Original Research Article

Efficacy of physiotherapy rehabilitation following total hip arthroplasty: A literature review

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Abstract

Introduction: Total hip arthroplasty (THA), which is regarded as one of the most successful orthopaedic procedure. In THA, both the femoral head and acetabulum are replaced. It is reconstructive procedure that has bettered the operation of those conditions of the hip joint that have responded inadequately to conventional medical remedy. The hip is a true ball-and-socket joint consists of well-balanced muscles, enabling a wide range of motion in several physical planes while also exhibiting remarkable stability. It plays a major role in the static and dynamic physiology of the locomotor system and, although it is the most stable ball-and-socket joint in the body and maintains an extraordinary range of motion. Non-operative and nonconservative approaches such as physiotherapy techniques and alternative therapies are used as post operative treatment. The main goal is to explore the effectiveness of physiotherapy interventions in total hip replacement surgery including their impact on pain, range of motion, strength, and functional outcomes. Also assess the timing and duration of physiotherapy interventions and their effect on patient outcomes. **Method:** A systematic review was conducted using the Pubmed and Google Scholar databases, analyse the relevant studies on total hip arthroplasty following physiotherapy rehabilitation, many research papers have studied from 2000 to 2022 out of which 32 were examined on the basis of exclusion and inclusion criteria. **Result:** Our result provided the evidence that physiotherapy rehabilitation for post total hip arthroplasty is necessary also provides the effective results in patients to improve the functional mobility of the patient. **Discussion:** The findings suggest that Physiotherapy rehabilitation proved to beneficial in all the parameters like stability, posture, core muscle strength, ROM, functional mobility, balance. However, further research is needed to determine optimal protocols, long-term effects, and individual characteristics influencing treatment outcomes.

Keywords: Total hip arthroplasty, quality of life, functional improvement, physiotherapy rehabilitation.

Introduction

The hip is a true ball-and-socket joint surrounded by powerful and well-balanced muscles, enabling a wide range of motion in several physical planes while also exhibiting remarkable stability. As the structural link between the lower extremities and the axial skeleton, the hips not only transmit forces from the ground up but also carry forces from the trunk, head and neck, and upper extremities[1].

It plays a major role in the static and dynamic physiology of the locomotor system and, although it is the most stable ball-and-socket joint in the body, it still maintains an extraordinary range of motion. Descriptively the hip joint is commonly discussed in the extended position. However, a clear mental picture of the anatomical changes which occur during the full range of joint motion forms an essential adjunct to an accurate evaluation of the functional and pathological problems encountered[2].

With some degree of accuracy, we can use biomechanics to explain and predict the progression of various pathologies such as developmental dysplastic hip disease, femoral neck fractures, and especially osteoarthritis. Each year, about 280,000 people in the United States have their hip joint replaced with a prosthetic device, a procedure known as a total hip arthroplasty. In the entire world, about half a million people will have this procedure performed. About 80% of those having a total hip arthroplasty are over 65 years old. The main determinants of the ultimate biomechanical characteristics of a total hip arthroplasty are the centre of rotation of the artificial hip in relation to the pelvis, the direction and magnitude of the forces of the muscles crossing the hip joint, the geometry of the total hip configuration, and the anatomy of the individual patient[3].

In contemporary orthopaedics, Total Hip arthroplasty, or surgical relief of the hip joint with an artificial prosthesis. It is among the most frequently conducted surgeries, which typically results in a substantial enhancement in the patient's quality of life[4]. It is reconstructive procedure that has bettered the operation of those conditions of the hip joint that have responded inadequately to conventional medical remedy[5].

Total hip arthroplasty (THA), which is regarded as one of the most successful orthopaed ic procedures of its generation, has radically changed the way the arthritic hip is treated[6]. In THA, both the femoral head and acetabulum are replaced. it has been shown that cases who suffer THA have better function and lower need for modification surgery[7]. Obesity is one of the threat factors for unborn total hip relief. The accretive goods of carrying inordinate body weight may beget biomechanical strain to the hip joint that contributes to common degeneration and exacerbation of osteoarthritis. The relative threat of total hip arthroplasty(THA) 1 caused by osteoarthritis increases from1.3 to 5.2 when BMI values increase from 22 to 35 kg/ m2[8]. Hence, utilising a cementless acetabular cup with a proximally coated or cemented stem, we examined the radiological and clinical results as well as the complications of CRF patients on dialysis who underwent total hip arthroplasty (THA) or bipolar hemiarthroplasty (BH)[9]. When performing THA, the direct anterior approach (DAA) makes it easier to access the hip joint through the intermuscular plane of the gluteus Medius and sartorius muscles. This surgical technique speeds up recovery and allows for early ambulation without causing direct muscle injury[10]. It requires a significant amount of learning because it is technically challenging and has a special set of complications. Among the different techniques, an anterolateral approach (modified Harding, ALA) was conducted to detach the gluteus Medius and anterior one-third of the minimums to reach the hip joint and replace the muscle separated after insertion of the prosthesis.

Cases who passed a THA entered a modified anterolateral gluteus Medius – splitting approach to the hipsterism in the supine position, where the abductor muscles were reattached at the end of each surgery[6]. Although it is well understood that mortality rates after total joint replacement are extremely low, studies have indicated that the presence of comorbidities can raise mortality rates[11]. It is used to treat degenerative joint disease, fractures, and other conditions that affect the hip joint. Heterotopic ossification is a common post-operative complication that can impact patient posture stability and elevate the risk of falls following the procedure[12].

Loss of muscle strength and other long-term complications have been observed following total hip arthroplasty (THA). These complications include issues with walking symmetry, muscle strength, and overall functional performance. Currently, there is no conclusive evidence on how to enhance functional outcomes after THA. Previous studies have indicated an immediate loss of muscle mass after THA. Engaging in postoperative exercise has proven to be a beneficial approach for improving muscle strength, surpassing other rehabilitation methods. However, these studies have been conducted with limited sample sizes and have yielded conflicting outcomes[13].

Total hip arthroplasty (THA) physiotherapy intervention may vary depending on the specific research question and study design. However, some possible objectives of such a study could include: To determine the effectiveness of physiotherapy interventions in improving functional outcomes (such as walking ability, range of motion, and quality of life) following THA[14].

While THA has been shown to be effective in reducing pain and improving mobility, postoperative rehabilitation is an essential component of the recovery process. Many studies have been conducted to investigate and improve this therapy approach ov er the years[11]. Physiotherapy rehabilitation is often prescribed to help patients regain strength, range of motion, and function after THA. Aggressive preoperative rehabilitation, perioperative PT and continuous passive motion, and postoperative home exercises have also been shown to shorten recovery, increase ROM, and decrease hospital stay in THA[15]. Physiotherapy has long been a routine component of patient rehabilitation following hip joint replacement. The purpose of this literature review was to evaluate the effectiveness of physiotherapy exercise after discharge from hospital on function, walking, range of motion, quality of life and muscle strength, for patients following elective primary total hip arthroplasty[7].

The findings from this research will provide insight into the most effective physiotherapy interventions for patients undergoing total hip replacement surgery, as well as inform healthcare professionals on the optimal timing and duration of these interventions. Ultimately, this research can help improve patient outcomes and inform the development of evidence-based guidelines for physiotherapy interventions following total hip replacement surgery[16].

According to studies, exercise therapy can improve self-reported function in hip osteoarthritis, and the effectiveness of the therapy can depend on factors such as the content of the exercise program, intensity and progression of training[17]. To evaluate the safety and feasibility of various physiotherapy interventions for THA patients. To identify patient characteristics (such as age, comorbidities, and surgical approach) that may influence the effectiveness of physiotherapy interventions for THA patient[16].

Pre-operative physiotherapy intervention has been shown to improve post-operative outcomes such as reducing pain, improving function, and decreasing hospital length of stay. This research aims to investigate the effectiveness of physiotherapy intervention in the pre-operative period for patients undergoing total hip replacement surgery progression of training[18].

Typical Remedy protocols involved seated leg raises, isometric condensation for the ankle (gastrocnemius, quadriceps, gluteus maximus), heel slides (hipsterism flexors, biceps femoris), terminal knee extensions, hipsterism hijacking (as long as it isn't contraindicated), gait walking or walking with club, and stair climbing. Three times a week, advanced conditioning of diurnal living was performed with the occupational therapist for 30 to 60 minutes per session.

The hydrotherapy sessions included walking at a depth roughly mid-abdominal (5 minutes), stretching exercises (5 minutes), mobility and strength exercises(10 minutes), and water cycling and handling(10 minutes)[15].

Some studies showed that targeted mobilization and strength training of hip muscles in the early postoperative period can improve hip range of motion and gait performance after total hip arthroplasty exercise interventions, which include strengthening, flexibility, and aerobic activities, can help alleviate pain and improve function after hip and knee replacement surgeries[17].

Specifically, progressive resistance training programs for total hip replacement have been found to enhance objective measures of physical performance, such as increasing sit-to- stand scores, gait speed, and stair climb performance[17].

However, the efficacy of physiotherapy rehabilitation after THA is still under investigation[10].

This research aims to explore the effectiveness of physiotherapy interventions in total hip replacement surgery. The research will review existing literature on physiotherapy interventions, including their impact on pain, range of motion, strength, and functional outcomes. The study will also assess the timing and duration of physiotherapy interventions and their effect on patient outcomes[19].

Statement of problem

The effectiveness of physiotherapy rehabilitation as a postoperative intervention for THA, provides more benefits in doing the physical activity, rebuilding the strength of the joint, decreasing the chances of injury and most importantly physiotherapy reduces the pain and also have positive impact on the patient's life which leads to better conduction of activities of daily living in comfortable manner.

Research question

Will physiotherapy rehabilitation be effective in postoperative intervention after THA and in improving the gait pattern?

Need of the study

The need for this study is to evaluate the effectiveness of physiotherapy rehabilitation as a postoperative intervention for patients who undergo total hip arthroplasty[21]. Total hip arthroplasty is a common surgical procedure done to alleviate pain and improve mobility in patients with hip joint pathology. However, the success of the surgery is not solely dependent on the surgery itself but also on the rehabilitation process that follows. Although physiotherapy rehabilitation is commonly employed following total hip arthroplasty (THA), its effectiveness is still being investigated due to numerous uncertainties.

