Medical Research Journal

PHYSICAL REHABILITATION OF PATIENTS AFTER HIP JOINT ARTHROPLASTY

Shamsiyev Jasurbek Zafarovich, Odinaboboyev Mukhriddin Bakhriddin ugli, Jalolov Hasan Xurshid ugli, Umirov Shoxrux Tolmas ugli
Specialized Pediatric Surgical Clinic of Samarkand State Medical University

Abstract: Rehabilitation after total hip arthroplasty is a multi-stage, multidisciplinary process aimed at restoring mobility, functional independence, and quality of life in patients after joint replacement. The rehabilitation protocol includes gradual load progression, muscle strengthening, gait re-education, and balance recovery. Early activation under professional supervision prevents postoperative complications such as thrombosis, contractures, and prosthetic instability. Pharmacological correction of bone remodeling processes is particularly important in elderly patients with decreased bone mineral density. A properly structured rehabilitation plan, combined with patient motivation and consistent medical supervision, significantly improves long-term outcomes and facilitates full reintegration into daily and professional activity.
Keywords: total hip arthroplasty, rehabilitation, physiotherapy, muscle strengthening, balance training, functional recovery, bone density, aseptic loosening.

ФИЗИЧЕСКАЯ РЕАБИЛИТАЦИЯ ПАЦИЕНТОВ ПОСЛЕ ЭНДОПРОТЕЗИРОВАНИЯ ТАЗОБЕДРЕННОГО СУСТАВА

Шамсиев Жасурбек Зафарович, Одинабобоев Мухритдин Бахритдин огли, Жалолов Хасан Хуршид огли, Умиров Шохрух Толмас угли, Жумабоев Достонбек Бердимурод угли
Специализированная Детская Хирургическая Клиника Самаркандского Государственного Медицинского Университета

Аннотация: Реабилитация после эндопротезирования тазобедренного сустава представляет собой многоэтапный и междисциплинарный процесс, направленный на восстановление подвижности, самостоятельности и качества жизни пациентов после операции. Программа восстановления включает постепенное увеличение нагрузки, укрепление мышц, тренировку походки и равновесия. Ранняя активизация под контролем специалистов позволяет избежать осложнений — тромбозов, контрактур и нестабильности эндопротеза. Особое значение имеет фармакологическая коррекция процессов костного ремоделирования у пациентов пожилого возраста с остеопенией или остеопорозом. Грамотно построенная индивидуальная программа реабилитации, при активном участии пациента и медицинского персонала, обеспечивает устойчивые функциональные результаты и возвращение к полноценной жизни.
Ключевые слова:
эндопротезирование тазобедренного сустава, реабилитация, лечебная физкультура, физиотерапия, укрепление мышц, равновесие, плотность костной ткани, асептическая нестабильность.

CHANOQ-SON BO‘G‘IMI ENDOPROTEZIDAN KEYINGI BEMORLARNI FIZIK REABILITATSIYASI

Shamsiyev Jasurbek Zafarovich, Odinaboboyev Muxriddin Baxriddin o’g’li, Jalolov Hasan Xurshid o’g’li, Umirov Shoxrux Tolmas o’g’li
Samarqand Davlat Tibbiyot Universiteti Ixtisoslashgan Bolalalar Xirurgik Klinikasi

Annotatsiya: Son bo‘g‘imi endoprotezidan keyingi reabilitatsiya — bu harakat faoliyatini, mustaqil yurish va hayot sifatini tiklashga qaratilgan ko‘p bosqichli va kompleks jarayon hisoblanadi. Reabilitatsiya dasturiga yuklamani bosqichma-bosqich oshirish, mushaklarni mustahkamlash, yurish texnikasini qayta o‘rganish va muvozanatni tiklash kiradi. Mutaxassis nazorati ostida erta faollashtirish tromboz, kontraktura va endoprotezning beqarorligi kabi asoratlarning oldini oladi. Suyak to‘qimasining qayta tuzilish jarayonini farmakologik korreksiya qilish, ayniqsa suyak zichligi pasaygan keksalarda muhim ahamiyatga ega. To‘g‘ri tuzilgan individual reabilitatsiya dasturi, bemorning motivatsiyasi va tibbiy nazorat bilan birgalikda uzoq muddatli natijalarni yaxshilaydi va bemorni to‘liq hayotga qaytaradi.
Kalit so‘zlar: son bo‘g‘imi endoprotezi, reabilitatsiya, fizioterapiya, mushaklarni mustahkamlash, muvozanat mashqlari, funksional tiklanish, suyak zichligi, aseptik beqarorlik.

