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ABSTRACT

Research objective: to develop proposals and recommendations for improving the medical and social rehabilitation of patients and invalids after knee arthroplasty.

Materials and methods. The research covered data of 125 patients and invalids with various degenerative-dystrophic processes of one or both knee joints whom the total knee arthroplasty was performed in the period 2012 to 2019. All patients underwent medical rehabilitation in the National Disabled Persons Rehabilitation and Prosthetics Centre of the Republic of Uzbekistan. 100 (80%) patients were of active working age - from 25 to 55. For the research the patients were distributed by three rehabilitation groups: the 1st group (n=86) - rehabilitants with a unilateral defect, replaced by the artificial implanted joint; the 2nd group (n=32) - rehabilitants with the unilateral defect, who underwent total knee arthroplasty; the 3rd group (n=7) - patients with a unilateral defect who underwent total knee arthroplasty, but had severe pathology: III-IV degree arthrosis-arthritis of the contralateral joint or lumbar osteochondrosis.

Results: Application of the proposed device designed by us for early activation of the operated joint contributed to reduce the number of contractures in the operated joint in 80% of patients. The results of the statistical analysis on using our individual rehabilitation program for patients and invalids after total knee arthroplasty allowed to evaluate the efficacy of the range and standards of rehabilitation care at inpatient and outpatient stages, which resulted in reduction of temporary disability up to 1 month in 37.5% patients.

Conclusion. The proposed timely and continuously conducted staged medical and social rehabilitation showed high efficacy in 65.5% of patients and good efficacy in 20.8%.

Key words: knee joint, rehabilitation, efficacy, lameness, surgical treatment, endoprosthetics, disability.

INTRODUCTION

In different countries the incidence of post-traumatic and orthopedic pathology of the knee joint (KJ) among adults ranges up to 25%, while disability is about 60% of cases. Annually over a thousand people are newly approved for disability due to the musculoskeletal system diseases and connective tissue of the orthopedic field. What is more, primary disability associated with these diseases is characterized by a persistent severity indicator (I group - 0.8%, II group - 22.1%, III group - 77.1%).

In order to achieve certain success in the treatment of this pathology, numerous studies are being carried out in the world practice. A number of surgical methods for osteosynthesis and osteotomy of bone fragments, joint decompression with capsule arthrotomy have been developed. In post-traumatic and orthopedic diseases of the knee joint, arthroplasty (AP) is often the only operation of choice. Various methods of AP were applied using unicompartmental and total arthroplasty. Nowadays AP is implemented in the daily practice and achieved significant success. Obtaining positive results after the surgery in the term up to 20 years has been proved. Despite the high efficacy of surgical intervention, in practice there is a number of complications characteristic only for total knee arthroplasty (TKA), such as wear of the prosthesis, patellar dislocation of the endoprosthesis, thromboembolism of pulmonary artery and the development of periprosthetic “severe” infection, which leads to patient disability. In order to solve these problems, it becomes relevant to develop new approaches to rehabilitation measures.

Inadequate positive results of various methods of surgical treatment of patients and invalids due to posttraumatic and orthopedic pathology of the knee joint put the TKA in the forefront - a replacement of the pathologically changed joint with an artificial prosthesis. Currently, TKA is a popular and highly effective method of treating many diseases and consequences of knee joint injuries, particularly arthrosis-arthritis. In 2008, more than 600,000 TKAs were performed in the United States. According to the projection, the number of such interventions will reach 4.0 million by 2030 (Zagorodny N.V., Nuzhdin V.I., Kudinov O.A., 2011).

According to V.L. Ignatenko, et al. (2011) modern technologies are not always able to fully reflect all changes occurring in the knee joint due to the influence of degenerative-dystrophic processes. One of the causes for the frequent wear of the components of the knee endoprosthesis and subsequent revision interventions is insufficient alignment of the mechanical axis, considering the

existing defects of the proximal tibia of the lower leg, soft tissue imbalance, and joint dysfunction. An important medical, social and economic problem today is the rehabilitation of patients with TKA. In this relation we studied the stages and types of rehabilitation in a separate direction: medical and social rehabilitation (L.G. Kazak, 2003; S.Kh. Kurbanov, 2009).

