



## IMPROVEMENT OF POSTURAL FUNCTION OF THE LOWER EXTREMITY AFTER TOTAL HIP REPLACEMENT

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### ABSTRACT:

Postural control is an integral part of the human motor function in a state of health and illness. Postural control impairments are often found in injuries and diseases of the musculoskeletal and nervous systems. Degenerative processes in the hip joint adversely alter the mechanoreception, which problem can be eliminated through total hip replacement. The purpose of this study is to follow the static balance recovery process, following a total hip replacement, after a 30-day sensorimotor stimulation at home.

**Material and methods:** Material: the study involves 20 women (60-72 years old) who underwent total hip replacement and a following sensorimotor stimulation at home. Methods: pain rating, according to the Visual Analogue Scale (VAS); Manual Muscle Testing (MMT) of certain muscle groups; test for static and dynamic balance, and postural control

**Results:** The obtained results show a significant improvement in motor and postural function during the postoperative period due to systematic physiotherapy at home.

**Conclusions:** the approved sensorimotor training program is easily implemented individually and at home and can be successfully integrated with other physiotherapeutic means from the functional recovery programs for total hip replacement during the minimally protective phase or chronic recovery period.

**Keywords:** physiotherapy, total hip replacement, postural control,

### INTRODUCTION

The postural function is a main and integral part of the human motor function in a state of health and illness. Most injuries and diseases of the musculoskeletal and nervous systems display varying degrees of postural function impairment, which contributes to the establishment of its medico-social significance [1]. Degenerative processes in the hip joint involve a number of anatomical structures (articular cartilage, synovial sheath, articular capsule, periarticular ligaments, tendons and periarticular muscles) and adversely alter the mechanoreception. This degenerative process can be stopped, and the disease symptoms can be eliminated through a total hip replacement [2, 3]. The role of physiotherapy is fundamental for the complete recovery of total hip replacement patients. Physiotherapy, with its active participation in the recovery process, has the ability

to improve impaired motor activity, restore the patients' independence to perform everyday activities, work capacity and even physical activities. The improvement of the pathologically altered postural control is possible through the application of appropriate means for sensorimotor stimulation, incl. at home.

*The purpose* of this study is to follow the static balance recovery process, following a total hip replacement, after a 30-day sensorimotor stimulation at home. The physiotherapeutic tasks are: determining the type of mechanoreception impairment after a total hip replacement and selecting the necessary functional examinations and tests for postural function evaluation, as well as applying appropriate sensorimotor stimulation at home.

### MATERIAL

The study involves 20 women (60-72 years old) who underwent a total hip replacement. After the establishment of the type of mechanoreception impairment (four months after the surgical intervention), they participated in exercises for sensorimotor stimulation at home (thirty-day program).

**The methods of influence** are sensorimotor stimulation exercises after total hip replacement.

**Research methods** (at the beginning and end of the study):

- Pain rating, according to VAS;
- MMT of certain muscles;

Test for static and dynamic balance and postural control [4, 5].

### RESULTS FROM THE CONDUCTED STUDY

The results analysed in the study were gathered from 20 women (65-72 years old) four months after a total hip replacement with cemented and uncemented fixation. The physiotherapeutic program, consisting of sensorimotor stimulation exercises at home, was applied four months after the surgical intervention. The patients were trained beforehand by a physiotherapist in the correct implementation of the physiotherapeutic program (PTP) [6]. At first, the exercises were performed on a solid base and later on an

unstable soft base (foam mat, 15-20 cm thick). The complex includes the stances “gymnastics scale” (fig. 1.), “semi-tandem” (fig. 2a.), “flamingo” (fig. 2b.).

**Fig. 1.** Stance “gymnastics scale”



The exercises are first performed standing on the healthy lower extremity with open and closed eyes, then on the endoprosthetic lower extremity with open and closed eyes [7]. The exercises with closed eyes are performed un-

**Fig. 2. a)** Stance “semi-tandem”; **b)** Stance “flamingo”



der physiotherapeutic control in order to prevent staggering and falling. Table 1 (Results from VAS before and after (n=20)) shows the results from VAS before and after the completion of the thirty-day program ( $\chi^2=30,7$ ):

**Table 1.** Results from VAS before and after (n=20)

Degree	0	1	2	3	4	5	6	7	8	9	10
Before	0	5	7	2	3	2	1	—	—	—	—
After	3	7	6	2	1	1	—	—	—	—	—

Four months after the total hip replacement, the respondents report minimal pain (60%), mild pain (24%) and moderate pain (16%), which only occurs under greater exertion. After completing the thirty-day sensorimotor stimulation at home, the patients report a significant change in pain perception (15% - no pain; 5% - moderate pain).