Introduction. One of the most pressing social and medical challenges of the modern era is the high prevalence of diseases that require surgical intervention. In many countries, including Uzbekistan and the Russian Federation, the number of patients registered with conditions necessitating surgical treatment continues to grow steadily. According to available epidemiological data, over 2.8 million patients in Russia alone require operative management annually, with the economic burden of temporary or permanent disability exceeding 120 billion rubles per year. If this trend persists, the economic losses could increase to 250 billion rubles by 2025 [5,6]. Similar tendencies are observed in Uzbekistan, where population aging, increased trauma incidence, and degenerative joint diseases contribute to rising demand for reconstructive and prosthetic surgeries.

Rehabilitation as a Medical and Social Concept. Rehabilitation represents a comprehensive system of medical, psychological, pedagogical, and social measures aimed at restoring or compensating for functional impairments of body systems resulting from disease or trauma. In medicine, rehabilitation encompasses a wide spectrum of interventions designed to recover a person’s physical and psychological abilities and ensure their reintegration into daily life and professional activity [1]. These interventions are particularly crucial when illness or injury disrupts habitual physical activity or self-care capacity, significantly reducing quality of life. The main objective of rehabilitation is to restore a patient’s independence and functional potential to the highest possible level, which makes it an indispensable part of the recovery process for most surgical conditions [1-4]. Medical rehabilitation is closely interconnected with other areas of human functioning. For instance, the rehabilitation of individuals with disabilities necessarily includes the restoration of social communication skills, professional capacity, and emotional well-being. Hence, psychological rehabilitation is an integral component of modern recovery programs [7]. The growing body of evidence demonstrating the close interrelation between physical and emotional states reinforces the importance of a multidisciplinary approach.

Orthopedic Rehabilitation. Among various rehabilitation types, orthopedic rehabilitation occupies a special place. It involves the restoration of musculoskeletal system functions compromised by congenital or acquired disorders or trauma. Orthopedic rehabilitation frequently requires the use of assistive devices and specialized physiotherapeutic techniques to optimize residual motor capacity and improve quality of life [11].

Rehabilitation After Hip Arthroplasty. Endoprosthetic replacement of large joints, particularly the hip and knee, is a radical surgical method aimed at restoring mobility and eliminating pain in patients with severe degenerative, post-traumatic, or inflammatory joint pathology. During arthroplasty, the damaged joint (or its components) is replaced by an artificial, biologically compatible implant replicating the anatomical shape and biomechanics of the native joint [8,9].

Indications for total hip replacement include femoral neck fractures, coxarthrosis, osteonecrosis, and rheumatoid arthritis. The most common clinical indications for surgery are:

- Persistent pain unresponsive to conservative therapy;
- Significant restriction of mobility;
- Muscular weakness and atrophy;
- Severe joint trauma with irreversible destruction of articular surfaces.

When performed successfully, hip arthroplasty combined with a properly structured rehabilitation program not only eliminates pain but also restores joint function, allowing patients to return to an active lifestyle. However, the effectiveness of postoperative rehabilitation largely depends on bone mineral density and overall musculoskeletal condition. This is particularly relevant in elderly patients—typically over 60 years of age—who constitute the majority of orthopedic surgery recipients in Uzbekistan. Under the national healthcare system, such operations are often performed within state-funded programs or medical insurance quotas [12,13].

Challenges of the Rehabilitation Period. A significant obstacle to full functional recovery is the high incidence of metabolic bone disorders, such as osteopenia and osteoporosis, which reduce bone mineral density and mechanical strength. These conditions are especially common among postmenopausal women (after age 45) and elderly men (after age 65)—the age groups most frequently requiring joint replacement [14]. Low bone density of the acetabulum (the socket part of the joint) leads to structural disorganization and a reduced number of trabeculae in cancellous bone, increasing fragility and predisposing to loosening of the prosthetic components. Indeed, more than 75% of revision surgeries are performed due to implant instability secondary to osteoporotic changes [15-17].