At present, a number of new systems of medical rehabilitation in patients after TKA were developed, but the literature data analyzed by us did not provide the technology of rehabilitation, as a comprehensive and continuous (surgical hospital - rehabilitation center - polyclinic), in the form of social and vocational rehabilitation and, accordingly, sociomedical examination (SME) (L.G. Kazak, 2003; I.V. Roy, I.K. Babova, E.I. Bayandina, 2011; Brett Levine, Beth Kaplanek, 2007; V.M. Maiko, 2011 ;).

Despite the gained experience for TKA, the early, late and long-term outcomes of the operation associated with the patient's disabilities have not been sufficiently studied, as well as the dynamics of disability after TKA. The recommended kinds of labor, taking into consideration the pathology of adjacent joints, have not been presented.

In this connection, this problem is considered relevant and requires further improvement of the technology of the complex continuous rehabilitation process.

RESEARCH OBJECTIVE

The aim of the study is to develop recommendations and proposals for improving the medical and social rehabilitation of patients and invalids after knee arthroplasty.

MATERIAL AND METHODS

The research is based on the data of patients and invalids with various degenerative-dystrophic diseases of one or both knee joints who underwent total knee arthroplasty over the past 7 years (2012-2019).

In total, 125 patients and invalids were examined at the National Disabled Persons Rehabilitation and Prosthetics Centre of the Republic of Uzbekistan for medical rehabilitation from the Occupational Medical Assessment Board and clinical hospitals in Tashkent and other medical institutions of the republic. 68 (54%) patients were women and 57 (46%) were men. All patients, 100 (80%), were of active working age - from 25 to 55 years.

From the total number of rehabilitants, we have identified 3 rehabilitation groups. For this, the main criterion for group distribution was the severity of the static-dynamic dysfunction of the musculoskeletal system.

The 1st group - rehabilitants with a unilateral defect, replaced by an artificial implanted joint. No pathologies of the contralateral joint or other musculoskeletal system organs were noted in these patients. The group included 86 patients. The mean age of the rehabilitants was 43.2 years; 3 (3.5%) patients were under 30; 28 (32.6%) patients aged 31-45; 32 (37.2%) patients aged 46-55, and 23 patients (26.7%) aged 56 and over. There were 40 (46.5%) men in the study group, and 46 (53.5%) women.

The 2nd group of rehabilitants had a unilateral knee joint defect, treated by TKA; from the side of the contralateral joint, I-II degree osteoarthritis was determined. The 2nd group consisted of 32 patients. The mean age of rehabilitants was 49.3 years; there were 4 (12.5%) patients under 30, 10 (31.3%) patients aged 31-45; 16 (50.0%) patients aged 46-55; 2 patients (6.2%) aged 56 and over. Of them, 15 were men (46.9%) and 17 (53.1%) were women.

The 3rd group included patients with a unilateral defect treated by TKA, but having severe pathology of other musculoskeletal system organs: III-IV degree arthrosis-arthritis of the contralateral joint or lumbar osteochondrosis. This group included 7 patients. The mean age of patients was 30.5 years. Distribution by age: 5 (71.4%) patients under 30 years, and 2 (28.6%) patients aged 31-45. Men were 2 (28.6%) and women - 5 (71.4%). The distribution of rehabilitants who underwent TKA surgery by sex, age, and severity of musculoskeletal system dysfunctions are presented in the Table 1.