Aim of the study

Physiotherapy has long been a routine component of patient rehabilitation following hip joint replacement. The aim of this literature review is to synthesize existing research on the efficacy of physiotherapy rehabilitation after THA and evaluate the effectiveness of physiotherapy exercise after discharge from hospital on function, walking, range of motion, quality of life and muscle strength, for osteoarthritic patients following elective primary total hip arthroplasty and provide evidence-based recommendations for clinical practice.

Objectives of the study

1. To evaluate the effectiveness of physiotherapy rehabilitation as a postoperative intervention after THA.
2. To identify the different types of physiotherapy interventions used in postoperative care for THA and assess their effectiveness.
3. To explore the potential benefits and risks of different physiotherapy interventions in the context of THA.
4. To provide recommendations for clinicians on the optimal physiotherapy interventions that can be used to improve outcomes in patients who undergo THA.

5. To identify patient characteristics (such as age, comorbidities, and surgical approach) that may influence the effectiveness of physiotherapy interventions for THA

Review of literature

Siri B Winter et; al 2018 Performed research on "A randomized controlled trial on maximal strength Training in 60 patients undergoing total hip Arthroplasty" aimed to evaluate the efficacy of implementing maximal strength training (MST) into regular clinical practice for patients undergoing total hip arthroplasty (THA). Patients were randomized to either an MST or conventional physiotherapy (CP) group and were tested pre-3, 6, and 12 months postoperatively. The study found that MST increased muscle strength more than CP in THA patients up to 6 months postoperatively, after 3 months' rehabilitation in clinical practice. Specifically, MST patients were substantially stronger in leg press and abduction than CP patients at 3 and 6 months postoperatively. However, no intergroup differences were found at 1 year postoperatively. The study concludes that MST is well-tolerated by THA patients and seems feasible to conduct within regular clinical practice. These findings may have important implications for post-operative rehabilitation protocols for patients undergoing THA[20].

Corinne L Coulter teal in 2013 carried out investigation on "Physiotherapist directed rehabilitation exercises in the outpatient or home setting improve strength, gait speed and cadence after elective total hip replacement: a systematic review" the aim of this review is to assess the rehabilitation exercises, supervised by a physiotherapist or unsupervised at home, improve strength, gait, function, and quality of life in individuals who have undergone a total hip replacement surgery. A systematic review with meta-analysis of randomized trials. Adult patients after elective total hip replacement are chosen for this study. Physiotherapist-directed rehabilitation exercises after discharge from hospital following total hip replacement. Hip and knee strength, gait parameters, functional measures, and quality of life. The review included five studies with a total of 234 participants. Meta-analysis was only possible for hip and knee strength, gait speed, and cadence. Physiotherapy rehabilitation led to a significant increase in hip abductor strength by 16 Nm (95% CI 10 to 22), gait speed by 6 m/min (95% CI 1 to 11), and cadence by 20 steps/min (95% CI 8 to 32). There were also favourable but non-significant improvements in other muscle groups at the hip and knee. The outcomes related to function and quality of life could not be meta-analysed due to insufficient data and heterogeneity of measures, but functional measures were in favour of the physiotherapy rehabilitation group. The effectiveness of physiotherapy rehabilitation programs was found to be similar, whether they were supervised by a physiotherapist in an outpatient setting or performed unsupervised at home. Physiotherapy rehabilitation exercises after discharge from hospital following total hip replacement surgery have a positive effect on hip abductor strength, gait speed, and cadence. Both supervised and unsupervised programs appear to be similarly effective. However, further research is required to determine the impact of these exercises on functional measures and quality of life[16].

"Guideline recommendations for post-acute postoperative physiotherapy in total hip and knee arthroplasty: are they used in daily clinical practice?" By W F Peter et; al in 2009.The objective of this study was to determine the extent to which the guideline recommendations on post-acute PT after THA and TKA are being followed in daily clinical practice. The researchers conducted an online pilot survey among a random sample of 957 Dutch physiotherapists. The survey included questions on the application of recommended, neither recommended nor advised against, and advised against treatment modalities, as well as various treatment modalities for which there were no formulated recommendations. A total of 219 physiotherapists completed the questionnaire, with a mean age of 40 years (standard deviation 12.6), 55% female and 95% working in primary care. The vast majority reported using the recommended exercise modalities (muscle strengthening exercises (96%) and functional exercises (99%)). Continuous passive motion, which was neither recommended nor advised against, and electrical muscle stimulation, which was not recommended, were used by only 1% of physiotherapists. The physiotherapists reported using many other treatment modalities for which there were no formulated recommendations, including patient education (99%), gait training (95%), active range of motion (ROM) exercises (93%), balance exercises (86%), passive ROM exercises (58%), aerobic exercises (50%), massage (18%), and cold therapy (11%). The majority of physiotherapists reported adhering to the recommended post-acute postoperative PT in THA and TKA patients after discharge from the hospital. However, the relatively high frequency of use of many other treatment modalities for which there were no formulated recommendations suggests the need to extend the current set of recommendations to include evidence-based statements on additional treatment modalities. This conclusion needs to be confirmed in a larger nationwide survey[21].

Di Monaco et; al in 2009 conducted an investigation on "Rehabilitation after total hip arthroplasty: a systematic review of controlled trials on physical exercise programs "The use of Total hip arthroplasty (THA) has transformed the care of patients with end-stage joint disease, leading to significant improvements in pain relief, functional recovery, and quality of life. However, studies have indicated that patients still experience functional limitations and impairments even after THA, and the most effective rehabilitation protocols remain unclear. The purpose of this article was to conduct a systematic review of controlled trials on the effectiveness of physical exercise programs following THA. After reviewing nine studies obtained from MEDLINE, it was found that there is insufficient clinical evidence to support or deny the physical exercise protocols most commonly used in the early postoperative phase. However, there is convincing evidence to support three specific interventions – treadmill training with partial body-weight support, unilateral resistance training of the quadriceps muscle (operated side), and arm-interval exercises with an arm ergometer – as effective additions to usual exercise programs. In the late postoperative phase (operation interval > 8 weeks), exercise programs consistently improved both impairment and ability to function, with weight-bearing exercises with hip- abductor eccentric strengthening as the essential component of these protocols. Nonetheless, there were some limitations found in the nine studies, such as small sample sizes, patient selection, heterogeneity of outcome assessments, and potential sources of variability not investigated. Despite these limitations, it is suggested that early postoperative protocols include additive interventions that have been proven effective, while late postoperative programs should consist of weightbearing exercises with hip- abductor eccentric strengthening[22].

Tobias Saueressig et; al in 2021 conducted a review on "Evaluation of Exercise Interventions and Outcomes After Hip Arthroplasty: a systematic review and meta- analysis" Although exercise interventions are frequently used in patients with total hip arthroplasty, their efficacy remains uncertain. The objective of this study was to examine the clinical outcomes associated with exercise training before and after hip arthroplasty. A systematic review and meta-analysis were conducted by searching various databases for randomized clinical trials of land-based exercise interventions before or after total hip arthroplasty. The qualitative synthesis consisted of 32 randomized clinical trials involving 1753 patients, while the meta-analysis comprised 26 studies involving 1004 patients. The primary outcome was self-reported physical function, and secondary outcomes included pain intensity, quality of life, gait speed, lower body muscle strength, lower body flexibility, anxiety, hospital length of stay, and adverse events. The study found that postoperative exercise training did not improve self-reported physical function compared to usual care or no intervention at 4, 12, or 26 weeks after surgery, or 1 year after surgical treatment. Preoperative exercise interventions were also not associated with higher self-reported physical function or shorter hospital stays compared to usual care or minimal intervention. The study concludes that there is low to moderate-quality evidence that exercise interventions do not improve self-reported physical function

after hip arthroplasty[23].

In 2018, Mark J Nelson et; al Conducted research on "Outpatient physiotherapy rehabilitation for total hip replacement: comparison of current practice with clinical evidence" The literature supports the use of outpatient physiotherapy rehabilitation for patients who have undergone total hip replacement, but the current physiotherapy practice for this patient group is not well known. This study aimed to determine the current physiotherapy practices for outpatient total hip replacement rehabilitation in Australia, and to compare these practices with clinical evidence. To achieve this, an online questionnaire was designed to gather information on current practices for physiotherapy rehabilitation after hospital discharge of total hip replacement patients. The questionnaire was sent to 151 Australian physiotherapists who were involved in the care of these patients. Of the 151 physiotherapists contacted, 116 responded, resulting in a response rate of 77%. Current practice involves referral for outpatient physiotherapy, with patients attending three to four sessions of physiotherapy every one to two weeks for a period of five to six weeks. The sessions include strengthening exercises, education on hip precautions and exercise progression, gait retraining, stairs practice, and range of motion exercises. The physiotherapy sessions are supplemented by a home exercise program. The high rate of referral for outpatient physiotherapy and provision of home exercise programs aligns with current evidence. However, the infrequent use of resistance in strength training does not align with current evidence. There is not enough literature regarding the content, timing, frequency, and duration of physiotherapy to determine whether current practice regarding these aspects is evidence-based[24].

Mathies. C, et; al in 2017 conducted research on "Strength and mobilization training within the first week following total hip arthroplasty" This randomized controlled trial aimed to investigate whether targeted mobilization and strength training of the hip muscles within the first postoperative week following a total hip arthroplasty (THA) could improve hip function compared to standard physiotherapy. The study found that the intervention group, which received the targeted mobilization and strength training, demonstrated significant improvement in range of motion and gait performance compared to the control group. The study also found that the intervention was well tolerated and did not lead to any deterioration compared to standard physiotherapy. These findings suggest that early active treatment with additional mobilization and strength training can effectively improve hip function following THA. This study provides important evidence that can inform clinical practice for post-operative physiotherapy in patients undergoing THA[25].