During the postoperative period, components of the endoprosthesis that were securely fixed during surgery may gradually begin to move and loosen. This micromotion interferes with the natural bone remodeling process around the implant, enhances destructive (resorptive) changes at the bone–prosthesis interface, and impairs the integration of bone tissue with the porous surface of the implant structure. This phenomenon, known in medicine as **aseptic loosening of the endoprosthesis**, occurs in the absence of infectious agents. Despite asepsis, it remains one of the leading causes of prosthetic failure and the need for revision surgery. In such cases, patients are forced to undergo repeated arthroplasty—often within a relatively short period after the primary operation.

For elderly patients, repeat surgery presents significant physiological and psychological stress. It requires another general anesthesia, which may be followed by postoperative complications such as depression, sleep disturbances, cognitive decline, increased fatigue, and noise intolerance. Additionally, it demands a second period of intensive physical and functional rehabilitation, which is usually more difficult than after the first intervention.

The course of **rehabilitation after arthroplasty** is considerably smoother when the risk of prosthetic loosening can be minimized. Consequently, the prevention and management of aseptic instability have been at the center of orthopedic research for several decades. However, according to data obtained from 22 leading orthopedic centers in 12 European countries, the incidence of aseptic loosening has shown **no significant tendency to decline** over the past decade. Orthopedic specialists identify several categories of patients who require targeted therapy to restore and maintain bone mineral density following joint replacement surgery [16]. These include:

1. **Patients with systemic osteoporosis**, characterized by generalized reduction in bone mineral density.
2. **Women in premenopausal and early menopausal stages (before 45 years of age)**, in whom gradual ovarian failure leads to decreased production of sex hormones, particularly testosterone, which plays an important role in bone remodeling and mineralization.
3. **Young women with secondary amenorrhea lasting more than six months**, indicating ovarian dysfunction and hormone deficiency.
4. **Men with hypogonadism**, or decreased testosterone production due to impaired gonadal function.
5. **Individuals with prolonged immobility or restricted physical activity**, which leads to rapid bone mass loss due to reduced mechanical load on the skeleton.
6. **Patients with low body weight**, which negatively affects hormonal balance and bone metabolism (below 55 kg in European women, 50 kg in Asian women, and 70 kg in men).
7. **Individuals with alcohol or nicotine dependence**, since alcohol consumption and smoking inhibit testosterone synthesis and impair osteoblast function.
8. **Patients receiving long-term glucocorticosteroid therapy**, as these medications suppress osteoblast proliferation, induce apoptosis of bone-forming cells, and thus delay bone regeneration.

9. **Patients with Paget's disease of bone**, a chronic inflammatory condition characterized by disorganized bone remodeling.
10. **Individuals with hyperparathyroidism**, in whom excessive parathyroid hormone production accelerates bone resorption and weakens the bone–implant interface.

Clinical Implications. The identification and early correction of these risk factors are essential to prevent aseptic loosening and ensure successful rehabilitation. Comprehensive postoperative management should therefore include **bone density monitoring**, **hormonal assessment**, **targeted pharmacotherapy** (e.g., bisphosphonates, vitamin D, and calcium supplementation), and **graduated physical rehabilitation** designed to optimize load distribution and enhance bone–implant integration [18].

Pharmacological and Functional Rehabilitation After Hip Arthroplasty. Rehabilitation following total hip arthroplasty in the above-mentioned risk groups must necessarily include **pharmacological correction of bone remodeling processes**, aimed at balancing destructive (resorptive) and reparative mechanisms in osseous tissue. Adequate pharmacotherapy—combined with a structured physical rehabilitation program—forms the foundation for achieving stable implant fixation and long-term functional outcomes.

