

# COMPARATIVE STUDY ON THE EFFICIENCY OF PHYSICAL THERAPY IN THE CONSERVATIVE TREATMENT OF KNEE OSTEOARTHRITIS

MARGIT HIDI<sup>1</sup>, ISTVÁN GERGELY<sup>2</sup>, SÁNDOR ZUH<sup>3</sup>, SORIN TUDOR POP<sup>4</sup>

<sup>1</sup>Mureş County Hospital, <sup>2,3,4</sup>University of Medicine and Pharmacy Tîrgu Mureş

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**Abstract:** With a sample of 40 study subjects undergoing total knee arthroplasty with cemented total endoprosthesis, a prospective observational study was performed in order to evaluate the effectiveness of the rehabilitation programme developed by the Department of Clinical Orthopaedics and Traumatology of Tîrgu-Mureş County Hospital, by evaluating the development of functional results obtained during regular evaluations. The follow-up period for the patients was 3 (three) months. Comparing average joint mobility measured at three months after surgery, a statistically insignificant difference was noted between the operated and the opposite – considered healthy – knee. By comparing averages function tests and WOMAC score obtained at each evaluation, a significant improvement in the patients' functionality was found. This rehabilitation protocol has proven effective in ensuring rapid functional recovery, three months after surgery patients showing normal mobility without having to limit their daily activities.

## INTRODUCTION

Osteoarthritis is characterized by degeneration of the articular cartilage of the knee joint. Untreated, the progress of the disease is slow but progressive. Pain is increasing and becomes constant, leading to significant impairment of quality of life.(1) In the case of advanced stage of the disease, when conservative treatment methods are no longer effective, knee arthroplasty is recommended.

The aim of surgery is to improve symptoms and restore joint function.(2)

For the success of the intervention, it is essential for the patient to follow a postoperative functional recovery programme based on active physiotherapy. In the case of knee arthroplasty, the main objective of the recovery is to restore joint mobility.

Limitation of joint movements makes impossible the fulfilment of other objectives of the recovery: reducing pain and inflammation, muscle toning on the operated member, recovering stability, balance and proprioception, resume walking without auxiliary support and restoring the independent movement of the patient.(3)

To restore joint mobility, the kinetic programme may begin with mechanical passive joint mobilization. The possible beneficial effects of assisted passive mobilization are the edema reduction, improving mobility and joint function and reducing the risk of thrombosis.(4)

## PURPOSE

The purpose of this paper is to present recovery protocol recommended in patients undergoing total knee arthroplasty and assessing the development of functional results obtained in the three months postoperative recovery, following the protocol of Tîrgu-Mureş County Hospital's Clinical Orthopaedics and Traumatology Department.

## MATERIALS AND METHODS

The prospective observational study conducted at the Department of Orthopaedics of Tîrgu-Mureş County Hospital, between September 2013 and January 2015, 40 study subjects undergoing total knee arthroplasty with cemented total endoprosthesis. Surgeries were performed according to the protocol of the clinic. Exclusion criteria for patients in the study: patient age under 60 or over 80 years old, contralateral symptomatic knee osteoarthritis (scored over 4 on the visual analogue pain scale), other orthopedic disorders of the legs or the presence of neurological disorders that can cause functional limitations, morbid obesity, body mass index (BMI) > 40 kg / m<sup>2</sup>, uncooperative patient or poor compliance to the proposed recovery programme.

Both passive mobilization and active exercises were initiated in the first postoperative day, the time allocated to do the proposed recovery exercises is 4 hours per day (2 times 1 hour for the mechanical passive mobilization during hospitalization, 4 times 30 minutes of active exercise with progressively increasing duration). The exercises were chosen in such a way that the patient can perform even after released from hospital, at home.

Average hospitalization length was 11 days. Discharge criteria: passive flexion of 110°, full extension, safe movements with one crutch, patient independently can climb or go down the stairs, the patient has learned and knows recovery exercises. Presentation of the recovery programme:

### Phase I (first two weeks of the postoperative recovery)

- objectives: improving muscle tone, improve joint mobility, reaching full extension, maintaining mobility of affected joints, resume walking with auxiliary support (a crutch) on level ground and stairs, self-care patient, pain intensity under 4 on the visual analogue scale.

