcRH30}$ and $\zeta_{aLAcLH30}$ determining the degree of movement occurring in the lumbar spine during the initial phase of executing the forward bending movement pattern

αLAn the lumbar angle determined based on markers placed on the spinous processes S1, L3, Th12

FMS_{SUM} total points achieved in the Functional Movement Screen test

VAS pain intensity

Tables. The pain level, total points obtained in the FMS test and angular relationships in individual segments during the forward bending movement determined by the BTS System in Group 1 and Group 2, before and after 12 weeks

α_{LAn}			group		$\bar{x} \pm SD$	Me	Min-Max	p
	p		G1 (n=12)	before	150,66± 7,69	150,41	138,27-161,16	0,00
before	G1 vs G2	0,31		after	155,97± 8,18	157,09	142,14-168,20	
after		0,04	G2 (n=12)	before	153,70± 6,49	154,10	141,51-160,57	0,24
between-group comparison				after	152,39± 10,39	153,01	140,54-165,91	

$\zeta_{aLAcRH30}$			group		$\bar{x} \pm SD$	Me	Min- Max	p
	p		G1 (n=12)	before	32,06± 5,86	30,36	24,18-42,51	0,00
before	G1 vs G2	0,13		after	20,43± 6,32	21,62	11,36-29,82	
after		0,01	G2 (n=12)	before	27,84± 7,31	28,47	16,87-39,68	0,63
between-group comparison				after	29,31± 10,21	29,21	11,37-42,51	

$\zeta_{aLAcLH30}$			group		$\bar{x} \pm SD$	Me	Min- Max	p
	p		G1 (n=12)	before	31,66± 6,24	31,08	21,56-44,19	0,00
before	G1 vs G2	0,11		after	20,47± 6,76	21,19	10,74-29,82	
after		0,03	G2 (n=12)	before	27,25± 6,89	28,79	16,87-38,68	0,53
between-group comparison				after	29,22± 10,69	30,08	10,58-44,19	

$\delta_{RHnaLA180}$			group		$\bar{x} \pm SD$	Me	Min-Max	p
	p		G1 (n=12)	before	24,63± 10,37	23,13	4,89-39,84	0,02
before	G1 vs G2	0,58		after	36,69± 14,31	34,99	12,73-56,71	
after		0,00	G2 (n=12)	przed	27,05± 10,99	28,87	6,99-39,88	0,77
between-group comparison				after	29,33± 7,15	19,42	8,44-28,56	

$\delta_{LHnaLA180}$			group		$\bar{x} \pm SD$	Me	Min-Max	p
	p		G1 (n=12)	before	25,63± 10,49	24,05	5,86-41,67	0,02
before	G1 vs G2	0,55		after	37,41± 15,18	36,26	13,77-60,05	
after		0,00	G2 (n=12)	przed	28,24± 10,30	29,75	8,13-41,67	0,98
between-group comparison				after	29,69± 7,04	29,49	8,25-28,98	

VAS			group		$\bar{x} \pm SD$	Me	Min-Max	p
	p		G1 (n=12)	before	5,50± 1,73	5,50	3,00-8,00	0,00
before	G1 vs G2	0,79		after	1,67± 0,89	1,67	0,00-3,00	
after		0,00	G2 (n=12)	before	5,33± 1,23	5,00	4,00-7,00	0,09
between-group comparison				after	4,42± 1,38	4,00	3,00-7,00	

FMS_{SUM}			group		$\bar{x} \pm SD$	Me	Min-Max	p
	p		G1 (n=12)	before	13,58± 2,74	14,50	8,00-17,00	0,00
before	G1 vs G2	0,81		after	16,83± 1,69	16,00	15,00-20,00	
after		0,00	G2 (n=12)	before	14,00± 2,37	15,00	8,00-17,00	0,96
between-group comparison				after	14,08± 2,07	14,50	11,00-18,00	

$\bar{x}$- arithmetic mean; Me- median; Min- minimum value; Max- maximum value; SD- standard deviation; n- group size; p< 0,05- statistically significant differences

RESULTS

↑ better quality of executing the functional movement pattern

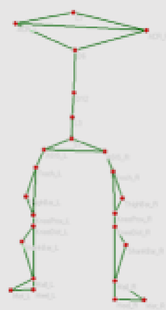
↓ VAS: the proposed training program significantly decreased pain level

↑ FTPKCMSI protocol: an improvement was observed in controlling the prescribed movements and muscle work efficiency

↑ BTS: significant changes in the values of the angular relationships in individual segments during the forward bending movement

↑ FMS: a significantly higher level of functional efficiency tests

↑ obtained in Group 1 results were significantly superior compared to the control group, where no significant differences were noted in the second assessment



BTS Smart Tracker

CONCLUSIONS

**The implementation of motor control training has proven to be an effective form of therapy.
A deeper understanding the pathophysiology of existing movement disorders may contribute to the physiotherapist or trainer's development of personalized therapeutic programs that includes the specific movement deficits of patients.**