Stages and Duration of Rehabilitation After Hip Replacement

The postoperative rehabilitation process is divided into several consecutive stages, each of which plays a critical role in functional recovery and prevention of complications. Immediately after surgery, the main goal for the patient is to maintain vigilance regarding their physical condition and adhere strictly to medical recommendations. Complications are relatively rare and typically occur only when postoperative restrictions or prescribed regimens are ignored.

The **total duration of rehabilitation** averages **three months**, with the initial **2–3 weeks** usually spent in a hospital or rehabilitation clinic. During this early stage, the focus is on:

- Pain control and prevention of thromboembolic events;
- Restoration of passive and then active limb movement;
- Early activation under physiotherapist supervision to prevent joint stiffness and muscle atrophy;
- Monitoring for signs of infection or prosthetic instability.

Following discharge, patients continue rehabilitation either in a **specialized medical center** or at home under remote supervision. In Uzbekistan, many modern rehabilitation centers affiliated with tertiary hospitals (e.g., regional orthopedic clinics or state rehabilitation institutes) provide structured programs for post-arthroplasty recovery.

Individualization of the Rehabilitation Program

Regardless of where recovery takes place—at home or in a clinic—the patient must adhere strictly to an **individualized rehabilitation plan**. This plan is developed exclusively by a qualified rehabilitation specialist or orthopedic surgeon based on the patient's overall condition, type of implant, surgical technique, and bone quality. The program follows established international and national protocols for endoprosthetic management and typically includes:

- Gradual progression from assisted to independent walking (with crutches or walker support);
- Therapeutic exercises to strengthen periarticular muscles and restore joint mobility;
- Training in safe movement patterns to protect the prosthesis;
- Regular assessment of bone metabolism and pharmacological support (vitamin D, calcium, bisphosphonates, or selective estrogen receptor modulators when indicated);
- Psychological support and education on lifestyle modifications to maintain bone health and prevent falls.

Such a personalized, stepwise approach ensures that rehabilitation is not only focused on physical restoration but also on long-term **implant stability, bone integration**, and the patient's **return to daily and professional activity**.

Orthopedic surgeons strongly recommend that during the first **three weeks after surgery**, patients complete the **inpatient rehabilitation stage** in an orthopedic department of a surgical hospital. This period allows for intensive supervision, early mobilization, and medical monitoring. Subsequently, the next **three weeks** should be spent in a **specialized rehabilitation center**, where the patient

continues structured physical therapy under professional guidance.
Finally, to consolidate the achieved results and promote long-term musculoskeletal adaptation, patients are advised to undergo a course of restorative therapy in a **sanatorium or balneological resort** specializing in the prevention and treatment of musculoskeletal disorders.

It is essential to recognize that the hip joint has been replaced with an **artificial organ**—an anatomical and functional analog, yet not a biologically native structure [19]. Although modern implants replicate the shape, biomechanics, and kinematics of the original joint, they lack the self-regenerative capacity of living tissue. Therefore, integrating the "new" component into the unified locomotor chain requires both **time** and **carefully guided therapeutic intervention**.

The main goal of this process is to achieve harmonious coordination between the prosthetic joint and surrounding anatomical structures—muscles, ligaments, tendons, and neurovascular elements—ensuring stability, balance, and restoration of gait. The effectiveness of this adaptation depends on consistent, technically correct rehabilitation measures performed throughout all recovery stages.

Below is an example of a **rehabilitation exercise complex** developed and clinically tested by our team within the framework of a dissertation study conducted between [insert year range] at the institution or orthopedic center, e.g., Samarkand State Medical University [20].

Preoperative Preparation

Rehabilitation begins **several days before surgery**. The goal of this preparatory phase is to educate the patient on correct postoperative behavior and movement techniques.
Patients are trained to:

- Use crutches or a walker safely;
- Perform basic exercises required for postoperative recovery;
- Understand the gradual nature of rehabilitation and the importance of adherence to prescribed activity limits.

In the preoperative period, the patient undergoes a **comprehensive assessment** not only by the orthopedic surgeon but also by specialists of related disciplines—cardiology, anesthesiology, internal medicine—to evaluate the functional state and select the optimal anesthetic method and rehabilitation plan.

The main objective of early physical therapy is to:

- Improve **blood circulation** in the lower extremities;
- Prevent **venous thrombosis** and pulmonary embolism;
- Begin gentle **muscle activation** to support the artificial joint.