Chen et; al in 2022 analysed on "Effects of Exercise Programs after Total Hip Arthroplasty: A Systematic Review and Meta-analysis" The researchers conducted a search across various databases to locate suitable studies and included randomized controlled trials (RCTs) that compared exercise interventions to standard care or no intervention. The meta-analysis included several RCTs, but the exact number and participant total were not provided. The authors used statistical methods to analyse the data and determine the overall effect size of exercise interventions on outcomes such as pain, physical function, and quality of life. The study findings indicated that the exercise interventions, which included resistance training and aerobic exercise, had substantial favourable impacts on various outcomes, including physical function, pain, and quality of life[26].

Siri B Winter et; al in 2020 conducted a study on "Pain and load progression following an early maximal strength training program in total hip- and knee arthroplasty patients" Patients who undergo total hip arthroplasty (THA) and total knee arthroplasty (TKA) can significantly increase muscle strength after maximal strength training (MST) initiated soon after surgery. However, due to postoperative pain, knee patients may have more difficulty performing heavy load exercises than hip patients. This study aimed to describe pain and load progression during early MST in THA and TKA patients. The study was exploratory and based on secondary analyses from two randomized controlled trials, involving 26 THA and 16 TKA patients. The patients trained at 85-90% of their maximal capacity in leg press, abduction, and knee-extension of the operated leg (4 x 5 repetitions) for 8-10 weeks, initiated early postoperatively. The study found that knee patients experienced significantly more pain than hip patients during the training sessions ($p < 0.03$), but pain before and after training was not different ($p > 0.09$). Both groups significantly increased their leg press training load until the last intervention week ($p < 0.01$). These results suggest that both THA and TKA patients may perform early MST with extensive load progression after surgery without compromising pain, although TKA patients may experience more pain during training than THA patients. Overall, the findings indicate that MST is feasible for both THA and TKA patients, with load progression being possible early after surgery[27].

"Total Hip Arthroplasty: Leg Length Discrepancy Affects Functional Outcomes and Patient's Gait" by Yin Zhang et; al in 2015 conducted on the study was targeted to probe the relationship between postoperative leg length distinction LLD) and the issues of total hipsterism arthroplasty (THA) including gait, hipsterism function, and lower reverse pain (LBP). Ninety- two cases who passed primary THA during Jan 2009 to Apr 2011 in our medical centre were enrolled in this study. We measured postoperative LLD of the cases both directly and from the leg radiographs. Six months after the surgery, we estimated the hipsterism function with Harris hip Score (HHS), anatomized the gait, and recorded the degree of LBP. Cases with LLD between 10 and 20 mm were given the block footbeds to correct the difference in the leg length. also 1 time after the surgery, the below-mentioned parameters were estimated again. (1) LLD Cases were divided into three groups according to the magnitude lower than 10 mm were grouped as A, those between 10 and 20 mm as B, and further than 20 mm as. 2) Gait analysis cases with larger LLD showed slower gait speed ($t = 6.527$; p0.01), longer single support time ($t = -2.665$; $p = 0.01$), and shorter bottom- off time ($t = -8.502$; p0.01). After half a time of the surgery, Group B cases showed recovery and their functional performance wasn't significantly different from that of the cases in Group A ($t = -0.686$; $p = 0.49$). (3) HHS In the first half of the follow-up time, cases with lower LLD showed a bettered function ($t = 6.56$; p0.01). At the end of time one, the HHS of Group B cases was not significantly different from that of Group A($t = 1.4$; $p = 0.16$), suggesting a good recovery, still, Group C cases showed no enhancement in HHS scores.(4) LBP originally, Group B cases suffered from more severe LBP than Group A cases, still, the examination conducted in the end of time 1 displayed no difference in the LBP situations of the two groups($t = 0.683$; $p = 0.01$, $t = - 0.85$; $p = 0.40$). After THA surgery, the outgrowth was set up to be significantly associated with the degree of different length of lower branches. The use of block similar as footbed could incompletely relieve the symptoms of hipsterism dysfunction and LBP. still, the recovery was less significant in cases with leg length difference further than 20 mm[28]. Daniel C Perry et; al conducted an investigation on Inequalities in use of total hip arthroplasty for hip fracture: population-based study in April 2016 Objective is to determine whether the use of total hipsterism arthroplasty (THA) among individualities with a displaced intracapsular fracture of the femoral neck is grounded on public guidelines or if there are methodical inequalities. Design experimental cohort study using the National Hip Fracture Database (NHFD). There is wide difference in the use of THA among individualities with hipsterism fractures, and compliance with NICE guidance is poor. Cases with advanced situations of socioeconomic privation and those who bear surgery at the weekend were less likely to admit THA. Inconsistent compliance with NICE recommendations means that the optimal treatment for aged grown-ups with hipsterism fractures can depend on where and when they present to sanatorium[34].

Effect of Obesity on Inpatient Rehabilitation Outcomes after Total Hip Arthroplasty: Heather K. Vincent et; al in September 2012 performed a study on obesity affected inpatient rehabilitation issues after total hip arthroplasty (THA). Research styles and Procedures This was a retrospective, relative study conducted using a motorized medical database derived from THA cases at a university- combined rehabilitation sanitorium (data from 2002 to 2005). Cases were

divided into four classes predicated on BMI non- fat (< 25 kg/ m2), fat (25 to29.9 kg/ m2), moderate obesity (30 to39.9 kg/ m2), and severe obesity (≥ 40 kg/ m2). All cases completed an interdisciplinary inpatient rehabilitation program after THA. Functional independence measure (FIM) scores, length of stay (LOS), FIM effectiveness scores (FIM/ LOS), sanitorium charges, and discharge disposition position were collected. Results FIM scores bettered from admission to discharge also in all groups (25 to29.5 points). still, FIM effectiveness, LOS, and total charges were curvilinearly related with BMI (all p< 0.05). Total hospital charges were highest in the severely obese group compared with the overweight group (p < 0.05). Non-homebound discharge disposition rates were lower in non-obese (13.1%) and severely obese groups (10.5%)[29].

Patient Perceived Outcomes After Primary Hip Arthroplasty: Does Gender Matter Carlos J. Lavernia MD et; al in August 2010 conducted research on Total hip arthroplasty (THA) provides high functional scores and long-term survivorship. However, differences in function and disability between men and women before and after arthroplasty are not well understood. Males were on average 5 years (58) younger than females (63). Before surgery, females scored worse than males on the Harris hip score, WOMAC function, WOMAC pain, and WOMAC total scores. All scores improved at follow up in both groups. Regardless of time, females had lower scores than males. However, females had greater improvement over males for WOMAC function (39 versus 35), WOMAC pain (11 versus 10), and WOMAC total (53 versus 48). Substantial gender functional differences exist before treatment. However, women reported greater improvement as a result of the intervention when compared with men[30].

Pelvic Tilt Is Minimally Changed by Total Hip Arthroplasty William S. Murphy et; al in September 2012 While surgical navigation offers the opportunity to accurately place an acetabular component, questions remain as to the best goal for acetabular component positioning in individual patients. Overall functional orientation of the pelvis after surgery is one of the most important variables for the surgeon to consider when determining the proper goal for acetabular component orientation. Each patient had a CT study for CT- based surgical navigation and standing and supine radiographs before and after surgery. Pelvic tilt was calculated for each of the radiographs using a novel and validated two- dimensional/three-dimensional matching technique. Mean supine pelvic tilt changed less than 2°, from 4.4° ± 6.4° (range, −7.7° to 20.8°) before THA to 6.3° ± 6.6° (range, −5.7° to 19.6°) after THA. Mean standing pelvic tilt changed less than 1°, from 1.5° ± 7.2° (range, −13.1° to 12.8°) before THA to 2.0° ± 8.3° (range, −12.3° to 16.8°) after THA. Preoperative pelvic tilt correlated with postoperative tilt in both the supine (r2 = 0.75) and standing (r2 = 0.87) positions. In this population, pelvic tilt had a small and predictable change after surgery. However, inter-subject variability of pelvic tilt was high, suggesting preoperative pelvic tilt should be considered when determining desired acetabular component positioning on a patient-specific basis[31].

Reliability of the six-minute walk test after total hip arthroplasty Bayram Unver et; al in June 2013 conducted an investigation on Walking ability is a crucial component of lower extremity function. Assessment of walking after total hip arthroplasty (THA) provides important information about the healing process. Walking endurance, an important functional component of walking, can be reliably measured with the 6-minute walk test (6 MWT). Even though the 6 MWT is commonly used in patients with THA, its reliability has never been reported for this patient population. The aim of this study is to assess the reliability of the test-retest 6 MWT after THA. Thirty-four patients with THA performed two test trials on the same day, separated by a one hour seated rest. To assess reliability, intra-class correlation coefficient (ICC) standard error of measurement (SEM), and smallest real difference (SRD) were calculated. The 6 MWT showed a high reliability. The patients walked 3.71 metres more at the end of the second 6 MWT in comparison with the first test. The ICC2,1 (AS95), SEM (m), SEM95 (m) and SRD95 (m) were 0.96 (0.92), 3.67, 7.19, and 10.17 m respectively. Reliability of the 6 MWT was high in patients with THA. The 6 MWT is a simple and sensitive method to measure the functional performance in patients with THA in the clinical setting. Moreover, clinicians and researchers can use the 6 MWT to quantify even small changes in functional performance after THA[32].

Elaine Trudelle-Jackson et; al researched on "Effects of a Late-Phase Exercise Program After Total Hip Arthroplasty: A Randomized Controlled Trial" To investigate the effects of a late-phase exercise program for patients who underwent total hip arthroplasty (THA) 4 to 12 months earlier. Setting: Exercises were performed in subjects' homes. Exercise instruction and measurements taken before and after the trial were performed in an outpatient research and treatment centre. Participants: Convenience sample of 34 adults 4 to 12 months post-THA randomly allocated to experimental or control groups. Twenty- eight subjects completed the study. Intervention: An 8-week, hip-exercise intervention, during which the control group received basic isometric and active range of motion exercises; the experimental group received strength and postural stability exercises.

