

Rehabilitation for Total Joint Arthroplasty

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ABSTRACT

Total hip and knee replacement are two of the most common and successful elective surgeries performed in the United States each year. Preoperative medical preparation and postoperative rehabilitation are equally important to a successful outcome. Physical deconditioning, tobacco use, obesity and medical co-morbidities can adversely affect outcomes and should be addressed before any elective procedure. Formal postoperative therapy is geared towards the specific surgery and is aimed at returning the patient to independent activity.

KEYWORDS: Total Joint Replacement, obesity, rehabilitation, smoking, medical management

INTRODUCTION

Total hip and knee arthroplasty (THA/TKA) are two of the most common and successful musculoskeletal surgeries in the United States, accounting for over one million procedures annually. Osteoarthritis (OA) is by far the main cause in both hip and knee disease and it is increasingly prevalent.¹ As our population becomes more obese, less active, and lives longer, many more patients are seeking medical attention for pain relief. While the causes of OA are multifactorial (genetics, activity level, diet, weight, etc.), the final result is breakdown of cartilage, leading to weight bearing on eburnated bone. Ongoing inflammation irritates the surrounding soft tissues and leads to joint effusions, soft tissue contractures, and limb deformity.

By the time that most patients reach an orthopedic surgeon's office, many have exhausted conservative care due to advanced OA. Pain, deformity, and disuse lead to decreased independence and a poor quality of life. The essential goals of THA and TKA are to reduce pain and improve quality of life.

The process of rehabilitation after total joint arthroplasty (TJA) is often an afterthought for the patient, but is essential for the overall success of the procedure. We will discuss rehabilitation concepts for the pre-, peri-, and post-operative periods.

The Pre-operative Period

Pre-habilitation or "pre-hab" starts when the patient becomes a candidate for TJA and ends the day of surgery.

Often patients will schedule a joint replacement surgery one to four months in advance. In that time there is much to accomplish, and the main goals are as follows. Patients should be educated and should have reasonable expectations regarding TJA and its postoperative course. Home preparations should be made for eventual discharge and post-op care. In conjunction with the patient's primary care physician, the surgeon should work to address modifiable medical co-morbidities that can directly affect surgical outcomes (e.g. smoking, obesity, diabetic glucose control, and immunomodulating medications.) An exercise program with specific goals will aid in the recovery process; it should include strengthening the upper extremities (for using assistive devices) and lower extremities (via non-load-bearing exercises such as cycling, aquatic aerobics). Unfortunately, less than one third of patients with arthritis are actively engaged in some formal exercise program.²

Pre-operative educational classes can help address patient concerns prior to the operation.² In this setting, patients are free to ask questions and interact with other patients who will undergo the same procedures. In some instances, patients who have undergone a joint replacement can provide "firsthand" knowledge of the subject.

Weight loss is important for overweight or obese patients considering joint replacement surgery, as obesity carries a high risk of complications. A recent meta-analysis of numerous studies that included over 15,000 knee replacements found evidence that obese patients were significantly more likely to have a superficial infection, a deep joint infection, and a revision surgery (odds ratios (OR) of 1.9, 2.38, and 1.3 respectively).³ Overweight patients will also put more stress on the implants, potentially leading to early failure from mechanical overload.

Smoking inhibits bony ingrowth into prostheses and also impairs wound healing. Smoking cessation should begin in the primary care office and should ideally lead to at least one nicotine-free month prior to TJA. In a review of 33,000 TJA patients in the Veterans Affairs system, current smokers had a greater risk of surgical site infection (OR 1.4), pneumonia (OR 1.53), stroke (OR 2.61), and one-year mortality (OR 1.63) than those who had never smoked.⁴

Optimal glycemic management is another crucial issue that should be addressed preoperatively. Up to 8% of patients undergoing a TJA are diabetic, and uncontrolled diabetes is associated with higher rates of perioperative stroke, urinary

tract infection, ileus, transfusion, infection and death.⁵ An ideal “safe” value for the Hemoglobin A_{1c} has not been established to reduce the risks of surgical complications after joint replacement, but a goal of less than 8.0 is currently a reasonable threshold for elective surgery. This important test should be included with the pre-operative screening bloodwork for patients known to be diabetic.