Table 1

Distribution of rehabilitants after TKA by sex, age and severity of musculoskeletal system disorders

Severity of musculoskeletal system disorders	Age								Total
	under 30		31-45		46-55		56 and over		
Unilateral defect compensated by TKA, without pathology of adjacent joints and spine	2	1	13	15	15	17	10	13	86
Unilateral defect compensated by TKA, osteoarthritis of the contralateral joint of II-III degree without spinal pathology	2	2	4	6	8	8	1	1	32
Unilateral defect compensated by TKA, severe osteoarthritis with contracture of the contralateral or adjacent joints, and spinal pathology	2	3	-	2	-	-	-	-	7
Total	6	6	17	23	23	25	11	14	125

In order to fulfil objectives, we carried out a comprehensive clinical and expert examination of 125 patients and invalids after TKA in various periods after the operation. According to the results of the survey and analysis of the outpatient cards, patients of the control group underwent standard physiotherapy applied as rehabilitation treatment method. Frequency of physiotherapy treatment was determined mainly by the patients.

During the study we applied clinical, biomechanical, electromyographic, radiographic research methods and the method of variation statistics.

Biomechanical research methods. To evaluate the recovery of support ability and static-dynamic function of the operated lower limb, as well as walking ability after TKA, biomechanical (basometry, ichnography, podometry) studies were carried out. The basometric method of research was based on a special medical balance MVEN-150-100. The basometric research method included measuring of body weight distribution in the limbs, which determined the asymmetry coefficient in the sagittal and frontal planes. These indicators should normally be 1.1 in the frontal plane, and 1.75 in the sagittal plane. For basometry, special balance was used, which simultaneously determined the distribution of body weight along both lower extremities. In patients with orthopedic pathology, the asymmetry coefficient was different. In case of unilateral pathology, the distribution of body weight was significantly greater than in the affected limb due to its shortening, and in case of bilateral pathologies this indicator was closer to normal, as the limb length was almost the same.

The studies were carried out in 64 patients, whom the asymmetry coefficient along the frontal and sagittal planes was determined. In 45 patients with unilateral knee joint pathology, the asymmetry coefficient was 2.35, and in case of bilateral pathology it was 1.9.

Basometry was performed before and after the surgery (Table 2.);

Table 2

1. Before surgery

Basometry	Norm %	Right	Left
Total weight, kg	80	55	25
along the frontal plane. kg %	100%	69%	31%
Asymmetry coefficient	50-50 0,97-1,1	2.2	
Along the sagittal plane		On the heel	Forefoot
Total weight, kg	80	61 (77%)	19 (23%)
Asymmetry coefficient	65%-35% 1,86	3,21	

2. After surgery, third month

Basometry	Norm %	Right	Left
Total weight, kg	82	47	35
along the frontal plane. kg%	100%	57%	43%
Asymmetry coefficient	50-50 0,97-1,1	1.33	
Along the sagittal plane		On the heel	Forefoot

Total weight, kg	82	56 (69%)	26 (31%)
Asymmetry coefficient	65-35	2.23	
	1,86		

3. After surgery, sixth month

Basometry	Norm %	Right	Left
Total weight, kg	81	42	39
along the frontal plane. kg%	100%	52%	48%
Asymmetry coefficient	50-50	1.09	
	0,97-1,1		
Along the sagittal plane		On the heel	Forefoot
Total weight, kg	81	53 (66%)	28 (34%)
Asymmetry coefficient	65-35	1.95	
	1.86		

After the rehabilitation measures in the core group of patients, the asymmetry coefficient was determined. The objective assessment of the results was closer to the norm, and in the control group, these indicators remained above the norm.

Electroneuromyographic research methods. Electromyographic studies were carried out based on the study of the global electrobiological activity of the lower extremities muscles. The indicators of muscle biopotentials were studied at maximum muscle contraction and at rest. Biopotentials were directed using bipolar silver electrodes set on the patient's skin. Firstly, having dubbed the skin with a special ointment, skin plates were set. Electromyography was performed on a Neuropack-51 apparatus, brand MEB -9400 AK by NIHON KonDEN, which recorded the total EMG parameters in the form of muscle biopotentials. In order to study the total electrical activity of the muscles, we used surface electrodes with the area of 100 mm^2. To reduce the resistance, the skin areas, where the electrodes were set, were treated with 70 ° ethyl alcohol. Standard skin electrodes (6-12 mm) were used.