<sup>2</sup>Corresponding author: Gergely István, Str. Mihai Viteazu, Nr. 31, 540080, Tîrgu-Mureş, România, E-mail: gergelyistvan@studium.ro, Phone: +40744 360293

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## CLINICAL ASPECTS

- recommended exercises: isometric contractions of the quadriceps and hamstring muscle group, mechanical passive mobilization (2x1h / day), active joint mobilization carried out in the open and closed kinetic chain, operated limb loading tolerability limit.

### Phase II (week 3-6 of the postoperative recovery)

- objectives: progressively increasing of flexion degree, improve muscle tone and strength of the operated limb, lower limb symmetrical loading.
- recommended exercises: continue the exercises recommended in the first phase, free and active exercises with resistance to improve muscle strength, bicycle without resistance, swimming and hydrokinetotherapy after complete wound healing.

### Phase III (weeks 7-12 of the postoperative recovery)

- objectives: normal walking without auxiliary support, movement possible on the whole range of motion, completely independence in the performance of all tasks of daily living, reintegration of patient in the environment he/she lives in.
- recommended exercises: continue the exercises recommended in the previous phases of the recovery, increasing intensity and duration of exercises to develop balance, coordination and proprioception, exercises with the unipodal support of operated leg.

Evaluation of patients was performed preoperatively, on the day of discharge and 3 months postoperatively. The evaluation of active joint mobility of the knee was performed in the supine position.

To assess joint mobility and stability "timed up and go" was performed – the time the patient needed to get up from a chair, travel a 3 m straight distance, turn back and sit down. Stops and recommences were allowed. Interpretation of results: ≤ 10 sec - normal mobility without limitations for daily activities, ≤ 20 sec - reduced mobility, functional limitation, ≤ 30 sec - severely reduced mobility.

To test the muscular endurance the „six minutes walk" was performed –the distance the patient covered in six minutes on a flat surface was measured. Stops, recommences, breaks were allowed. By the WOMAC (McMaster Universities Osteoarthritis Western Ontario and Index) the difficulty to perform everyday activities was measured.

All statistical calculations were performed in spreadsheets and GraphPad InStat 3 software. Data were considered as nominal or quantitative variables. Nominal variables were characterized using frequencies.

Quantitative variables were tested for normality of distribution using Kolmogorov-Smirnov test and were characterized by median and percentiles (25-75%) or by mean and standard deviation (SD), when appropriate.

A chi-square test was used in order to compare the frequencies of nominal variables. Quantitative variables were compared using t test, ANOVA test or Kruskal-Wallis test, when appropriate.

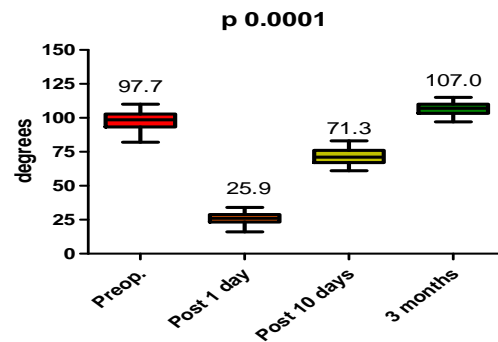
We used the Bonferroni or Dunns correction in order to account for multiple comparisons. The level of statistical significance was set at  $p < 0.05$ .

## RESULTS

Distribution by age and gender of the subjects included in the study was balanced.

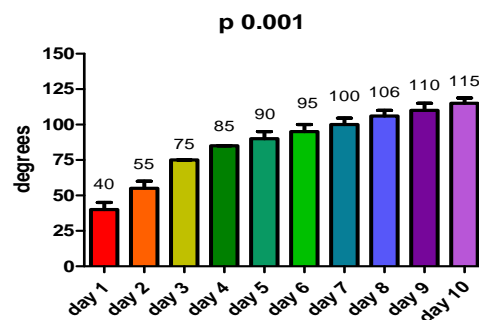
The average values in active mobility are given by figure no. 1.

Figure no. 1. The average values of active mobility



Comparing the goniometric averages obtained during the four evaluations by Anova and Bonferroni multiple comparability tests, the result was a significant p ( $p = 0.0007$ ), there is a statistically significant difference between the obtained averages. Comparison of active range of motion measured at three months, with the degree of contralateral (considered healthy) knee mobility, was possible with a student test. Operated knee mobility is lower ( $107.0^\circ$ ) than contralateral knee ( $108.1^\circ$ ), but the difference was not statistically significant ( $p = 0.01$ ). Evolution of passive mobility averages are shown in figure no. 2.

Figure no. 2. Evolution of passive mobility averages



Using Kruskal Wallis test, the statistically significant differences between the medians of the 10 developments were highlighted.