The Peri-operative Period

This phase extends from surgery to hospital discharge. In the immediate post-operative period, patients who receive a total joint arthroplasty (TJA) can bear weight as tolerated (in most protocols). Pain control is of utmost importance, and a “multi-modal” combination of local anesthesia (perioperative block or regional nerve block), narcotics, analgesics, and NSAIDS are utilized in combination.

A typical hospital stay is two to three days. Ambulation should begin either the night of surgery or the following morning. In fact, a recent study demonstrated that patients who were mobilized on the day of surgery as opposed to the day after were discharged a day earlier on average. Additionally, shorter hospitalizations resulted in improved short-term outcomes and quality of life as well as decreased costs.⁶ Within the perioperative period, several decisions must be made, especially the discharge destination.

During the perioperative period, surgeons and patients

strive to prevent several complications. Bladder catheters are frequently used during TJA and have been linked to complications including urinary tract infections and delirium, so they should be avoided when possible, and removed as soon as possible when used. Incentive spirometry can help prevent atelectasis and pneumonia, especially in those with pre-operative pulmonary disease.

Finally, mechanical compression stockings and boots are used in conjunction with chemical prophylaxis for one month to prevent venous thromboembolic events (VTE). Clinical guidelines from the United States Preventative Service Task Force (USPSTF), American College of Chest Physicians (ACCP), Surgical Care Improvement Project (SCIP), and the American Academy of Orthopaedic Surgery (AAOS) are utilized to guide decision making for chemical VTE prophylaxis. Active exercises of the hip, knee, and ankle in combination with early and frequent ambulation during the patient’s recovery are strongly encouraged as additional means for VTE prophylaxis.

Postoperative Period

From the hospital, patients are either discharged home, to a skilled nursing facility, or to an acute rehabilitation hospital. Medicare standards currently allow acute rehabilitation for patients with bilateral TJA, morbid obesity, or age 85 or greater. Close communication and coordination between

the receiving facility and the operating surgeon are crucial to prevent complications and readmissions. Coordination of care between the patient’s primary care physician and the operating surgeon is also important during this period. The use of electronic medical records may help facilitate the accurate and timely transmission of this information.

Total Knee Replacement

There is general agreement that rehabilitating a total knee replacement is more difficult than a hip replacement. Patients typically make their greatest functional gains within the first 6 months after a THA and the first 12 months after a TKA.² The knee is a rotating hinge joint with an extensor mechanism (quadriceps, the patella and the patellar tendon) that originates at the pelvis and proximal femur and inserts on the

A typical pattern of arthritis is seen in this series of radiographs. There is tricompartmental arthritis, most pronounced in the medial compartment. In this patient the patella was not resurfaced with a polyethylene component.



tibial tubercle. During a total or partial joint replacement, the extensor mechanism is disrupted to a certain degree. In the standard approach, the quadriceps tendon is split at or near its origin, down through the medial patella and patellar tendon to the tibial tubercle. Moving the patella laterally allows access to the knee joint. An extensor mechanism that is well-aligned, repaired, and healed is essential to a successful knee replacement.