In case of total EMG, we used skin electrodes made of metal in the form of round cups, into which electrode jelly was placed. To reduce the resistance, the skin surface was treated and degreased with alcohol 70º before applying the discharge electrodes.

During EMG, a voluntary muscle tension was determined, and attention was paid to the EMG amplitude, as well as the oscillation frequency. Using this method, the study of m.m. vastus medialis, lateralis and rectus were carried out, as well in the medial muscle group m.semimembranosus, and muscle groups m, biceps, the lower leg muscle m.m. tibialis anterior, gastrocnemius on both sides of both damaged and healthy knee joints. We were interested in the functional state of

myoneurons-axons, which regulated motor function. The data obtained were analyzed by the electromyograph and processed automatically.

The EMG data were studied and analyzed in 64 patients to evaluate the state of the neuromuscular apparatus of the lower extremities before and after TKA. The patients' age was from 25 to 70 years.

Indicators for unilateral and bilateral pathology were studied in a comparative aspect.

Table 3

EMG indicators in the control group

Muscle	Hz, before	Hz, after	mv, before	mv, after
m.m. vastus medialis, lateralis and rectus	38,73±0,67	75,9±0,73 p<0,001	4,36±0,47	1,31±0,04 p<0,001
m,semimembranosus, and m muscle groups, biceps	34,7±0,6	72,3±1,33 p<0,001	4,22±0,07	1,45±0,03 p<0,001
m.m. tibialis anterior, gastrocnemius	40,3±0,63	76,3±0,67 p<0,001	4,41±0,05	1,41±0,04 p<0,001

EMG indicators in the core group

Muscle	Hz, before	Hz, after	mv, before	mv, after
m.m. vastus medialis, lateralis and rectus	40,6±0,61	77,97±0,71 p<0,001	3,6±0,08	1,14±0,05 p<0,001
m,semimembranosus, and m muscle groups, biceps	43,04±0,58	73,03±0,97 p<0,001	3,99±0,064	1,14±0,03 p<0,001
m.m. tibialis anterior, gastrocnemius	39,35±0,58	83,7±0,39 p<0,001	4,34±0,05	1,3±0,039 p<0,001

As the tables show according to the results of the total EMG, the state after treatment changed significantly in a positive direction than in the initial one before the operation.

The duration of the neuromuscular system excitation after treatment improved 2.0 times, the amplitude in PD-DR - 2.3 times, and the areas occupied by individual motor units decreased 2.5 times, which confirms the efficacy of the complex therapeutic measures.

The data obtained were statistically processed using Excel 7.0. Differences were considered significant if the Student's t-test was equal or greater than 2.0 or the probability of coincidence was less than 5% ($p < 0.05$).

Radiologic research methods. Radiologic examination of the knee joint is the most important objective method used to diagnose and monitor the TKA efficacy. In this study, all patients underwent frontal and lateral projection radiography of the knee joint with the capture of n/3 femur and the proximal part of the leg bones in a strictly upright, using for this typical patient positioning and strictly observing the focal distance (100 cm) between the X-ray tube and joint.

Radiologic examinations were carried out using Bacara apparatus (Apelem, France), which allowed to conduct simultaneously roentgenoscopy online with the load of the operated limb. Besides, by changing the position of the apparatus tube, the bone state determination in a clear view was carried out.

Strict adherence to research technologies allows to obtain reliable data on the size and shape of the femur, tibia and patella, as well as the size and condition of the articular surface of the knee joints. The data obtained were considered when determining the size of the endoprosthesis and the nature of its fixation.

In case of pathological changes detection in the spine, radiologic examinations were performed in the lateral (position of maximum flexion and extension) and direct projections. Patients with polyarthritis underwent additional examinations of the knee, ankle, shoulder and elbow joints.

RESULTS AND DISCUSSION

Results of treatment of patients and invalids after knee arthroplasty

The treatment outcomes of 64 patients were studied and analyzed after performed TKA using a device developed by us to improve active and passive motion in the operated joint.