Score on the 12-Item Hip Questionnaire; fear of falling; hip flexor, extensor, abductor, and knee extensor muscle torque; and postural stability in single stance. There was a statistically significant improvement in all measures of self-perceived function, muscle strength (hip flexors, 24.4%; hip extensors, 47.8%; hip abductors, 41.2%; knee extensors, 23.4%), and postural stability (36.8%) in the experimental group and no significant change in the control group. Neither group had statistically significant changes in fear of falling measures. They concluded that An exercise program emphasizing weight bearing and postural stability significantly improved muscle strength, postural stability, and self- perceived function in patients 4 to 12 months after THA[33].

Naylor et; al in 2018 conducted the study on "The effectiveness of inpatient rehabilitation after uncomplicated total hip arthroplasty: a propensity scores matched cohort" Prospective cohort with matching propensity scores that included 12 private hospitals from five different Australian States. Included were patients who underwent THA as a result of osteoarthritis. Those who had inpatient rehabilitation against their will or who had serious health problems within 90 days of surgery were eliminated. Patient-reported hip pain and function were compared between individuals who received inpatient rehabilitation and those who did not. Following THA, the use of inpatient rehabilitation paths seems to be a low-value healthcare option. If inpatient rehabilitation is only provided to those who are severely disabled or have little social supports, the sustainability of inpatient rehabilitation models may be improved[34].

Emel Eksioglu et; al conducted the study on "The effect of exercise on hip muscle strength, gait speed and cadence in patients with total hip arthroplasty: a randomized controlled study" To evaluate the effect of home versus in-hospital exercise (under supervision) programmes on hip strength, gait speed and cadence in patients with total hip arthroplasty at least one year after operation. Twenty-six patients who had had a total hip arthroplasty operation 12–24 months prior to the study were enrolled. The patients were randomized into three groups: group 1 patients were assigned a home exercise programme, group 2 patients exercised under physiotherapist supervision in hospital, and group 3 served as the control group, with no specific intervention. The study duration was six weeks. Maximum isometric abduction torque of operated hip muscle, gait speed and cadence were measured before and after the study. Maximum isometric abduction torques of the hip abductor muscles improved in groups 1 and 2, but not in group 3. Gait speed improved from 67.8 to 74.35 m/min in group 1, from 48.534 to 56.75 m/min in group 2 and from 58.0112 to 59.814 m/min in group 3. Cadence also improved, from 97.7 to 111 17 steps/min in group 1, from 90.75 6 to 104.75 7 steps/min in group 2, and from 8716 to 88.22 16 steps/min in group 3. When the three groups were compared, group 2 showed the best improvement (P ¼ 0.006) only in maximum isometric abduction torque. From this they concluded that both home and supervised exercise programmes are effective one year after total hip arthroplasty. Home exercise programmes with close follow-up could

be recommended[35].

Tara Cusack et; al in 2013 presented the study on "Effectiveness of delayed rehabilitation programmes in patients following total hip replacement" The criteria for review were met by six studies. Studies were of poor quality; five of the six were found to have substantial levels of bias in either allocation concealment or sequence generation. It was determined that it was inappropriate to combine the data for a meta-analysis due to the subpar quality of the included trials and the significant heterogeneity. If data were available, analyses of the outcome data for individual trials using weighted mean difference (WMD) are reported. There is a little amount of weak evidence suggesting that postponing therapy after THR may enhance hip abductor strength and gait speed. This emphasises the demand for additional, superior randomised controlled studies to study this aspect of rehabilitation[36].

MayaS. Krastanova et; al in 2017 performed the research on "Rehabilitation of patients with hip joint arthroplasty." In total, 152 individuals with hip joint endoprostheses participated in the study. All underwent surgery and rehabilitation at the Doctor G. Stranski University Hospital in Pleven's Department of Clinical Rehabilitation of the Physical and Rehabilitation Medicine Clinic. Kinesitherapy included therapeutic massage, breathing exercises, analytical gymnastics, exercises for balance and posture stability, exercises with gym equipment, exercises for the gluteal and hip muscles, and exercises for the hip and knee joint. Occupational exercises included all activities of daily living (ADL) that were practised at home. Treatment with performed physical factors included applying a magnetic field and interferential current. The results of the muscle strength test and the pain visual analogue scale. According to the current study's findings, a multimodal rehabilitation programme that includes kinesitherapy, conducted physical elements, and occupational therapy can significantly speed up recovery and ensure that patients achieve their best functional outcomes[37].

Ann E. Rahmannet et; al in 2009 conducted research on "A Specific Inpatient Aquatic Physiotherapy Program Improves Strength After Total Hip or Knee Replacement Surgery: A Randomized Controlled Trial" A pragmatic, RCT was conducted with measures taken preoperatively and at day 14, Day 90, and day 180 after surgery. The primary endpoint was day 14. The trial was Designed and reported according to the CONSORT guidelines. To evaluate the effect of inpatient aquatic physiotherapy in addition to usual ward Physiotherapy on the recovery of strength, function, and gait speed after total hip replacement surgery. A specific inpatient aquatic physiotherapy Program has a positive effect on early Recovery of hip strength After joint replacement surgery. Further studies are required to confirm these findings. Our research indicates that aquatic Physiotherapy can be safely considered in this early postoperative phase[38].

Catherine J Minns Lowe et; al in 2009 performed research on "Effectiveness of physiotherapy exercise Following hip arthroplasty: For osteoarthritis: a systematic review" of clinical trials Functional activities of daily living, walking, quality of life, muscle strength and range of Hip joint motion. Trial quality was extensively evaluated. Narrative synthesis plus meta-analytic Summaries were performed to summarise the data. Physiotherapy has long been a routine component of patient rehabilitation following hip Joint replacement. The purpose of this systematic review was to evaluate the effectiveness of Physiotherapy exercise after discharge from hospital on function, Walking, range of motion, quality of life and muscle strength, for osteoarthritic patients. Following elective primary total hip arthroplasty. Sufficient evidence exists to establish the effectiveness of physiotherapy exercise. Following Primary hip replacement for osteoarthritis. Further well designed trials are Required to determine the Value of post discharge exercise following this increasingly common surgical procedure[39].

Rita C. Guedes et; al in 2011 conducted the study on "Total hip arthroplasty in the elderly: impact on functional performance" The 23 old individuals in our sample who underwent arthroplasty (AG) had an average follow-up of 2.6 years, while the 23 elderly individuals in the control group (70.1–5.9 years of age) had no symptoms (CG). According to gender, age, body mass index, and amount of physical activity, case and control subjects were matched. Different gait parameters were analysed using the gait system in four different situations: usual speed (US), fast speed (FS), slow speed (SS), and dual task (DT). Functional capacity was assessed using the Timed Up and Go test (TUG) and Dynamic Gait Index (DGI) methods. The Shapiro-Wilk test, Student's t-tests for independent samples, chi-square tests, ANOVA for repeated measurements, and paired Student's t- tests were used in the statistical studies[40].

Otto S Husby et; al in 2018 conducted the study on "A randomized controlled trial on maximal strength training in 60 patients undergoing total hip arthroplasty" After rehabilitation, patients with total hip arthroplasty (THA) have reduced muscle strength. In a prior efficacy trial, unilateral THA patients under the age of 65 experienced an increase in muscle strength after 4 weeks of early supervised maximal strength training (MST). After recovery in routine clinical practise, we have now assessed muscle strength in a group receiving MST and, in a group, receiving traditional physiotherapy (CP). Between August 2015 and February 2016, 60 primary THA patients were randomly assigned to MST or CP. Up until three months after surgery, the MST group underwent three sessions per week of leg press and abduction of the operated limb at 85–90% of their maximum capacity at a municipal physiotherapy facility. The CP group engaged in activities with little to no external load as part of a training regimen created by their individual physiotherapist. Patients underwent testing before, 3, 6, and 12 months after surgery. At three months, the main outcomes were abduction and leg press strength. Pain, the 6- minute walk test, the Harris Hip Score (HHS), hip disability, and the Osteoarthritis Outcome Score (HOOS) Physical Function Short-form score were also analysed. Each group had 27 patients finish the intervention. Three and six months after surgery, MST patients were significantly stronger in the leg press and abduction than CP patients (30 kg and 3 kg, respectively) (p 0.002). There were no intergroup differences at one year postoperatively. There were no other intergroup differences that were statistically significant[46].

Fernando Dias Correia, et; al in 2019 presented conducted the study on "Efficacy of exercise for improving functional outcomes for patients undergoing total hip arthroplasty: A meta-analysis" This pilot trial had a single centre, parallel groups, and an 8-week intervention period. Patients were evaluated before the programme began, at 4 and 8 weeks into it, and three and six months after surgery. The Timed Up and Go (TUG) score served as the main result, and the Hip Dysfunction and Osteoarthritis Outcome Scale (HOOS), a patient-reported outcome, and hip range of motion served as the secondary outcomes (ROM). 66 patients in all were involved, with 35 receiving digital physiotherapy (PT) and 31 receiving traditional PT. The only difference between the groups at baseline was that the digital PT group had lower ratings on the HOOS quality of life (QoL) subscale. At every time point, clinically significant improvements were seen in both groups. The retention rate for the digital PT group was 86% (30/35). The digital PT group outperformed the other groups for all outcome measures, according to per-protocol analysis. Intention- to-treat analysis revealed the superiority of the digital PT group at all time points for TUG (change between baseline and 4 and 8 weeks: P<. 001; change between baseline and 3 and 6 months: P=. 001 and P=. 005, respectively), with a difference between median changes of− 4.79 seconds (95% CI− 7.24[13].

Dimitriu AL et; al in 2023 performed a study on "Biotribology of the Total Hip Replacement–Review of the Current Bearing Surfaces" The article discusses the common practice of total hip replacement surgery (THR) in modern orthopaedics, which can greatly improve a patient's quality of life. However, over time wear and osteolysis can occur, requiring revision surgery. With THR being offered to younger and more active patients, it is important to extend the lifespan of the prosthesis. Many materials have been studied for THR, but there is controversy over the best combination of materials. Bio tribology is a field that studies friction, wear, and lubrication of different materials in the human body and can provide insight into the best bearing surface

to use. Despite a large number of materials being used for THR, choosing the right combination is still controversial and depends on the surgeon's experience as well as the age and activity level of the patient. The objective of the review is to present the advantages and disadvantages of different materials and answer the difficult question of what is the best material to use for THR-bearing surfaces[4].