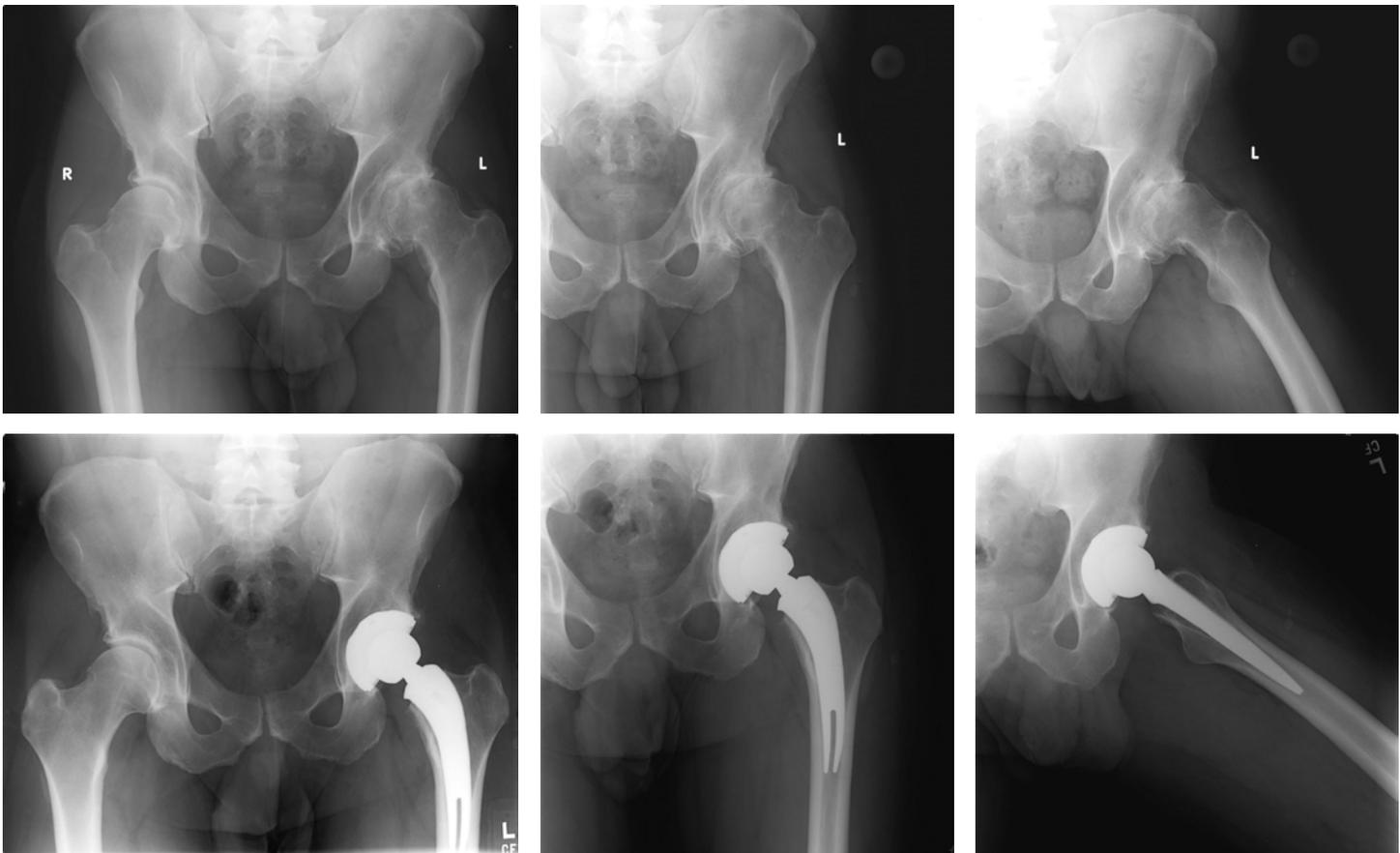
During ambulation, the knee must fully extend during the stance phase or large amounts of energy are needed to keep the body upright. Arthritis frequently results in deformity in the sagittal plane (knee flexion contracture) or in the medial to lateral plane (varus or valgus knee). A knee flexion contracture can cause a limp and concurrent quadriceps atrophy. Notably, in the month following a TKA, quadriceps strength can be reduced by up to 60%, so pre-operative strengthening is critical.⁷ At 6 months, these patients continue to have significant limitations in strength and function compared to healthy matched individuals. A weakened quadriceps muscle can decrease stair climbing ability, gait speed, coordination, and endurance. Both quadriceps neuromuscular electrical stimulation and a progressive resistive strengthening program can improve long-term strength and function.⁷

After a total knee replacement, the expected range of motion is from full extension to 90 degrees of flexion, the minimum required for most activities of daily living. Many patients will achieve 115 degrees of flexion or more.⁸ Most patients who have had a total knee replacement state that the knee did not feel “normal” until roughly a year after surgery. Swelling can persist long after surgery, especially with prolonged activity or ambulation; ice and non-steroidal anti-inflammatory medications can be used as needed during this period. Many patients may also experience “anterior knee pain” or have difficulty kneeling after TKA, which can cause functional limitations and frustration after an otherwise successful operation.