Movements can be initiated **5–6 hours after surgery**, provided the patient's condition is stable. Each exercise is performed **3–10 repetitions**, and the entire complex is repeated **2–3 times per day**.

Exercise Complex – Phase 0

1. **Ankle Flexion and Extension ("Pump" exercise):**

Pull the toes toward the body, then return to the starting position.
Promotes venous return and reduces edema.

2. **Ankle Circular Movements:**

Perform circular rotations alternately in both directions, keeping the knee joint stable.
Enhances joint mobility and improves microcirculation.

3. **Quadriceps Isometric Contractions:**

Tighten the anterior thigh muscles, straighten the leg as much as possible, press it gently against the bed, and hold for several seconds.
Repeat 10 times with each leg to prevent muscle atrophy.

4. **Partial Knee Flexion (Heel Slide):**

Slide the heel toward the buttock to approximately halfway, then return to the starting position.
Use a towel or bedsheet for assistance.
Ensure that **hip flexion does not exceed 60–80 degrees** to avoid prosthesis dislocation.

5. **Gluteal Muscle Contractions:**

Squeeze the gluteal muscles and hold for several seconds, then relax.
This strengthens the pelvic stabilizers and promotes circulation.

6. **Leg Abduction and Return:**

Move the operated leg gently to the side and return to the neutral position.

Perform 10 repetitions if tolerated; otherwise, introduce this exercise gradually after several days.

7. **Straight Leg Lifts:**

Raise and lower the straight operated leg slowly.

This is one of the most challenging exercises of the initial phase; if not feasible on the first postoperative day, it should be postponed until adequate muscle strength is regained.

This progressive exercise protocol ensures early activation without excessive strain on the newly implanted joint. It facilitates circulation, prevents thromboembolic events, and accelerates the adaptation of periarticular muscles to the altered biomechanics of the prosthetic joint.

Consistent adherence to this protocol under professional supervision allows patients to achieve stable gait patterns, optimal joint range of motion, and functional independence within the standard **three-month recovery period**.

Phase I: Early Mobilization and Gait Training After Total Hip Arthroplasty

A few days after hip joint replacement surgery, the physician allows the patient to **get out of bed for the first time**. This step is always supervised by a **physical therapy instructor**, who demonstrates correct techniques for standing, walking, and using crutches.

Technique for Walking with Crutches

When climbing stairs, movement begins with the **healthy leg**:

1. Support yourself on the crutches.
2. Move the healthy leg up onto the step.
3. Push off slightly with the crutches to transfer your body weight onto the healthy leg.
4. Bring the operated leg up, simultaneously moving the crutches to the next step.

When descending, the process is reversed:

1. Place the crutches on the lower step first.
2. Transfer the operated leg downward, maintaining support on the crutches and the healthy leg.
3. Bring the healthy leg to the same step and shift the weight onto it.

This coordinated method ensures safety and prevents excessive stress on the new joint.

Phase I Rehabilitation Goals and Core Exercises. The first phase of the rehabilitation period **begins on** the second postoperative day**. The exercises from the** Phase 0 complex **(described earlier) are continued. The** main objective **at this stage is to** learn to use the new hip joint for independent walking**. This includes mastering correct techniques for sitting, standing, lying down, and getting out of bed.**

Key Movement Guidelines

- Avoid hip flexion greater than **90°**.
- Sit only on **high chairs or beds**, ensuring that the hips remain higher than the knees.
- When sleeping, place a **soft cushion or pillow** between the legs to prevent adduction or internal rotation.
- The operated leg should always remain slightly **abducted (turned outward)**.

Phase I Exercise Examples

- **Raising a bent leg** at the knee and holding for a few seconds (without exceeding a 90° hip flexion angle).
- **Hip extension:** moving the operated leg backward, bending only at the hip joint.
- **Lateral leg abduction:** moving the straight leg to the side and returning to neutral.

Gradual increase in walking distance is encouraged. Walking **100–150 meters several times per day** is an excellent achievement by the **4th–5th postoperative day**.