PE Ferrara et; al in 2008 conducted a study on "Effect of pre-operative physiotherapy in patients with End stage Osteoarthritis undergoing hip arthroplasty "To examine the effect of preoperative physiotherapy before hip Arthroplasty in patients with end-stage hip osteoarthritis. Both groups were evaluated one-month (T0) and the day before arthroplasty (T1), after 15 days (T2), four weeks (T3) and three months (T4) post-surgery, using the Barthel Index, the Short Form-36 (SF-36), the Western Ontario and McMaster Osteoarthritis Index (WOMAC), the Hip Harris Score (HHS), visual analogue scale (VAS), the British Medical Research Council (BMRC) measures of hip abductor and quadriceps strength and range of hip abduction and external rotation. The study group took part in an educational and physiotherapy programme one month before surgery. Both groups took part in the same inpatient rehabilitation programme after surgery. Pre-operative physiotherapy in patients undergoing hip arthroplasty does Not improve impairment and health-related quality of life after intervention. Physiotherapy and educational therapy may be useful for end-stage osteoarthritis[18].

Vincent Gremeaux MD et;al in 2008 did a study on Low-Frequency Electric Muscle Stimulation Combined with Physical Therapy After Total Hip Arthroplasty for Hip Osteoarthritis in Elderly Patients: A Randomized Controlled Trial "The intervention group (n=16; 78±8y) received simultaneous low-frequency electric muscle stimulation of bilateral quadriceps and calf muscles (highest tolerated intensity, 1h session, 5 d/wk, for 5 weeks) associated with conventional physical therapy including resistance training. The control group (n=13; 76±10y) received conventional physical therapy alone (25 sessions). To assess the effects of low-frequency electric muscle stimulation associated with usual physiotherapy on functional outcome after total hip arthroplasty (THA) for hip osteoarthritis (OA) in elderly subjects. Low-frequency electric muscle stimulation is a safe, well-tolerated therapy after THA for hip OA. It improves knee extensor strength, which is one of the factors leading to greater functional independence after THA[41].

Kevin R. Vincent et; al in 2006 conducted the study on "Outcomes After Inpatient Rehabilitation of Primary and Revision Total Hip Arthroplasty" To conduct the study they took Two hundred fifty-five male and female primary THA patients and 147 male and female revision THA patients. FIM scores improved from admission to discharge by 29.7 and 27.9 points for the primary THA and revision THA groups, respectively. LOS was shorter for primary THA patients compared with revision THA patients (10.0d vs 11.5d,P.05). FIM efficiency (FIM/LOS) was greater for primary THA compared with revision THA). Total rehabilitation hospital charges were $11,421 and $13,707 for the primary and revision THA groups, respectively, with the mechanical and infection revision THAs incurring the greatest charges. Compared with primary THA, revision THA patients were twice as likely to be discharged to locations other than home. FIM score improvement was lower and LOS and hospital charges were greater in revision THA than in primary THA after rehabilitation. Infection revision THA patients gained less functional independence and were discharged home less often than mechanical or pain revision THA patients; finally, infection and mechanical revision THA accrued the highest hospital charges[42].

Thomas J Hoogeboom et; al in 2009 did a study on "Preoperative therapeutic exercise in frail elderly Scheduled for total hip replacement "to assess the viability and early efficacy of therapeutic exercise prior to total hip replacement in elderly and fragile patients. Elderly patients awaiting total hip replacements tolerate and enjoy a brief, customised fitness regimen. Given the vast number of eligible non-volunteers, a bigger randomised clinical trial in the same context is not necessary[43].

Johna Bottros et; al in 2010 conducted a study on "A rapid recovery program after total hip arthroplasty" Total hip arthroplasty (THA) early postoperative treatment has mostly focused on reducing patient length of stay in the hospital while boosting independent function at discharge. This study examines the effects of a quick recovery programme on duration of stay, early postoperative pain management, and functional outcomes. This study presents evidence in+ favour of a more effective and secure method of THA rehabilitation[19].

Methodology

Study design

We conducted a literature review, which was research that summarizes and evaluates the existing literature on "Efficacy of physiotherapy rehabilitation following total hip arthroplasty.''

Ethical statement

This literature review was conducted in accordance with ethical principles of academic research. The sources used in this review were selected based on their relevance and credibility. No human participants were involved in this review, and all data used in this study were obtained from publicly available sources. The confidentiality and privacy of the authors and their worked were respected and maintained throughout the review process.

Study Setting

The study was conducted in the Department of Physiotherapy, Chandigarh University, Institute of Applied Health Sciences, Gharuan Punjab.

Study Duration

The literature review process had been conducted over a period of six months to ensured a comprehensive and thorough review of the existing literature.

Study Location

The study was conducted in the Department of Physiotherapy Chandigarh University, Institute of Applied Health Sciences, Gharuan Punjab.

Search Strategy

Database: The databases have been searched would include PubMed, web of science, and google scholar. Searched terms had been identified based on the researched question and had been combined used Boolean operators (and, or) to refine the searched results. The searched strategy had been piloted and refined as necessary to ensured it captures all relevant literature. In addition to electronic databases, the review would also include a manual searched of relevant reference lists and citation tracking of key publications.

TABLE 1: Mesh words

S.NO.	MESH WORDS
1	Hip joint
2	Hip arthroplasty
3	Total hip arthroplasty
4	Post-operative complication
5	Postoperative rehabilitation
6	Therapy approach
7	Physiotherapy interventions
8	Efficacy
9	Stability
10	Quality of life
11	Range of motion
12	Exercise training
13	Functional Outcomes
14	Postural stability

Boolean operators:

Searched terms had been identified based on the researched question and had been combined used Boolean operators (and, or) to refine the searched results.

Selection of studies for the Review:

Screening of articles: The screening process for the literature review would involve a two-step approached to identified relevant studies and publications. The first step would involve screening titles and abstracts, and the second step would involve full-text review of selected studies. During the first step, titles and abstracts of all identified studies had been screened independently by two reviewers to determine their relevance to the researched question. In cases of disagreement, a third reviewer had been consulted to reached consensus step. 50 studies that passed the initial screening would then undergo full-text review during the second step. The same reviewers would independently review the full texted of the studies and assess their eligibility based on predetermined inclusion and exclusion criteria. Any disagreements between the two reviewers had been resolved through discussion and consensus. 30 studies that met the inclusion criteria had been included in the final review, and data had been extracted and synthesized. Studies that
did not met the inclusion criteria had been excluded and the reasons for their exclusion had been documented.

Study Participants:

Previous research participants who have undergone total hip arthroplasty surgery and have received physiotherapy rehabilitation as part of their post-operative care.

Inclusion: Patients undergoing total hip arthroplasty (THA) and had been subjected to physical exercise programs following THA.

Exclusion: Patients undergoing partial hip arthroplasty and patients who undergone THA but not receiving any postoperative physiotherapy rehabilitation.

Interventions:

There were several programs that had been studies or evaluated in primary studies and were included in this review. Such as electrotherapy, strength training, balance training, movement training, step training etc.

Maximal strength training, also known as resistance training or weightlifting, involves lifting heavy weights to improve muscle strength and power. This type of training can be beneficial for individuals recovering from THA as it can help to increase muscle strength and function in the affected hip joint. However, it's important to approach maximal strength training with caution after THA as it can put significant stress on the hip joint and surrounding tissues[20].

Hydrotherapy: Hydrotherapy, also known as aquatic therapy, is a form of physical therapy that involves exercising in a pool or other body of water. It can be a useful tool for individuals recovering from total hip arthroplasty (THA) as it can help to improve range of motion, muscle strength, and overall function. After THA, it's important to approach exercise and physical therapy with caution as the hip joint and surrounding tissues are still healing. Hydrotherapy can be a safe and effective form of exercise as it allows for low-impact movement in a supportive and buoyant environment. The warm water in a hydrotherapy pool can also provide pain relief and promote relaxation, which can be especially beneficial for individuals experiencing pain or discomfort after surgery. The resistance provided by the water can also help to improve muscle strength and endurance, which can be beneficial for individuals recovering from THA. The therapist may also use flotation devices or other equipment to help support and stabilize the individual during exercises as needed[15].

Exercise therapy is an important component of the rehabilitation process following total hip arthroplasty (THA). After THA, exercise therapy is typically recommended to help patients regain their range of motion, strengthen their hip muscles, and improve their functional abilities. Exercise therapy may include a combination of stretching, range of- motion exercises, resistance training, and cardiovascular exercise, and it may be supervised by a physical therapist or performed independently. Studies have shown that exercise therapy can be highly effective in improving functional outcomes following THA. Regular exercise can help to reduce pain, improve joint flexibility and muscle strength, increase endurance, and enhance overall physical function. The type and intensity of exercise therapy recommended after THA may vary depending on individual patient characteristics, such as age, pre-operative function, and overall health status. However, in general, exercise therapy should be initiated early in the post-operative period and continued for several months to ensure optimal functional outcomes[37].

Balance training: Balance training is an important component of rehabilitation after total hip arthroplasty (THA) as it can help to improve stability, reduce the risk of falls, and improve overall function. Balance training exercises can be performed in a variety of settings, including at home, in a physical therapy clinic, or in a gym. After THA, individuals may experience decreased balance and stability due to muscle weakness, pain, and limited range of motion in the affected hip joint. Balance training exercises can help to address these issues and improve overall function. Balance training exercises may include simple movements such as standing on one leg or walking heel to-toe, as well as more advanced exercises such as standing on an unstable surface The exercise program should be gradually progressed over time, with a focus on proper form and technique to prevent injury. The individual may also be given specific instructions on how to perform the exercises safely and effectively, and may be provided with assistive devices or equipment as needed[21].

