



Original Article

Evaluation of the effects of a physiotherapy program on quality of life in females after unilateral total knee arthroplasty: a prospective study

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Abstract. [Purpose] Osteoarthritis is a chronic and degenerative joint disease and is considered to be one of the most common musculoskeletal disorders. This study evaluated the differences in the quality of life of females treated with supervised physiotherapy and a standardized home program after unilateral total knee arthroplasty. [Subjects and Methods] From January 2012 to May 2015, a total of 40 females were examined at the Central Military Hospital in Ruzomberk, Slovakia. Quality of life was assessed with the Short Form-36. Quality of life and intensity of pain after normal daily activity, according to the visual analog scale, were assessed before total knee arthroplasty, immediately after physiotherapy, 3 months after total knee arthroplasty, and 6 months after total knee arthroplasty. [Results] We found statistically significant improvement of the quality of life results and a decreased intensity of pain at each time point compared with before total knee arthroplasty. [Conclusions] The results of this study provide further evidence indicating that patients who undergo total knee arthroplasty for primary osteoarthritis of the knee can achieve a significant improvement in the quality of life by using supervised physiotherapy compared with a standardized home program.

Key words: Quality of life, Physiotherapy, Total knee arthroplasty

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INTRODUCTION

Osteoarthritis (OA) is a chronic and degenerative joint disease and is considered to be one of the most common musculoskeletal disorders. Knee OA is a disease of the elderly that leads to pain and disability, to degeneration of the knee joint, and to worsening of quality of life (QOL). OA usually disturbs the QOL of women more than of men¹⁻³⁾. The main clinical symptoms are pain, stiffness, edema, deformity, and loss of range of motion, muscle weakness may develop, and even activities of daily life may be hindered by pain as the disease progresses. At the advanced stage, the pain is so unbearable that it disrupts sleep. This physical incapacity may affect psychological health and social functions⁴⁻⁶⁾.

Total knee arthroplasty (TKA) is a common, reliable surgical operation performed at the late stages of OA on patients

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Table 1. Baseline characteristics

	Supervised physiotherapy	Standardized home program
Patients (n)	20	20
Age (yrs)	67.9 ± 3.5 (59.0–73.0)*	68.2 ± 3.7 (59.0–73.0)*
Level of education (n):		
Primary school graduates	10	13
Secondary school graduates	2	3
University graduates	8	4
Economic status – active/retired (n)	4/16	3/17
Marital status – single/married (n)	7/13	5/15
OA duration (yr)	12.4 ± 2.9 (9.0–19.0)*	12.9 ± 2.6 (9.0–19.0)*
Treatment knee – right/left (n)	12/8	14/6
Patients with associated diseases – yes/no (n):	20/0	18/2
Diabetes	3	5
Hypertension	4	3
Back pain	6	4
Osteopenia	4	5
Depression	3	1

*Data are expressed as the mean ± SD (min–max).

that are unresponsive to conservative treatment. TKA relieves pain and restores function by increasing mobility and correcting any deformity, which consequently helps to improve the QOL of the patient both psychologically and physically^{7–13}. Physiotherapy techniques are the most important tools that patients and doctors have for rapidly improving QOL. However, although the provision of physiotherapy-based rehabilitation after TKA is seemingly ubiquitous, its role in restoring mobility and function after surgery remains unclear^{14–17}.

Therefore, evaluation of the effects of physiotherapy programs on QOL in patients can provide important information for doctors, physiotherapists, and patients with OA regarding selection of the most appropriate treatment based on patient preferences and convenience.

The aim of this study was to investigate the differences in QOL of females treated with supervised physiotherapy (SP) and a standardized home program (SHP) after TKA for primary OA of the knee.

SUBJECTS AND METHODS

From January 2012 to May 2015 a total of 40 females, who underwent unilateral TKA for primary OA of the knee were examined. This study was performed at the Central Military Hospital in Ruzomberk, Slovakia. All the females were advised to undergo TKA by a surgeon and met the inclusion criteria, including advanced changes of OA, unrelenting pain, limitation of movement, and muscle contractures, which are unresponsive to conservative treatment. None of the females met the exclusion criteria (presence of a malignancy, Charcot arthropathy, joint infection, advanced osteoporosis, obesity, varices, local infection, or progressing neurological defects; failure of an abductor muscles procedure; or in the need for extensive urological or dental procedures. The baseline characteristics of the females are shown in [Table 1](#).