The novelty of the newly developed device is as follows: firstly, compared to the prototype, in the new device the foot holder in the frame moves with the help of rollers, the frame is specially designed in the arched shape so that during the development process the motions were smooth and effortless for the operated joint (No. FAP 1270) (Fig. 1.).

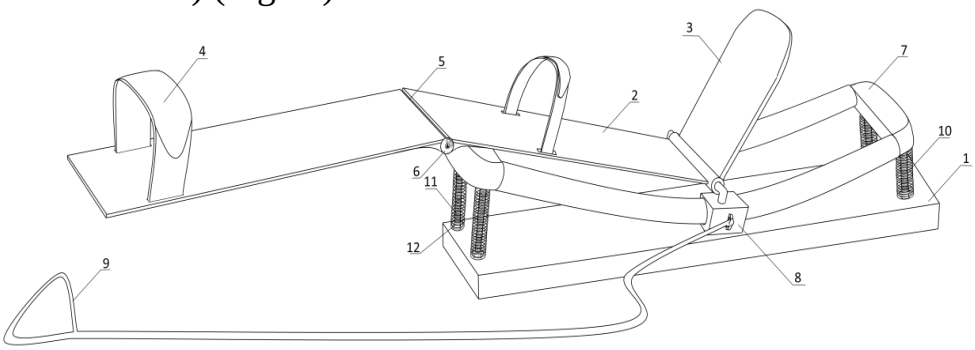

Fig. 1. Device for the functional treatment of the knee joint

The second difference of the device is that due to a special tightening belt patients will be able to control the range of motion and load on the operated joint. Features of the device for the functional treatment of the knee joint: easy to use, does not need helpers, affords early adaptation of the limb to the implanted joint, reduces the percentage of postoperative contracture of the operated limbs, improves the efficiency of arthroplasty and improves the patient's quality of life. Motion development begins on the first day after the operation twice a day, adding 1 min daily to develop the limb. The range of movement in the operated joint is increased daily to 70 º. The limb is developed for 10-12 days. The device is convenient to use and provides active and passive motion development in the knee

and hip joints. Besides, it allows to treat patients with diseases of the knee joints and to carry out early activation of the patient. Available for every orthopedic traumatologist, and is recommended for wide usage in practical medicine.

Motion development using the device began from the 1st day after the operation. On the 2nd day after the operation, the patient rose upright with the help of a physiotherapy trainer and began to move with the help of a walking frame. The trainer monitored the patient's condition so that not to get into a state of collapse. Patients were allowed to step on the operated limb while walking with a load of 35-40%. The load when walking was added daily.

At the third stage of the rehabilitation treatment, the patients after TKA underwent an enhanced physiotherapy from the 6th week in the gym with physiotherapy equipment. During this period, all procedures were aimed at load increasing on the operated joint and improving the static-dynamic function of the lower extremity. For this purpose, patients underwent simultaneously a physiotherapeutic treatment Amplipulse to improve the recovery of the sartorius contractile ability and massage. In addition, an exercise bike and a treadmill were used to restore the correct gait. The patient performed daily exercise therapy on the treadmill for 30 minutes, considering his general condition. To increase the range of motion in the operated joint, a foot weight machine was used. After warming the soft tissues of the operated joint, the trainer performed manual massage of the operated limb to improve flexion and extension in the operated joint. The duration of this stage lasted up to 2 weeks depending on the range of motions.

The results of the performed restorative treatment were studied according to the recovery of the static-dynamic state and support ability of the operated lower limb, the range of motion of the operated joint and the correct gait in patients after TKA. Good results of functions recovery of the operated limb were obtained in 48 patients (75.0%), satisfactory with mild contracture and lameness when walking - in 13 patients (20.3%), poor results in patients with systemic pathology of a rheumatic nature - in 3 patients (4.7%)

The results of medical and social examination of patients and invalids after knee arthroplasty. We studied and analyzed results of the occupational medical assessment board (OMAB) in patients after TKA. After studying the severity indicators, the disability dynamics and nosological causes in patients who underwent TKA, it was established that disability in this category of patients had inadequately high severity indicators and low rates of decline, which caused significant and unjustified annual losses of labor resources in various industries of the national economy of the country.