Total Hip Replacement

The hip is a ball-and-socket joint with a functional range of motion less than that of the knee. Prolonged arthritis often leads to hip joint contracture, stiffness, and limited abduction and rotation. Releasing the hip capsule contracture during surgery is often needed for the necessary access to the joint. The diseased capsular tissue is often excised, and a new pseudocapsule will ultimately form around the new prosthetic joint.

In the first three radiographs there is advanced arthritis of the left hip and degeneration of the joint space. After a total hip replacement we can see a well-reconstructed joint. In this instance a “neck-sparing” prosthesis was used, which removes less bone from the femoral neck with the intention of saving bone for future revision if needed.



The most popular approaches to the hip joint include the direct anterior, the antero-lateral, and the posterior approach. Each approach disrupts different muscle planes on the way to the hip joint. Certain exposures are considered “minimally invasive” in that minimal soft tissue is dissected from the bone. Regardless of the surgical approach, all patients must follow certain precautions to reduce the risk of hip dislocation. In the antero-lateral and the posterior approach, the abductor muscles (Gluteus Minimus and Medius) and external rotators are respectfully interrupted and then repaired after the implants are placed. These muscles must be allowed to heal for 6 to 8 weeks, followed by a strengthening regimen. Failure to heal can result in a significant limp.

The direct anterior approach (DAA) is the only truly “muscle sparing” approach to the hip joint. During DAA surgery, the muscles are “parted” between the major nerve groups, and the origin and insertion of the hip flexors, rotators, abductors and adductor groups are completely preserved. This allows the patient to utilize these muscles fully in the immediate postoperative period. A recent randomized study that compared the direct anterior and the anterolateral approaches demonstrated faster functional recovery in the DAA group up to 1 year from surgery. By 2 years, the results were the same.⁹ The long-term results of surgery (10+) years are based largely on the intrinsic durability of the implants and bearing surfaces, and have little to do with the surgical approach chosen at the time of implantation.

As mentioned previously, total hip replacement entails the risk of dislocation. The hip muscles and capsule contribute to joint stability, keeping the femoral head (native or prosthetic) within the acetabulum (or shell). When these muscles are weakened, certain leg positions can result in dislocation of the joint. This depends on the muscle tone of the patient as well as the surgical approach. For instance, hyperextension, adduction, and external rotation should be avoided after a direct anterior or antero-lateral approach. With a posterior approach, the patient should avoid flexion beyond 90 degrees, adduction, and internal rotation. These precautions are most important in the early postoperative period but should be followed permanently. Thankfully, over the past decade the rate of hip dislocations has diminished after THA, due to larger prosthetic femoral head sizes.¹⁰

SUMMARY

Joint replacement surgery remains a dynamic field in orthopedics, and there is an enormous pool of patients whose long-term outcomes can be followed. Countries such as Sweden and Australia have established total joint registries to follow long-term implant performance. Data monitoring has led to worldwide improvements in TJA outcomes. An “American Joint Replacement Registry” is currently being organized on a national level to help follow the outcomes after THA and TKA in this country.

For any joint replacement surgery, patients who are in

better physical condition stand to gain the most function and tend to be the most satisfied. In these elective surgeries, optimizing modifiable risk factors such as glycemic control, weight, and cigarette smoking is critical to obtain a satisfactory result. Successful rehabilitation spans the pre-, peri- and post-operative periods of THA and TKA, so an interdisciplinary partnership between practitioners taking care of each patient is required for a successful outcome.

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