The unilateral TKA was performed on all the patients by the same surgeon. Following combined epidural and spinal anesthesia, the knee was concomitantly prepared and draped with the patient in the supine position. The skin was incised at the midline, and the joint was accessed through a paramedian incision. Both femoral and tibial components were fixed using bone cement. All patients received prophylaxis for deep vein thrombosis and infection. No surgery-related complications were observed.

The hospital physiotherapy program included passive knee flexion and extension using a continuous passive motion (CPM) machine, which was started on the 1st postoperative day. The rehabilitation program on the first day included ankle dorsiflexion and plantar flexion, isometric exercises for the quadriceps muscle, straight leg raising, active flexion and extension of the knee as tolerated, and isometric and active exercises for hip muscles. On the 2nd postoperative day, the patients sat at the side of a bed and performed active knee flexion and extension exercises, learned how to sit and rise from the bed, and were mobilized to walk with a walker. Stair climbing was performed on the 5th day, and the patients were discharged on the 6th postoperative day.

After discharge, the patients who underwent TKA were randomized on 1:1 ratio to two groups (SP, n=20) and (SHP, n=20) using a random number table. The patients in the SP and SHP groups participated in a total of 20 sessions of their respective physiotherapy programs for an hour a day, 5 days a week, for 4 weeks ([Table 2](#)). All the participants were evaluated by a

Table 2. Components of the supervised physiotherapy and standardized home programs

Modalities	Supervised physiotherapy
Warm-up and stretching (10 min):	1. Global flexion-extension of the lower limb. 2. Alternated dorsal plantar flexion of the ankles. 3. Stretching of the hamstrings.
Strengthening (10 min):	1. Isometric knee extensors: flex 0°. 2. Isometric knee extensors: flex 60°. 3. Isometric hamstrings: flex 60°. 4. Concentric-eccentric hip abductors.
Functional task-oriented training (20 min):	1. Get up and sit down. 2. Knee extensor strengthening while standing with Thera-Band. 3. Controlled bilateral knee flexion-extension while standing. 4. Unilateral knee flexion to 90° while standing. 5. Climbing on a platform or a flight of stairs. 6. Walking backward, on a slope and/or laterally, while crossing the lower limbs. 7. Walking in place, with a large amplitude of hip and knee flexion and upper-limb movements.
Endurance (10 min):	1. Walking. 2. Stationary cycling.
Cooldown (10 min):	1. Stretching of the quadriceps, hamstrings, and calf. 3. Ice.
Modalities	Standardized home program
Range of motion (10 min):	1. Prone knee flexion. 2. Stationary bicycle for range of motion stimulus and endurance. 3. Hamstring, quadriceps, and gastrocnemius/soleus stretching.
Strengthening (10 min):	1. Straight leg raise. 2. Supine submaximal leg press or equivalent (emphasis on pain-free motion and neuromuscular control vs. pure strengthening). 3. Front and lateral step-ups progressing from 10 cm. 4. Resistive exercises against Thera-Band while sitting (starting with 90–30° and progressing to 90–0°).
Balance/gait (20 min):	1. Braiding (alternate front and back crossover steps whilst moving laterally), progressing by increasing speed. 2. Tandem walk forward and backwards. 3. Walking with multiple changes in direction on command. 4. Shuttle walking to increase endurance.
Proprioception (10 min):	1. Balance exercises in a single-leg stance. 2. Sit to stand. 3. Balance ball. 4. Perturbation from soft unstable surface.
Cooldown (10 min):	1. Stretching of the quadriceps, hamstrings, and calf. 3. Ice.

different physiotherapist, that is, not the one applying the therapy program.

QOL was examined in all patients with the Short Form-36 questionnaire (SF-36) in Slovakian, and the severity of pain was examined using the scale (VAS); both instruments were administered after daily activities before TKA, immediately after physiotherapy (IAP), 3 months after TKA, and 6 months after TKA. The SF-36 questionnaire is divided into 2 summary measures, the physical component and the mental component. It includes 36 questions in total, that cover 8 domains: 10 questions for physical function, 2 questions for social behavior, 4 questions for physical role, 2 questions for bodily pain, 5 questions for mental health, 3 questions for emotional role, 4 questions for vitality, and 6 questions for general health. The score ranges from 0 to 100, with the best quality of life corresponding to 100 points and the worst to 0 points. The VAS is performed with a 10 cm long line, with the leftmost side representing 0 (no pain) and the rightmost side representing 10 (unbearable pain). The participants marked their current level of pain on the scale after normal daily activities. The study was administered by a surgeon, psychologist, and physiotherapist. This study was designed in accordance with the rules for human experimental studies and approved by the Bioethical Committee of the Catholic University in Ruzomberk. This study also conformed to the principles of the Declaration of Helsinki (1975, revised 1983). All participants signed informed consent forms prior to participation.

IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA) was used for the statistical analyses. The data are presented as the mean \pm standard deviation (SD), mean difference (MD), and 95% confidence interval (95% CI). All the variables presented normal distributions according to Shapiro-Wilk tests. Two-way repeated-measure analysis of variance (ANOVA) was used for comparisons between the SP and SHP groups before TKA, IAP, 3 months after TKA, and 6 months after TKA and to assess the differences in the variables. The Tukey's procedure was used as a post hoc test to identify specific differences between groups at each assessment point. The results were determined to be statistically significant at $p < 0.05$.

RESULTS

We found the statistically significant improvements in the SF-36 and VAS results IAP and 3 and 6 months after the TKA in both treatment groups ($p < 0.05$) in all patients in both treatment groups (Table 3). The results post hoc testing with Tukey's procedure revealed that there were no significant differences in domains of QOL, except for physical role (PR), vitality (V), bodily pain (BP). A statistically significant difference was detected in the PR domain 6 months after TKA ($p = 0.019$), in the V domain 3 months after TKA ($p = 0.037$) and in the BP domain 3 months after TKA ($p = 0.000$) in favor of the SP group. When the intensity of pain was compared using the VAS, a statistically significant difference was detected IAP ($p = 0.004$) and 3 months after TKA ($p = 0.001$), and the difference was also in favor of the SP group (Table 4).

Table 3. Intragroup differences from the time before TKA until 6 months after TKA

Domain	Supervised physiotherapy				Standardized home program			
	Before TKA	IAP	3 mo	6 mo	Before TKA	IAP	3 mo	6 mo
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
PF	15.1 (10.6)	53.1 (10.2)	73.9 (8.0)	87.8 (9.9)*	14.7 (10.0)	44.9 (8.9)	65.3 (8.8)	80.7 (10.6)*
PR	15.7 (7.9)	51.4 (9.7)	73.3 (7.9)	85.3 (9.6)*	16.2 (7.8)	44.6 (9.9)	66.0 (8.0)	75.7 (10.3)*
GH	27.4 (9.9)	52.1 (10.1)	71.6 (8.2)	82.1 (9.3)*	28.3 (9.5)	44.3 (9.8)	65.3 (8.5)	74.2 (7.3)*
V	29.0 (9.5)	61.2 (7.7)	71.5 (6.5)	81.1 (8.9)*	29.3 (9.3)	55.6 (9.0)	62.3 (11.8)	75.3 (9.3)*
SF	31.2 (10.2)	62.6 (9.4)	80.2 (8.5)	87.8 (9.6)*	32.3 (10.3)	55.9 (10.7)	74.2 (9.7)	80.4 (10.4)*
ER	28.1 (11.0)	66.9 (10.0)	82.5 (8.0)	89.0 (7.1)*	27.7 (10.9)	58.6 (9.8)	74.7 (12.1)	81.7 (7.8)*
MH	46.0 (11.4)	67.6 (10.5)	73.4 (9.1)	81.1 (7.9)*	45.7 (11.3)	60.4 (10.1)	66.1 (9.4)	74.3 (8.7)*
BP	14.7 (6.9)	53.7 (9.3)	68.7 (7.3)	83.1 (9.2)*	14.1 (6.7)	46.3 (9.7)	56.5 (8.2)	76.1 (7.5)*
VAS	7.9 (0.8)	4.4 (1.3)	3.0 (0.8)	1.8 (1.3)*	7.5 (0.9)	5.6 (1.1)	4.3 (0.7)	2.6 (0.9)*

*Statistically significant within group ($p < 0.05$).

Before TKA: before total knee arthroplasty; IAP: immediately after physiotherapy; 3 mo: 3 months after TKA; 6 mo: 6 months after TKA; PF: physical function; PR: physical role; GH: general health; V: vitality; SF: social function; ER: emotional role; MH: mental health; BP: bodily pain; VAS: visual analog scale of pain