The indicators collected according to the data of the complex staged medical and social rehabilitation based on the decision of OMAB (Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 195 dated 2011) were analyzed by Tashkent and the Tashkent region (Table 1). The analysis of the disability dynamics before and after TKA showed that surgical treatment of the knee joint diseases led to a decrease in disability status in case of provided adequate postoperative rehabilitation.

Table 4

Results of partial and complete rehabilitation according to the decision of OMAB

Decrease in disability status	Core group n = 64		Control group n = 61	
From I to II group	2	Partial rehabilitation (20.3%)	1	Partial rehabilitation (13.1%)
From II to III group	11		7	
From III to 0 group (healthy)	10	Complete rehabilitation (15.6%)	8	Complete rehabilitation (13.1%)

It was established that if the disability status in the core and control groups before TKA was comparable, then a year after the operation in the control group we clearly observed an increase in disability status in comparison with its decrease in the core group. In the core group of patients after completion of the individual rehabilitation programs, the proportion of invalids of II group decreased due to partial rehabilitation, i.e. transition to the III group of disability. At the same time, the volume and injury rate of the surgery allow the experts to rank such patients as having anatomical defects. For this reason, complete rehabilitation is impossible for invalids of II group. However according to our data, about 62.5% of rehabilitants had a good functional outcome after surgery and upon completion of the individual rehabilitation program could return to production labor in the main profession.

Thus, in order to create a rehabilitation system for the patient after TKA, we should consider anatomical, biomechanical and social characteristics of the patient. The diagnosis should reflect the severity of the degenerative-dystrophic lesion, surgical features, the method of fixation of the patient reflected in the biomechanical indicators of the major skeletal muscles activity, the features of statics and localization. The social aspect contains information about the nature of motion activity, the transport used, the intensity of walking, marital status, disability status, etc.

Evaluation of efficacy of the medical rehabilitation technology. The evaluation is based on the results of studying the medical rehabilitation efficacy, with regard to static-dynamic function recovery of the operated joints, adaptation to the implanted joint, return to the indicated labor and economic benefits of arthroplasty. For medical rehabilitation, the reduction rate of the social and professional restrictions was determined as the most significant for a particular patient. However, re-establishment of the social role of the disabled persons is preceded by a decrease in his life activity through the recovery of existing injuries and improvement in the quality of life.

It is known that the dynamics of various functions in the same patient occurs at different rates. Thus, according to our data, in the early rehabilitation period, there was a positive dynamic at the level of the proximal femur defect after

replacement with an endoprosthesis, which significantly outstripped other changes in the body. On the contrary, in the late rehabilitation period in patients after TKA, recovery at the level of limitation of vital activity due to the development of compensatory-adaptive reactions occurred much faster than the recovery of impaired functions from the side of the implanted joint. Therefore, at the stationary stage, when evaluating the rehabilitation efficacy, we used the indicators of rehabilitation in short-term (immediately after the stage of rehabilitation) and long-term periods (after 6 months - 1 year). After the completion of medical rehabilitation, the efficacy of rehabilitation was assessed by three levels: organ (deficit recovery of the function of the total replaced joint), organismic (decrease in the severity of disabilities due to reduced abilities) and social (re-establishment of the social role of the rehabilitant).

We evaluated the results of the inpatient medical rehabilitation program in patients after TKA according to the intensity of the disorders and disabilities in patients. For this reason, we evaluated the efficacy of medical, social and vocational rehabilitation of patients who underwent TKA according to the developed scoring scale (Table 5).