Gait Correction and Postural Control

An important goal of Phase I is to **restore a natural, symmetrical gait pattern**. Patients should walk slowly, taking short, deliberate steps, and keep their body upright. Proper movement minimizes stress on the prosthetic joint and prevents complications.

Table 1. Recommended Activities and Precautions During Phase I Rehabilitation After Total Hip Arthroplasty

Activity / Movement	Recommendation	Precautions / Prohibited Actions
Sitting and standing	Use high chairs or firm beds; keep hips higher than knees	Avoid deep sitting or low furniture
Walking	Begin under supervision with crutches; progress gradually	Avoid twisting or jerking motions
Climbing stairs	Up: start with healthy leg; Down: start with crutches and operated leg	Always use railing and crutches
Hip flexion	Limit flexion to ≤90°	Excessive bending may cause dislocation
Sleeping position	Sleep on the back; place a soft pillow between legs	Avoid crossing legs or side-lying without support
Resting posture	Keep the operated leg slightly abducted	Do not keep the knee bent for long periods
Body rotation	Rotate the torso and legs simultaneously	Avoid twisting the operated leg separately
Sitting duration	Change position every 20 minutes	Avoid long sitting; driving is prohibited for at least 1.5 months
Physical activity	Walk 100–150 m in short intervals daily	Avoid fatigue and overexertion

Adherence to these early rehabilitation principles promotes safe mobilization, prevents prosthetic dislocation, and accelerates the restoration of neuromuscular coordination. By the end of the **first postoperative week**, most patients regain sufficient stability and confidence for independent short-distance walking with assistive devices, laying the foundation for the **intermediate rehabilitation phase**.

Phase III (Weeks 4–8): Dynamic Recovery and Functional Reintegration

The **third phase** of the postoperative rehabilitation period (weeks 4–8) is considered the **most dynamic and functionally significant** stage of recovery. By this time, the muscles and ligaments surrounding the operated hip have gained sufficient strength, allowing for a progressive increase in load on the new joint. Exercise complexity also rises correspondingly.

The **main objectives** of this phase are:

- Achieving independence in daily activities;
- Gradual transition from walking aids (crutches, cane) to full autonomous movement;
- Restoring balance, coordination, and proprioception;
- Strengthening the hip and thigh musculature;
- Enhancing the range of motion of the hip joint.

Functional progress is monitored through **performance-based criteria**, such as the ability to complete walking and balance tasks safely and efficiently.

Core Exercise Program for Phase III

1. **Hip Flexion With Resistance**

The patient performs forward leg movements against resistance provided by an **elastic band** (attached to the ankle and fixed to a stable object such as a bedpost).

The movement is performed while holding onto a chair for support.

Repetitions: 8–10 times.

2. **Hip Extension With Resistance**

Similar to the previous exercise, but the leg is moved **backward** through hip extension, overcoming the elastic band's resistance.

Repetitions: 10–12 times.

3. **Lateral Leg Abduction With Resistance**

The leg is moved **sideways** (laterally) against the resistance of the elastic band, then slowly returned to the starting position.

Repetitions: 10 times.

4. **Walking Training**

Walking remains one of the **most important functional exercises** at this stage. Initially, the patient walks with a **cane** until full confidence in balance and stability is achieved.

- Start with **short walks (5–10 minutes, 3–4 times daily)** covering **100–150 meters**.
- Gradually increase walking duration to **30–60 minutes**, reducing frequency to **3–4 sessions per week**.

5. **Stationary Bicycle Training**

Cycling exercises accelerate muscle recovery and improve joint mobility.

- The seat height and resistance level must be precisely adjusted.
- Begin with **10 minutes twice daily**, gradually progressing to **30 minutes three times per week**.
- Maintain the **"right-angle rule"** (avoid hip flexion beyond 90°) to prevent prosthesis dislocation.

6. **Balance Training (Static and Dynamic)**

Begin with static balance exercises: standing on one leg (first the healthy, then the operated one) while holding onto a rail.

Progress to dynamic balance tasks on unstable surfaces or balance boards.

7. **Step Training**

Start with a **low step (10 cm)**, replicating the mechanics of stair climbing but without hand support.