Therefore we can affirm that the applied sensorimotor stimulation causes statistically significant changes in terms of reducing pain symptoms. Table 2 (Comparison of the MMT results before and after the PTP (n=20)) presents the MMT results:

**Table 2.** Comparison of the MMT results before and after the PTP (n=20)

Indicators	Before		After		d	t	P(t)
	X 1	S x1	X 2	S x2			
m. gl. medius	3.5	0.5	4	0.45	0.5	2.41	0.05
m. gl. maximus	3.8	0.4	4.4	0.44	0.6	2.37	0.05
Internal rotators	3.5	0.45	3.9	0.40	0.4	2.25	0.05

The results show that muscle weakness is reduced in all tested muscle groups. The improvement in the external rotators of the hip joint is 0,40 with 1,10 until the norm of the healthy leg. For the gluteus medius muscle, the improvement is 0,50 with 1,00 until the norm, and for the gluteus maximus muscle, 0,60 with a deficit of 0,60 until the norm. The test is subjective, but the evaluations show a possibility for stabilisation of the hip joint, given that,

according to the literature, muscle weakness after total hip replacement is experienced even after 2 years. In comparison to the results from patients with arthrosis, who are treated non-operatively, these evaluations are better. Table 3 (Comparison of the results from the static part of the test in seconds (n=20)) presents the results from the static postural balance (standing on the operated lower extremity):

**Table 3.** Comparison of the results from the static part of the test in seconds (n=20)

Indicators	Before		After		d	t	P(t)
	S x1	S x1	X 2	S x2			
1st position	14.8	2.28	18.9	3.21	4.1	4.71	0.01
2nd position	8.9	1.47	11.9	2.42	3	4.57	0.01
3rd position	3.8	1.21	6.8	1.13	3	4.75	0.01

The improvement in all examined positions is statistically significant. The results show a notable increase in the average values in the 1st position by 4,10 sec and in the 2nd and 3rd position by 3,00 sec, provided that the patients performed a limited number of physical

therapy procedures after the surgery. Table 4 (Comparison of the results from the dynamic part of the test between the initial and final examinations) presents the results from the dynamic part of the test:

**Table 4.** Comparison of the results from the dynamic part of the test between the initial and final examinations

Before		After		d	t	P(t)
X1	Sx1	X2	Sx2			
2.5	0.52	3.25	0.61	0.75	4.46	0.01

The good average, the initial assessment X1 - 2,50 points and the statistically significant increase of 0,75 points and a deficit of 0,75 points is observable. These data display a good recovery of the motor and postural function four months after the total hip replacement.

The presented results are notably improved during the postoperative period due to continuous physiotherapy at home. This shows that physiotherapy has abilities that are underestimated and partially implemented. One of the responsibilities of the physiotherapists is to give instructions and train the patients' relatives to assist them at home.

The generalised results from the study show that after total hip replacement, the organic pathological mechanoreception is maintained until the somatic pain subsides or resolves and the function of the surrounding articular tissues is restored. The evaluations from the functional recovery are good for the type of healing process. The applied test for static and dynamic balance and postural control is appropriate for total hip replacement. The applied sensorimotor stimulation at home is suitable

and shows good results. The comparison of the results shows that the applied systemic physiotherapy at home gives positive results as far as recovery of motor and postural function.

### CONCLUSIONS

Our research on the recovery of static and dynamic balance after 30 day of sensorimotor stimulation at home following a total hip replacement displays its effectiveness and ability to improve the equilibrium function and the quality of life. The prepared methodology for research, evaluation and sensorimotor stimulation facilitates the patients and their relatives and improves their independence and quality of life. It is one of the physiotherapeutic means that effectively improves static and dynamic balance [8, 9]. The approved sensorimotor training program is easily implemented individually and at home and can be successfully integrated with other physiotherapeutic means from the functional recovery programs for total hip replacement during the minimally protective phase or chronic recovery period.

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