Table 5

Scoring system for determining the efficacy of medical, social and vocational rehabilitation of patients who underwent TKA

Indicators	**Characteristics of indicators**	**Efficacy level (in scores)**
Pain in the operated joint	none; mild: episodic, rare, mild pain; moderate: does not affect vital activity, although sometimes it may require taking pain relievers. Sometimes the patient has to limit his activity, but continues to work, taking stronger pain medications; severe: limitation of activity due to the pain. Constant use of strong pain relievers.	5 4 3 0
Manner of walking (lameness)	None Light walk Moderate Pronounced	5 4 3 0
Possible walking distance without pain	not limited 2-3 km. only at home	5 4 3
Axis of the limb	Normal Valgus and varus deformities up to 15 º Valgus and varus deformities over 16 º	5 3 1
Range of motions	flexion: full partial extension: full partial external rotation: partial not determined	5 3 5 3 5 3

	internal rotation: partial not determined	5 3
Daily activity	Stairs: - can easily walk up the stairs without the help of the stair railing; - using the stair railing, stepping only one foot; - with difficulty using a cane. on the uphill road on the downhill road	 5 3 1
Putting on shoes and socks	- easily; - with moderate difficulty; - with difficulty; - impossible.	5 3 2 0
The use of auxiliary rehabilitation technical means	- does not use - a cane for walking; - a crutch for walking; - two canes (or two crutches) for walking;	5 4 3 1
Professional recommendation:	- with the preservation of the previous profession or type of labor; - changing for another job close to the previous one (possibly with restrictions on the volume and conditions of work); - changing for a new job or profession (possibly with training); - out-work.	5 4 3 2
Need for drugs usage	- none - occasionally (only in the presence of pain syndrome) - systematic - constantly	5 4 3 0
The social status of the patient	Do not have a disability status III group of disability due to joint implantation II group of disability due to the pathology of the contralateral and adjacent joints I group of disability due to pathology in the operated joint	5 4 3 0

Based on the analysis of the data on the above point scale, the gradation of points is determined in the following order (Table 6):

Table 6

Indicators of the point scale by gradation

Rehabilitation efficacy level	Number of points
High	60.2 and higher
Good	from 49.7 to 60.1 points
Medium	from 39.2 to 49.6 points
Poor	below 39.1 points

Timely and continuously conducted staged medical and social rehabilitation in the core group showed high efficacy in 60.5% of patients and good in 20.8% of patients. In the control group, the rates were 55.5% and 18.2%, respectively. Thus, we may conclude that the comprehensive medical and social rehabilitation developed by us made allowed to improve the proportion of high efficacy in patients by more than 5.0% than the traditional method of rehabilitation (Fig. 2).