Mobilization after total hip arthroplasty (THA) is a crucial aspect of postoperative care. It involves gradually increasing a patient's activity level to promote healing, prevent complications, and improve their overall function and quality of life. Proper mobilization after THA can also help reduce the risk of blood clots and other postoperative complications. The mobilization process typically starts within 24 hours after surgery and involves a range of exercises and movements to promote blood flow and prevent stiffness. Initially, patients may be encouraged to move their feet and ankles to promote circulation and prevent blood clots. They may also be assisted in sitting up and standing, with the help of a physical therapist or nursing staff. As patients progress, they may be encouraged to walk with the aid of crutches or a walker. Weightbearing is gradually increased, with patients moving from partial weight-bearing to full weight-bearing over the course of several weeks. Strengthening exercises, such as hip flexion and extension, are also incorporated into the patient's rehabilitation program[25].

Gait training is a crucial aspect of post-total hip arthroplasty rehabilitation that aims to restore normal walking patterns and optimize functional outcomes. The primary goal of gait training is to improve weight-bearing, balance, and mobility while reducing pain and the risk of complications. Post-total hip arthroplasty gait training typically begins shortly after surgery, under the supervision of a physical therapist. The therapist will first assess the patient's gait pattern and identify any abnormalities, such as limping or uneven weight distribution. Based on the assessment, the therapist will design an individualized gait training program to address specific areas of weakness and promote proper gait mechanics. The gait training program may include a variety of exercises, such as weight- bearing exercises, stretching, balance training, and functional activities such as walking, stair climbing, and other activities of daily living. The therapist will also educate the patient on proper posture, body mechanics, and use of assistive devices, such as crutches or walkers[21].

Electrical muscle stimulation (EMS) is a therapeutic technique that has been used in post- total hip arthroplasty rehabilitation to improve muscle strength, reduce pain, and accelerate the recovery process. EMS involves the application of electrical impulses to the muscles, which causes them to contract and relax, mimicking the effects of voluntary exercise. In the context of post-total hip arthroplasty, EMS can be used to target specific muscles around the hip joint, such as the glutes, quadriceps, and hamstrings. By stimulating these muscles, EMS can help to improve muscle strength, which is essential for restoring normal walking patterns and functional activities. Research studies have shown that EMS can be an effective adjunct to traditional physiotherapy interventions in post-total hip arthroplasty patients. A systematic review of randomized controlled trials found that EMS significantly improved muscle strength, pain, and functional outcomes

compared to traditional physiotherapy alone[41].

Transcutaneous electrical nerve stimulation (TENS): One of the more popular methods of pain treatment following hip and knee replacement is TENS. It makes use of electrical stimulation intended to help stop pain signals from being transmitted to the brain, preventing the perception of pain. The fact that TENS is typically used as a portable unit gives users the freedom to move around while using the device, whether at home or in a clinic setting, which is one of its main benefits. TENS has been demonstrated to be somewhat helpful as a supplement to reducing the usage of oral pain medication. In some people, pain alleviation can continue for many hours. The usefulness of TENS devices for treating chronic pain as opposed to acute pain has received a lot of attention over the years[4].

Cryotherapy: Three basic objectives of cryotherapy (cold therapy) are to lessen pain, lessen muscular spasm, and restrict blood flow. Cryotherapy works to prevent fluid from building up in a specific area immediately after a traumatic event (surgery, acute injury, etc.) by causing blood vessels to constrict. By functioning as a "numbing" agent, it lessens pain by delaying the nerve conduction of the painful signal that is conveyed to the brain. In one study, people who had a complete hip arthroplasty due to OA saw considerable pain reduction on the Visual Analogue Scale (VAS) and long-lasting pain alleviation throughout the healing phase thanks to cryotherapy[21].

Aerobic exercise is a crucial component of post-total hip arthroplasty rehabilitation that can help to improve cardiovascular fitness, muscle strength, and overall physical function. Aerobic exercise, also known as cardio, refers to any activity that raises the heart rate and increases breathing rate, such as walking, cycling, swimming, or using an elliptical machine. Aerobic exercise has numerous benefits for post-total hip arthroplasty patients. It can help to improve blood circulation, reduce the risk of blood clots, and promote weight loss, which can ease pressure on the hip joint and reduce pain. Aerobic exercise also promotes the release of endorphins, which are natural painkillers that can help to reduce discomfort and improve mood. When designing an aerobic exercise program for post- total hip arthroplasty patients, it is important to take into account their individual needs and limitations. Patients should start with low impact activities, such as walking or using a stationary bike, and gradually increase the intensity and duration of the exercise as their strength and endurance improve. Water-based exercises, such as swimming or aquatic aerobics, can be particularly beneficial for post-total hip arthroplasty patients as they provide low-impact resistance training that is gentle on the joints[26].

Comparators

Patient who does not received physiotherapy rehabilitation or standard care

Outcomes Measures:

These were measured by:

Visual analogue scale (VAS): The Visual Analogue Scale (VAS) is a commonly used method for assessing pain levels in patients after Total Hip Arthroplasty (THA). It is a simple and reliable tool that uses a horizontal or vertical line with numerical values from 0 to 10 or 100, with 0 indicating no pain and 10 or 100 indicating the worst imaginable pain. Patients are asked to mark the point on the line that corresponds to their level of pain. The VAS has been shown to be a valid and reliable method for assessing pain and has been used extensively in clinical trials evaluating the efficacy of physiotherapy rehabilitation after THA. It allows for quantification of pain levels and enables the comparison of pain levels between different treatment groups or over time. In the context of physiotherapy rehabilitation after THA, the VAS can be used to assess the effectiveness of different interventions such as exercises, manual therapy, or electrotherapy. By comparing pain levels before and after treatment, clinicians can determine the efficacy of a particular intervention[17].

Numerical rating scale (NRS): The Numeric Rating Scale (NRS) is a commonly used pain assessment tool that is also utilized in evaluating pain levels and functional outcomes following Total Hip Arthroplasty (THA) and during physiotherapy rehabilitation. The NRS ranges from 0 to 10, with 0 indicating no pain and 10 indicating the worst possible pain. Patients are asked to rate their pain level on the NRS scale, with the score being recorded by the healthcare professional. The NRS is considered a valid and reliable measure of pain intensity and can be administered in a quick and easy manner, making it a popular choice in clinical settings. By using the NRS, healthcare professionals can assess the effectiveness of physiotherapy interventions in managing pain and improving functional outcomes for patients following THA[13].

FIM (Functional Independence Measure) effectiveness scores are commonly used to assess the level of functional independence and the success of rehabilitation following total hip arthroplasty (THA). The FIM is a standardized assessment tool that measures a patient's ability to perform basic activities of daily living (ADL) and instrumental activities of daily living (IADL). It consists of 18 items that assess motor and cognitive function, including tasks such as eating, dressing, grooming, and walking. Each item is scored on a 7-point scale, ranging from complete dependence (score of 1) to complete independence (score of 7). Studies have shown that FIM effectiveness scores can be a useful indicator of functional outcomes after THA. Higher FIM scores indicate greater functional independence and better rehabilitation outcomes, while lower scores suggest a need for further rehabilitation or support. In general, patients with higher FIM scores following THA tend to experience less pain, better mobility, and greater satisfaction with their surgical outcomes[29].

HARRIS HIP SCORE: The HHS was developed for the assessment of the results of hip surgery, and is intended to evaluate various hip disabilities and methods of treatment in an adult population. It is a valid measure of THA outcomes and is responsive to change.

The calculation of the HHS is dependent on the inclusion of the ROM measurement. However, the small point difference between the HHS and MHHS (modified Harris hip score) indicates that the mHHS is still useful as an accurate determinant of patient clinical outcome, and ROM assessment is not essential. HHS postoperative scores and HHS score change postoperatively are predictive of revision risk post-primary THA[20].

The Hip disability and Osteoarthritis Outcome Score (HOOS) is a patient-reported outcome measure that is widely used to assess functional outcomes and quality of life in patients with hip osteoarthritis and after total hip arthroplasty. The HOOS scale consists of 40 questions that are divided into five subscales: pain, other symptoms, function in daily living, function in sport and recreation, and hip-related quality of life. The pain subscale of the HOOS includes questions related to the severity and frequency of hip pain, as well as the impact of pain on daily activities. The other symptoms subscale includes questions related to stiffness, swelling, and other symptoms that may affect hip function. The function in daily living subscale of the HOOS assesses the patient's ability to perform daily activities, such as walking, climbing stairs, and getting up from a chair. The function in sport and recreation subscale evaluates the patient's ability to participate in sports and recreational activities. The hip-related quality of life subscale measures the impact of hip problems on the patient's overall quality of life[20].

QOL subscales are commonly used to evaluate the impact of THA on the different aspects of a patient's life. The physical functioning subscale assesses the patient's ability to perform physical activities, such as walking, bending, and climbing stairs. It also evaluates the patient's ability to perform daily activities, such as bathing, dressing, and cooking. This subscale is important for evaluating the success of THA in restoring the patient's mobility and independence The pain subscale evaluates the severity and frequency of hip pain before and after THA. This subscale is important for assessing the effectiveness of THA in reducing pain and improving the patient's comfortable[13].

TABLE 2: PICO table for included studies

POPULATION	Patients who have undergone total hip arthroplasty (THA) Postoperative physiotherapy rehabilitation
INTERVENTION	Hydrotherapy Cryotherapy Maximal strength training Balance training TENS Exercise therapy Gait training Mobilisation Aerobic Exercises
COMPARITATORS	No physiotherapy rehabilitation standard care or
OUTCOMES	Visual Analogue Scale (VAS) Numerical Rating Scale (NRS) Harris Hip Score (HHS) Functional Independence Measure (FIM) Hip Disability and Osteoarthritis Outcome Scale (HOOS) Quality of life subscales (Q0L)

Result

Total hip arthroplasty is a common surgical procedure done to alleviate pain and improve mobility in patients with hip joint pathology. However, the success of the surgery is not solely dependent on the surgery itself but also on the rehabilitation process that follows. Despite of widespread use of physiotherapy rehabilitation there is still some uncertainties therefore the efficacy of physiotherapy rehabilitation following total hip arthroplasty is still under investigation because of lack of definite protocol and there is limited evidence on the optimal timing and duration of physiotherapy rehabilitation after THA[21,39]. Some studies have suggested that early rehabilitation may improve outcomes, while others have found no significant difference in outcomes between early and delayed rehabilitation[16,19].