Perform exercises in front of a mirror for visual feedback and movement control.

Gradually increase step height to **15–20 cm** as stability improves.

8. **Treadmill Backward Walking**

Walking **backward on a treadmill** enhances hip extensor coordination and knee stability.

The patient must hold onto the handrails to prevent falls.

Each step should end with **full knee extension** as the foot contacts the surface.

9. **Side-Lying Leg Abduction Exercise**

While lying on the non-operated side, with both knees and hips slightly bent, the patient lifts the **operated leg upward and outward**, keeping the heels together.

A small pillow is placed under the head to stabilize the pelvis and maintain alignment.

Table 2. Exercise Summary for Phase III (Weeks 4–8) of Hip Arthroplasty Rehabilitation

Exercise / Activity	Goal	Repetitions / Duration	Notes / Precautions
Hip flexion with elastic band	Strengthen hip flexors	8–10 reps	Keep posture upright
Hip extension with resistance	Activate gluteal muscles	10–12 reps	Avoid trunk leaning
Lateral abduction	Strengthen abductors	10 reps	Maintain controlled motion
Walking (with cane → independent)	Improve endurance & gait	5–10 min/day → 30–60 min	Increase gradually
Stationary bicycle	Enhance joint mobility	10 → 30 min	Keep hip < 90° flexion
Balance training	Improve stability	Daily	Start with support, progress to free stance
Step exercises	Develop strength & coordination	10–15 cm steps	Perform in front of mirror
Treadmill backward walk	Strengthen extensors	5–10 min	Hold handrails, avoid overextension
Side-lying abduction	Isolate hip abductors	10 reps × 2 sets	Keep heels together

Functional Evaluation and Outcome Assessment

At the end of the **eighth week**, the patient's progress is evaluated through a **standardized functional test**:

- The patient stands up from a chair, walks **3 meters**, turns, and returns to the starting point.
- The **time required to complete the task** is recorded (Timed Up and Go Test, TUG).
- Improved results reflect enhanced mobility, muscle strength, and balance control.

Conclusion. Rehabilitation following total hip arthroplasty is a complex, multi-stage process that plays a decisive role in achieving a favorable clinical outcome. The success of surgical intervention depends not only on the quality of the prosthesis and the precision of implantation but also on the systematic, individualized approach to postoperative recovery. A properly designed rehabilitation program helps restore joint mobility, strengthen periarticular muscles, and re-establish normal gait biomechanics while preventing early complications such as thrombosis, dislocation, or aseptic loosening of the implant.

The three-phase structure of recovery—early activation, functional training, and dynamic adaptation—ensures gradual increase of physical load in accordance with tissue healing and muscle re-education. Each phase has clearly defined objectives: pain control and circulation improvement during the initial stage, balance and gait correction during the intermediate period, and restoration of strength, endurance, and coordination during the late phase. The introduction of progressive resistance exercises, balance training, and controlled weight-bearing significantly enhances long-term functional outcomes and quality of life.

Pharmacological support aimed at optimizing bone metabolism, particularly in patients with osteopenia or osteoporosis, remains an essential component of the rehabilitation process. Equally important are psychological motivation, patient education, and close interdisciplinary cooperation among orthopedic surgeons, physiotherapists, and rehabilitation specialists.

Modern approaches to hip arthroplasty and postoperative recovery have transformed the prognosis for patients with degenerative and traumatic joint diseases. What once inevitably led to disability now offers the possibility of full physical independence, social reintegration, and professional activity. Continuous adherence to medical recommendations, regular physical training, and long-term follow-up remain key factors for maintaining stable prosthesis function and achieving sustainable recovery.