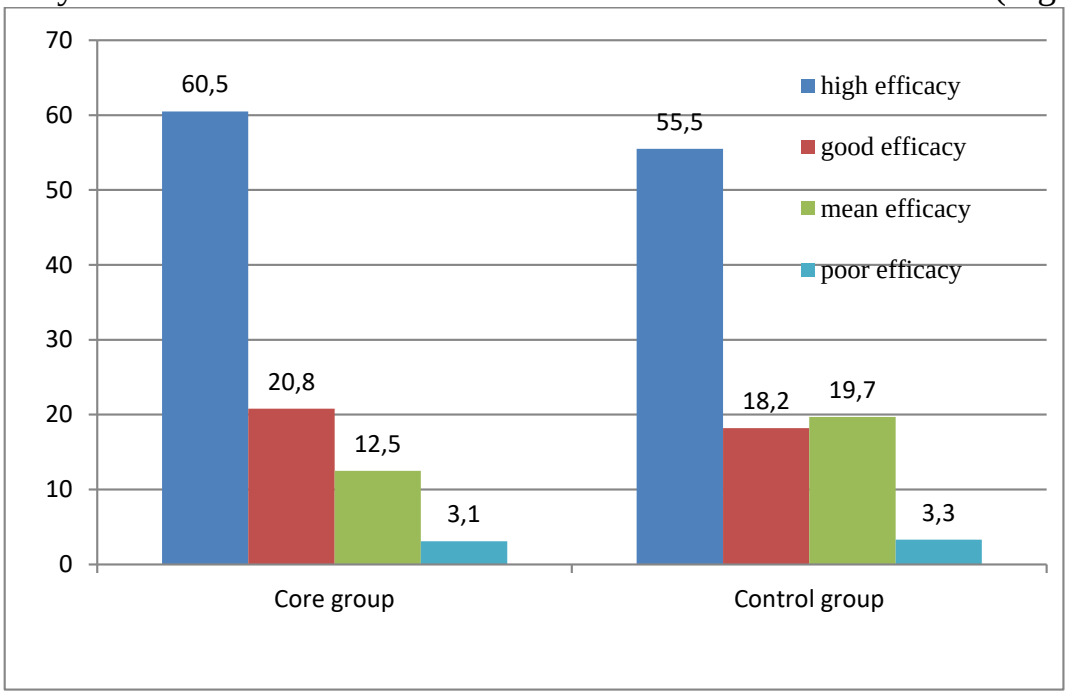

Fig. 2. Characteristics of the rehabilitation efficacy of patients

The data studied on the social and professional status of patients before the surgery showed that the majority of patients were production and agricultural workers.

After the conducted social and vocational rehabilitation, most of the patients managed to readapt to the family and society (Fig. 4).

The main factors for assessing the labor capacity of patients and invalids with artificial implanted joints were the nature of the disease course, the stage of the pathological process, the pathology of adjacent joints, recovery of static-dynamic functions. The patients of the core group returned to work in 67.5%, and in the control group - 60.2%.

The proposed complex system of physiotherapy minimized the frequency of dislocation of the endoprosthesis, one of the complications, which improved the efficiency of endoprosthetics.

Thus, we may conclude that the developed complex physiotherapy prevents venous thromboembolic complications and reduces mortality from thromboembolism in patients after knee arthroplasty. Comprehensive physiotherapy helps patients with the artificial knee joint in their faster adaptation to social conditions. We recommend the developed method as a variant of physiotherapy in the rehabilitation of patients who underwent TKA.

As a result of biomechanical studies we established improvement in static-dynamic functions in patients after TKA. Besides, early activation of the operated joint on the developed device allowed to eliminate contracture in 80% of patients.

The severity of primary disability in patients who underwent arthroplasty is due to persistent, pronounced contracture and degenerative-dystrophic process in other sections of the musculoskeletal system. According to the analysis of occupational medical assessment board in the core group 28.3% of patients showed a decrease in the disability, and in the control group it was 16.5%.

In 53 (82.8%) patients of the core group, positive dynamics of motion disorders in the functional class was achieved, assessed as insignificant. Most patients were found to have contractures in the operated knee joint in the functional class. Others were directed to rehabilitation 4 months after the operation, when hard-to-remove cicatrical processes developed in the soft tissues of the operated joint. In these patients, it was advisable to evaluate rehabilitation measures in a long-term period after the completion of all stages of rehabilitation.

CONCLUSIONS

1. The results of the analysis of disability status in patients after knee arthroplasty showed that the disability group did not change in 6.4% of patients after the rehabilitation in the presence of negatively influencing factors: persistent contracture and degenerative-dystrophic processes in other sections of the musculoskeletal system.
2. Application of the device developed by us for early activation of the operated joint contributed to reduce the number of contractures in the operated joint in 80% of patients.
3. The results of the statistical analysis, obtained by using our individual rehabilitation program for patients and invalids after TKA allowed to evaluate the efficacy of the range and standards of rehabilitation care at the inpatient and outpatient stages, which resulted in reduction of temporary disability up to 1 month in 37, 5% of patients.
4. The main factors of the working ability of patients and invalids after knee arthroplasty were the nature of the disease course, the stages of pathological processes, combined pathology of the adjacent joints and the spine. Taking into consideration all these factors the increase in returns to the indicated type of labor was achieved in 67.5% of patients.
5. The proposed timely and continuously conducted staged medical and social rehabilitation showed high efficacy in 65.5% of patients and good efficacy in 20.8% of patients.

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