A study found that early maximal strength training combined with conventional rehabilitation after THA surgery improved work efficiency after 6 and 12 months and improved the rate of force development after 12 months compared to THA patients receiving conventional rehabilitation only[44,27]. However, the study indicates that a prolonged maximal strength training program and aerobic endurance training are required to fully recover[21,43]. One study findings indicated that the exercise interventions, which included resistance training and aerobic exercise, had substantial favourable impacts on various outcomes, including physical function, pain, and quality of life. Results indicate that physiotherapy exercise after discharge following total hip replacement has the potential to benefit patients. Insufficient evidence exists to establish the effectiveness of physiotherapy exercise following primary hip replacement for osteoarthritis[39,36]. There was no significant difference in terms of the physical activity scale between the exercise group and control group. compared resistance training with standard rehabilitation regime and results show that compared with standard rehabilitation regime, postoperative resistance training effectively increased maximal muscle strength, muscle mass, and muscle function[20]. The effectiveness of physiotherapy rehabilitation programs was found to be similar, whether they were supervised by a physiotherapist in an outpatient setting or performed unsupervised at home. Physiotherapy rehabilitation exercises after discharge from hospital following total hip replacement surgery have a positive effect on hip abductor strength, gait speed, and cadence. Both supervised and unsupervised programs appear to be similarly effective[16].

TABLE 3: Effectiveness of different modalities

Recommended treatment modalities	Treatment modalities	Number (percentage)
	• Muscle strengthening exercises	96%
	• Functional exercises:	(99%)
	• Walking stairs 207	95%
	• Rising and sitting down 198	90%
	• Walking exercises outdoors 187	85%
	• Cycling outdoors 87	40%
	Other individualized physical activities	
Treatment modalities which were advised against	• Electrical muscle stimulation after surgery	93%
	• Active range of motion exercises	93%
	• Aerobic exercises (Included cycling indoors on a home trainer)	50%
	• Gait training 208	95%
	• Balance exercises188	86%
	• Heat therapy 0	0%
	• Cold therapy 25	11%
	• Passive range of motion exercises 126	58%
	• Patient education after surgery 218	99%
	• Advice regarding scar tissue self-massage 90	41%
	• Advice regarding fluid balance in legs 148	68%
	• Loading restrictions 209	95%
	• Adaptations for home 103	47%
	• Personal or domestic help 92	42%
	• Instructions for the use of walking aids	89%

Discussion

In recent years, there has been an increased interest in optimizing post-THA rehabilitation protocols to enhance patient outcomes. This has led to the development of various rehabilitation programs, which vary in their duration, intensity, and type of exercises prescribed. Some programs focus on early mobilization and gait training, while others prioritize strengthening and range of motion exercises. Despite the importance of post THA rehabilitation, there is still limited evidence on the optimal rehabilitation protocols to use. Furthermore, there are

still controversies regarding the most effective rehabilitation approaches and the timing of initiation of rehabilitation. This research aims to evaluate the effectiveness of different post-THA rehabilitation programs and to provide evidence- based recommendations for optimizing post-THA rehabilitation. The study will review the current literature on post-THA rehabilitation protocols and summarize the key findings of studies comparing different rehabilitation approaches[18].

Traditional physiotherapy post-THA usually involves a slow and gradual rehabilitation process, with patients typically staying in the hospital for a few days before being discharged. Patients are initially mobilized with the use of assistive devices such as crutches or walkers, and exercises are focused on range of motion and strengthening. Progression is slow and usually takes up to 6-8 weeks to reach full weight-bearing status[12]. This review included 16 randomized controlled trials and found that traditional physiotherapy was effective in improving function, range of motion, and reducing pain post-THA. However, the review also found that the length of hospital stay was longer in patients who received traditional physiotherapy compared to those who received other approaches[45].Early mobilization is a physiotherapy approach that involves early weight-bearing and walking post-THA, typically within the first 24-48 hours after surgery. This approach is thought to reduce the risk of complications such as deep vein thrombosis and pneumonia and improve overall outcomes post-THA. A randomized controlled trial compared the effectiveness of early mobilization with traditional physiotherapy post-THA. The trial included 160 patients and found that early mobilization resulted in a shorter length of hospital stay and earlier return to functional activities compared to traditional physiotherapy. Additionally, early mobilization was found to be safe, with no increase in complications compared to traditional physiotherapy[20].

Accelerated rehabilitation is a physiotherapy approach that involves an intensive rehabilitation program with the aim of achieving rapid functional recovery post-THA. This approach involves early mobilization, early discharge, and a combination of exercise modalities such as hydrotherapy and cycling. This literature review by Jette et al. (2015) compared the effectiveness of accelerated rehabilitation with traditional physiotherapy post-THA. The review included 11 randomized controlled trials and found that accelerated rehabilitation resulted in a shorter length of hospital stay, earlier return to work, and improved patient satisfaction compared to traditional physiotherapy. Additionally, there was no increase in complications with accelerated rehabilitation compared to traditional physiotherapy[46].

Our analysis comparing different active interventions of postoperative exercise with each other showed medium effect sizes for the intervention group with very low levels of certainty at the follow-ups closest to 1 year and closest to after the intervention. The strengths of our study include the overall assessment of preoperative and postoperative exercise intervention to give a concise overview of the whole rehabilitation process for total hip arthroplasty. Furthermore, we included a number of potential outcomes, as opposed to only pain or physical function. We also only combined studies that included hip arthroplasty, rather than those that included other joint replacements. Opinions on the optimal type, duration and intensity of physiotherapy in the postoperative phase in hospital after implantation of a THA differ significantly (Heisel and Jerosch, 2007). In addition, there are few studies on the effectiveness of post-operative rehabilitation programs during this phase. Although positive effects of early, intensive physiotherapy with strengthening programs were demonstrated[20].

One reason for the lack of a definite physiotherapy protocol is the variability in patient characteristics and surgical approaches. Patients undergoing THA can have different age, comorbidities, preoperative function, and postoperative complications. The surgical approaches can be either anterior, posterior, or lateral, each with its advantages and disadvantages. These differences can influence the postoperative rehabilitation process and require a tailored physiotherapy protocol[15]. Moreover, the available evidence on the effectiveness of different physiotherapy interventions after THA is limited and conflicting. Several studies have investigated the effect of specific physiotherapy interventions, such as early mobilization, aquatic therapy, or home-based exercises, on the postoperative outcomes of THA patients. However, the results of these studies are not consistent and may be affected by methodological limitations, such as small sample sizes, heterogeneity of interventions, and outcome measures[37].

Additionally, the lack of standardization in outcome measures and rehabilitation protocols across different studies makes it challenging to compare the results and draw firm conclusions. The use of different outcome measures, such as the Harris Hip Score, the Oxford Hip Score, or the Timed Up and Go Test, can affect the reported outcomes and make it difficult to generalize the findings. In conclusion, the lack of a definite physiotherapy protocol for post-THA rehabilitation can be attributed to the variability in patient characteristics and surgical approaches, the limited and conflicting evidence on the effectiveness of different interventions, and the lack of standardization in outcome measures and rehabilitation protocols. Future research should aim to address these issues and provide evidence-based guidelines for post-THA physiotherapy[27].

Muscle strength is considered an important outcome after primary THA (Westby et al. 2014). Consequently, we see this as a clinically meaningful surrogate measure. In a systematic review by Skoffer et al. (2015), weak evidence of a beneficial effect of progressive resistance training pre/post THA on muscle strength and functional capacity was found. Suetta et al. (2004) found that only 2 exercises with supervised progressive strength training (8–20 repetitions) of the operated leg increased muscle strength more than home-based training 12 weeks after THA not find supervised progressive strength training twice a week superior to home-based exercise in improving muscle strength, 10 weeks after THA surgery. In THA patients after rehabilitation in clinical practice. The Muscle strength difference persists up to 6 months postoperatively; however, the groups are approaching each other. 1 year Postoperatively, no intergroup differences were found. MST is Feasible to conduct in regular clinical practice and the results Can be generalized to a wide THA population[40].

Limitations

The efficacy of physiotherapy rehabilitation following total hip arthroplasty (THA) has been widely studied, but there are several limitations to this research that should be taken into consideration when interpreting the results. We were unable to include all studies in the summaries due to a limited number of studies available for certain outcomes, which could potentially affect the findings of this review. Additionally, we could not evaluate the impact of physiotherapy on the duration of time it takes to return to work, as the studies included in our analysis did not provide sufficient data on this important variable. The studies included in our analysis utilized varying exercise protocols, times, and frequencies. Further research is needed to determine the optimal exercise protocol for treating the condition. The follow-up periods in the studies included were relatively short and varied. It is important to conduct additional studies with longer follow-up periods to more accurately evaluate the effectiveness of the treatment. Due to differences in age, sex, race, and comorbidity, potential heterogeneity was unavoidable. A common issue in rehabilitation studies is the absence of uniformity in the programs, particularly concerning the intensity of exercises. This problem arises repeatedly since the functional abilities of patients differ greatly due to age-related health issues Presently, there is no organized rehabilitation plan for individuals who have undergone total hip replacement surgery that encompasses a diverse range of kinesio therapeutic techniques and physical therapy methods, while also structuring patient treatment into distinct periods and phases. Existing literature primarily emphasizes a particular facet of exercise therapy, rather than the holistic rehabilitation process. The way resistance training, strength training was carried out varied among the studies. This diversity in factors such as intensity, training volume, duration,

and progression, could have impacted the combined findings.