Table 4. Intergroup differences at each assessment time

Domain	Supervised physiotherapy vs. Standardized home program			
	Before TKA	IAP	3 mo	6 mo
	MD (95% CI)	MD (95% CI)	MD (95% CI)	MD (95% CI)
PF	0.4 (-9.0; 9.8)	8.2 (-1.1; 17.6)	8.6 (-0.7; 18.0)	7.1 (-2.3; 16.5)
PR	-0.5 (-9.2; 8.2)	6.8 (-1.9; 15.5)	7.3 (-1.4; 16.0)	9.6 (0.9; 18.3)*
GH	-0.9 (-9.8; 8.0)	7.8 (-1.0; 16.7)	6.3 (-2.6; 15.2)	7.9 (-1.0; 16.8)
V	-0.3 (-9.1; 8.5)	5.6 (-3.2; 14.5)	9.1 (0.3; 17.9)*	5.8 (-2.9; 14.7)
SF	-1.1 (-10.7; 8.5)	6.7 (-2.8; 16.3)	6.0 (-3.6; 15.6)	7.4 (-2.2; 17.0)
ER	0.4 (-9.1; 9.9)	8.3 (-1.1; 17.8)	7.8 (-1.6; 17.3)	7.2 (-2.2; 16.7)
MH	0.3 (-9.3; 9.9)	7.2 (-2.3; 16.8)	7.3 (-1.1; 15.4)	6.8 (-2.7; 16.4)
BP	0.6 (-7.3; 8.6)	7.4 (-0.5; 15.4)	12.2 (4.2; 20.1)*	7.0 (-0.9; 14.9)
VAS	0.3 (-0.6; 1.3)	-1.2 (-2.2; -0.3)*	-1.3 (-2.3; -0.4)*	-0.8 (-1.8; 0.2)

*Statistically significant between groups ($p < 0.05$).

MD: mean difference; 95% CI: 95% confidence interval; before TKA: before total knee arthroplasty; IAP: immediately after physiotherapy; 3 mo: 3 months after TKA; 6 mo: 6 months after TKA; PF: physical function; PR: physical role; GH: general health; V: vitality; SF: social function; ER: emotional role; MH: mental health; BP: bodily pain; VAS: visual analog scale of pain

DISCUSSION

Physiotherapy after TKA is usually recommended to help patients become functionally independent following knee surgery and to help them return to their pre-disease conditions. SP and SHP programs are commonly preferred methods of achieving these goals¹⁸⁻²¹). The available studies indicate that there is no significant difference between patients treated with SP and those treated with a SHP program with respect to functional status of the patient, and overall health status of the patient²²⁻²⁵). However, Moffet et al.²¹) found that an intensive SP program between the 2nd and the 4th months after TKA was more effective than an SHP program in improving short-term and mid-term functional ability after TKA. Therefore, more intensive rehabilitation should be promoted in the subacute recovery period after TKA to optimize functional outcomes in the first year after surgery. Furthermore, Shields et al.²⁶) found that subjects who received an intensive SP program had fewer problems with work or other daily activities because of physical health (PR domain), had less physical limitation, had fewer disabilities and fewer decrements in well-being, and had higher energy levels and better health than subjects in an SHP group.

In our study, all the patients showed the significant improvement in the SF-36 and VAS results from the time before TKA until 6 months after TKA. However, there were no significant differences in domains of QOL between the SP and SHP groups, except for the PR domain 6 months after TKA, and the V and BP domains 3 months after TKA in favor of the SP group. In our study, we assessed pain with the VAS because the SF-36 questionnaire evaluates pain and its effects on QOL

broadly with a few questions but does not take into consideration intensity of pain. Taking the VAS results into consideration, the level of pain was consistently reduced from IAP to 3 months after TKA and persisted until 6 months after TKA in the SP group compared with the SHP group, and this significantly improved the QOL of females who underwent unilateral TKA. The QOL improvement of our patients from the time before TKA until 6 months after TKA, may be due to meticulous preoperative interviews conducted prior to surgery and active participation of the patients in the SP or SHP program, which led to earlier restoration of mental and physical functions.

One of the limitations of the study is inclusion of only female patients who underwent unilateral TKA. Moreover, our conclusions are limited by the fact that the sample sizes for the SP and SHP groups were smaller than would be ideal. Therefore, further studies should be carried out on a larger representative sample to verify our results. Another limitation of the study is the lack of a long-term comparative analysis of the impact of SP and SHP programs on

QOL. Such a study is needed, as it would enable physiotherapists to use the optimal model of therapy in order to obtain the maximum health benefits in people who undergo TKA for advanced OA.

In conclusion, despite the limitations of the study, their results provide further evidence indicating that patients who undergo TKA for primary OA of the knee can achieve a significant improvement in QOL by using SP or SHP procedures. Moreover, the present study provides important information for doctors, physiotherapists, and patients with OA regarding selection of the most appropriate treatment based on patients' preferences and convenience.

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