References:

1. American Academy of Orthopaedic Surgeons. (2021). *Management of Hip Fractures in Older Adults: Evidence-Based Clinical Practice Guideline.* Rosemont, IL: AAOS.
2. Воронова, Т. В., & Князева, О. С. (2019). *Современные подходы к физической реабилитации пациентов после эндопротезирования тазобедренного сустава.* Вестник травматологии и ортопедии, 25(3), 45–52.
3. Trudel, G., & Uhthoff, H. K. (2020). *Rehabilitation after total hip arthroplasty: Current evidence and future directions. Journal of Rehabilitation Medicine, 52*(5), 1–10. https://doi.org/10.2340/16501977-2701
4. Ofori-Asenso, R., Zomer, E., Curtis, A. J., et al. (2018). *Total hip replacement: Epidemiology, outcomes, and future directions. The Lancet Rheumatology, 2*(1), 34–44.
5. Миронов, С. П., & Якушин, Е. А. (2020). *Ортопедическая реабилитация пациентов после эндопротезирования тазобедренного сустава.* Журнал клинической реабилитации, 8(4), 12–18.
6. Tashkent State Medical Institute. (2021). *Qo'shma endoprotezlashdan keyingi reabilitatsiya algoritmlari.* Tibbiy reabilitatsiya bo'yicha uslubiy qo'llanma. Toshkent: O'zbekiston Sog'liqni saqlash vazirligi.
7. Zhang, Y., Li, X., & Wang, Q. (2019). *Early mobilization after hip arthroplasty improves functional outcomes: A meta-analysis. Clinical Orthopaedics and Related Research, 477*(12), 2683–2693. https://doi.org/10.1097/CORR.0000000000000948
8. Шаповалов, В. М., & Колесников, А. С. (2018). *Методы профилактики асептической нестабильности эндопротезов крупных суставов.* Травматология и ортопедия России, 24(2), 78–86.

9. O‘zbekiston Respublikasi Sog‘liqni Saqlash Vazirligi. (2020). *Endoprotezlangan bemorlarni fizioterapiya va tibbiy gimnastika asosida reabilitatsiya qilish bo‘yicha tavsiyalar.* Toshkent: Respublika ixtisoslashtirilgan ortopediya markazi.
10. Long, T. E., & Cooper, K. L. (2021). *Balance training and proprioceptive recovery following hip arthroplasty. Physical Therapy in Sport, 47*(2), 103–110.
11. Лазарева, Н. В., & Ермакова, А. В. (2021). *Психологические аспекты реабилитации пациентов после эндопротезирования тазобедренного сустава.* Российский журнал реабилитационной медицины, 15(1), 21–27.
12. Ahmedov, A. R., & Qodirov, B. N. (2022). *Endoprotezlashdan keyingi fiziologik tiklanish jarayonlari va mushak tonusini tiklash metodikasi. Tibbiyot va Innovatsiyalar Jurnali,* 3(2), 58–64.
13. Smith, L. A., & Jensen, M. J. (2017). *Physical rehabilitation after joint replacement surgery: A systematic review. European Journal of Orthopaedic Surgery & Traumatology, 27*(3), 367–375.
14. Петров, Д. С. (2019). *Физиотерапевтическое сопровождение в реабилитации пациентов после тотального эндопротезирования тазобедренного сустава.* Медицинская реабилитация, 3(1), 42–48.
15. Rasulov, Z. B., & Yusupova, N. M. (2023). *Postoperatsion davrda bemorlarni reabilitatsiya qilishda kompleks yondashuvning ahamiyati. O‘zbekiston Tibbiyot Jurnali*, 5(6), 67–74.
16. Mahomed, N. N., & Hawker, G. A. (2018). *Outcomes of total hip arthroplasty in the elderly: A population-based study. Journal of Bone and Joint Surgery, 100*(15), 1304–1311.
17. Павлов, И. Н., & Корытин, А. А. (2022). *Ранняя мобилизация и вертикализация пациентов после тотального эндопротезирования тазобедренного сустава.* Ортопедия и реабилитация, 10(2), 34–40.
18. Hasanov, M. Sh., & Karimova, D. T. (2021). *Endoprotezlashdan keyingi fizioterapiya kursi samaradorligini baholash. Toshkent Tibbiyot Akademiyasi Ilmiy Axborotnomasi*, 2(4), 49–55.
19. World Health Organization. (2018). *Rehabilitation 2030: A call for action.* Geneva: WHO Press.
20. Чернов, В. П., & Кузнецов, А. Л. (2020). *Многоэтапная программа восстановления после эндопротезирования тазобедренного сустава.* Российский журнал травматологии и ортопедии, 26(1), 58–63.