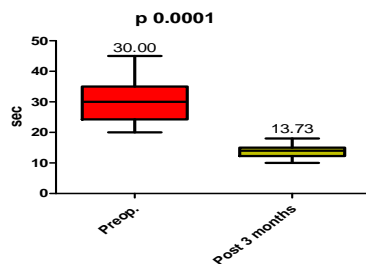
The average values of the "up and go" test are shown in Table 1. The comparison of the average test results was made by ANOVA. The statistically significant differences ( $p < 0.0001$ ) between the averages of three developments were revealed. The multiple compatibility test showed significant differences between the averages of the preoperative and 10 days postoperative, preoperatively and 3 months postoperatively, respectively 10 days postoperative and 3 months postoperatively results.

Table no. 1. Average values of the „up and go" test

	Preop.	Post. 10 days	Post 3 months
Minimum	11.00	56.00	8.000
Median	21.00	64.00	10.00
Maximum	33.00	72.00	14.00
Mean	21.08	64.05	9.975
Std. Deviation	4.927	4.613	1.577

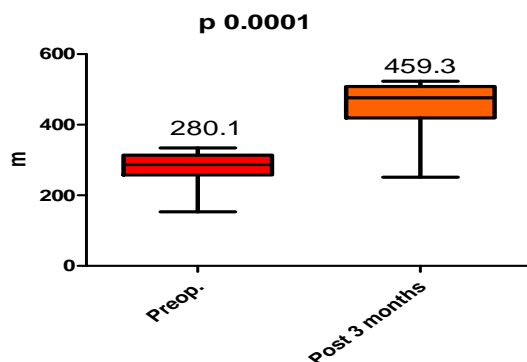
The averages of the "stair climbing" and the "six minutes walk" tests, performed preoperatively and 3 months postoperatively were compared by using the student test. The differences were statistically significant in both of the cases. The results are shown in figure no. 3 and figure no. 4.

Figure no. 3. "Stair climbing" tests averages



Comparing averages WOMAC score was performed using student test. Average values obtained from preoperative evaluation was 34.08, and the average obtained in the final evaluation at 3 months postoperatively was 79.56, the difference between the two values being statistically significant ( $p = 0.0001$ ).

Figure no. 4. "6 minute walk" tests averages



### DISCUSSIONS

The importance of postoperative recovery methods is a topic much discussed and debated by specialists worldwide. The literature abounds with data on the importance of postoperative recovery and the procedures used in the rehabilitation of patients with knee prosthesis, given the large number of these interventions.(5) However, there is still a well-established and widely accepted protocol recommended in these patients. Rehabilitation objectives are similar for all protocols, but during different stages of recovery larger variations are shown.(6,7,8)

The purpose of this paper is to present the recommended recovery protocol of our patients and assess the evolution of functional results obtained in three months postoperative recovery, following the protocol of the clinic.

With patients included in our study, the recovery program was initiated in the first postoperative day: the active and passive joint mobilization, and muscle toning exercises. Labraca NS.(9) et al. demonstrated the efficacy of exercise recovery starting in the first 24 hours postoperatively. They showed that patients who started recovering in the first postoperative day spent fewer days in hospital than patients, whose recovery was started after 48-72 hours passed from the procedure.

The beneficial effects of passive joint mobilization are widely debated by scholars, who are having contradictory opinions. Many studies (10) show that continuous passive mobilization does not benefit in the long-term restoring joint mobility and physical function.

According to the study we made, the recommended protocol ensures the improvement of patients' functionality in just three months. Comparing the average results of the active mobility with the contralateral knee motion, the difference was insignificant statistically speaking. Function test values showed

significant improvements between the average values obtained during the different assessments. According to the "up and go" test, preoperative patients have reduced mobility, functional limitation, and at the three months evaluation they exhibit normal mobility without limitations for daily activities. This result is confirmed by the average WOMAC score. Our results are consistent with the results of other similar studies confirming that full recovery after total knee arthroplasty takes three to six months. Studying the factors influencing postoperative recovery, we found out that in many studies demonstrated the importance of developing muscle strength of the quadriceps muscle, starting right from the preoperative period.(12,13) The subject of a future study could be the presentation of an efficient protocol in order to develop muscle strength.

### CONCLUSIONS

This personalized recovery protocol, recommended in patients undergoing total knee arthroplasty has proven effective in ensuring rapid functional recovery. Strictly following the presented protocol, three months after surgery, patients have normal mobility without the limitations of daily activities.

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