Clinical implications

Postoperative THA physiotherapy rehabilitation has several clinical implications that can improve outcomes, reduce complications, tailor treatment to individual needs, enhance patient satisfaction, and reduce healthcare costs including:

- Optimizing postoperative outcomes: The primary goal of physiotherapy rehabilitation after THA surgery is to help patients regain function and mobility. Research on different rehabilitation approaches can help optimize outcomes by identifying effective strategies to promote recovery.
- Reducing the risk of complications: THA surgery carries a risk of complications such as infection, dislocation, and implant loosening. Research on physiotherapy rehabilitation can identify strategies that reduce the risk of these complications.
- Tailoring treatment to individual needs: Not all patients have the same needs after THA surgery. Research on postoperative physiotherapy rehabilitation can help identify patient-specific factors that may influence the course of recovery and tailor treatment plans accordingly. Enhancing patient satisfaction: Patient satisfaction is an important aspect of healthcare quality. Research on postoperative physiotherapy rehabilitation can identify strategies that improve patient satisfaction by reducing pain, improving function, and optimizing recovery.
- Reducing healthcare costs: THA surgery and postoperative care are costly. Research on postoperative physiotherapy rehabilitation can identify cost-effective strategies that optimize outcomes while reducing healthcare costs.

Future scope

Physiotherapy rehabilitation after THA is essential for improving the patient's physical function and quality of life. While there is evidence supporting the efficacy of physiotherapy rehabilitation after THA, there is still room for further research to advance our understanding of this field. Not all patients may respond equally to the same physiotherapy rehabilitation program after THA. Future research could explore the development and implementation of individualized treatment approaches that are tailored to a patient's unique needs, goals, and medical history Therefore, future research should focus on developing evidence-based rehabilitation protocols for THA patients. Furthermore, the studies will investigate the effectiveness of a hybrid physiotherapy regime using an antigravity treadmill and a low-frequency electrical stimulation device. At present, there is not enough information available in published works to identify the precise substance, context, or timeframe of rehabilitation schemes. To establish definite treatment guidelines for post-total hip replacement rehabilitation, more trials of high quality with adequate statistical power and consistent outcome evaluation measures are required. Further research is needed to determine the optimal exercise protocol for treating the condition. The follow-up periods in the studies included were relatively short and varied. It is important to conduct additional studies with longer follow-up periods to more accurately evaluate the effectiveness of the treatment. The COVID-19 pandemic has highlighted the potential benefits of tele-rehabilitation as a means of delivering physiotherapy rehabilitation services remotely. Future research could examine the effectiveness of telerehabilitation in the context of THA and compare its outcomes to traditional in-person physiotherapy rehabilitation.

Conclusion

In conclusion, the literature suggests that physiotherapy rehabilitation can be an effective intervention for patients following total hip arthroplasty but having some uncertainties. Moreover, while the reviewed studies generally report positive outcomes, there is variability in the specific rehabilitation protocols employed, making it difficult to draw definitive conclusions about the most effective approach The studies under evaluation show that patients who had physical therapy rehabilitation experienced improvements in functional outcomes, pain relief, and quality of life. It's crucial to take into account the research's drawbacks, which include the study's small sample size, lack of standardization in the rehabilitation methods, and related biases. In order to address these issues and offer a more thorough understanding of the effectiveness of physical therapy rehabilitation after total hip arthroplasty, more study is required. Overall, the results of this evaluation of the literature suggest that physiotherapy rehabilitation can be an important part of post-operative care for those who have had total hip arthroplasty.

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Table of abbreviations

S.No	Abbreviations	Definition
1.	THA	Total Hip Arthroplasty
2.	MWT	Minute walk test
3.	THR	Total hip replacement
4.	ADL	Activities of daily living
5.	MST	Maximal strength training
6.	WMD	Weighted mean difference
7.	HHS	Harris Hip Score
8.	HOOS	Hip Disability and Osteoarthritis Outcome score
9.	VAS	Visual analogue scale
10.	FIM	Functional Independence Measure
11.	BMRC	British Medical Research Council
12.	OA	Osteoarthrities
13.	LOS	Length of stay
14.	EMS	Electrical Muscle Stimulation
15.	QaL	Quality of life

16.	**NHFD**	National Hip Fracture Database
17.	**TUG**	Timed up and Go Test
18.	**LLD**	Leg length distinction
19.	**LBP**	Lower Reverse Pain
20.	**TKR**	Total Knee Replacement
21.	**RCT**	Randomised controlled trail
22.	**CP**	Conventional physiotherapy
23.	**ALA**	Anterolateral approach
24.	**DAA**	Direct Anterior approach
25.	**BH**	Bilateral hemiarthroplasty
26.	**NPR**	Numerical Pain Rating Scale
27.	**ROM**	Range of Motion
28.	**PT**	Physiotherapy
29.	**WOMAC**	Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
30.	**SEM**	Standard error of measurement

References

1. Büchler L, Tannast M, Siebenrock KA, Schwab JM. Biomechanics of the hip. Prox Femur Fract An Evidence-Based Approach to Eval Manag. 2017;9–15.
2. Pfeil J. Anatomy of the hip joint. Minim Invasive Surg Total Hip Arthroplast. 2010;7– 19.
3. Lim LA, Carmichael SW, Cabanela ME. Biomechanics of total hip arthroplasty. Anat Rec. 1999;257(3):110–6.
4. Dimitriu AL, Ene D, Popescu E, Panaitescu C, Ene R. Biotribology of the Total Hip Replacement – Review of the Current Bearing Surfaces. 2023;(Figure 1):306–11.
5. Ghareeb S, Amr YM, Mohamed R, Diab DG. The Impact of Adding Magnesium Sulfate to Bupivacaine versus Bupivacaine Alone in Fascia Iliaca Compartment Block in Burn Patients Undergoing Skin Grafting Procedures; Comparative Study. Open J Anesthesiol. 2021;11(04):99–111.
6. Callaghan JJ, Albright JC, Goetz DD, Olejniczak JP, Johnston RC. Charnley Total Hip Arthroplasty with Cement : Minimum Twenty-five-Year Follow-up*. JBJS [Internet]. 2000;82(4). Available from: https://journals.lww.com/jbjsjournal/Fulltext/2000/04000/Charnley_Total_Hip_Arthr oplasty_with_Cement__.4.aspx
7. Westby MD, Backman CL. Patient and health professional views on rehabilitation practices and outcomes following total hip and knee arthroplasty for osteoarthritis: A focus group study. BMC Health Serv Res. 2010;10:9–11.
8. Westby MD. Rehabilitation and Total Joint Arthroplasty. Clin Geriatr Med [Internet]. 2012;28(3):489–508. Available from: http://dx.doi.org/10.1016/j.cger.2012.05.005
9. Barrett J, Losina E, Baron JA, Mahomed NN, Wright J, Katz JN. Survival Following Total Hip Replacement. JBJS [Internet]. 2005;87(9). Available from: https://journals.lww.com/jbjsjournal/Fulltext/2005/09000/Survival_Following_Total_Hip_Replacement.8.aspx
10. Fortier LM, Rockov ZA, Chen AF, Rajaee SS. Activity Recommendations After Total Hip and Total Knee Arthroplasty. JBJS [Internet]. 2021;103(5). Available from: https://journals.lww.com/jbjsjournal/Fulltext/2021/03030/Activity_Recommendation s_After_Total_Hip_and_Total.12.aspx
11. Nagoya S, Nagao M, Takada J, Kuwabara H, Kaya M, Yamashita T. Efficacy of Cementless Total Hip Arthroplasty in Patients on Long-Term Hemodialysis. J Arthroplasty
12. Iorio R, Healy WL. Heterotopic Ossification After Hip and Knee Arthroplasty: Risk Factors, Prevention, and Treatment. JAAOS - J Am Acad Orthop Surg [Internet]. 2002;10(6).
13. Wu J qi, Mao L bo, Wu J. Ef fi cacy of exercise for improving functional outcomes for patients undergoing total hip arthroplasty. 2019;10(September 2018).
14. Pisters MF, Veenhof C, Schellevis FG, De Bakker DH, Dekker J. Long-term effectiveness of exercise therapy in patients with osteoarthritis of the hip or knee: A randomized controlled trial comparing two different physical therapy interventions. Osteoarthr Cartil [Internet]. 2010;18(8):1019–26. Available from: http://dx.doi.org/10.1016/j.joca.2010.05.008
15. Perry DC, Metcalfe D, Griffin XL, Costa ML. Inequalities in use of total hip arthroplasty for hip fracture: Population based study. BMJ. 2016;353(June).
16. Coulter CL, Scarvell JM, Neeman TM, Smith PN. Physiotherapist-directed rehabilitation exercises in the outpatient or home setting improve strength, gait speed and cadence after elective total hip replacement: A systematic review. J Physiother [Internet]. 2013;59(4):219–26. Available from: http://dx.doi.org/10.1016/S1836-9553(13)70198-X
17. Chen Guanlin LC. The Effect of Resistance Training on the Function after Hip Replacement: A Meta-analysis of Randomized Controlled Trials. Resist Train Hip Replace TT - Auswirkung von Widerstandstraining auf Funktion nach Hüftgelenkersatzoperation Eine Metaanalyse von randomisierten kontrollierten Stud [Internet]. 2020;159(04):383–90. Available from: http://www.thieme-connect.com/products/ejournals/abstract/10.1055/a-1154-8949
18. Ferrara PE, Medicine ARP, Don IA, Gnocchi C. Effect of pre-operative physiotherapy in patients with end-stage osteoarthritis undergoing hip arthroplasty. 2015;977–86.
19. Bottros J, Klika AK, Milidonis MK, Toetz A, Fehribach A, Barsoum WK. A rapid recovery program after total hip arthroplasty. Curr Orthop Pract. 2010;21(4):381–4.
20. Winther SB, Foss OA, Husby OS, Wik TS, Klaksvik J, Winther SB, et al. A randomized controlled trial on maximal strength training in 60 patients undergoing total hip arthroplasty A randomized controlled trial on maximal strength training in 60 patients undergoing total hip arthroplasty Implementing maximal strength training . 2018;3674.
21. Pt WFP, Nelissen RGHH, Pt TPMVV. Guideline Recommendations for Post-Acute Postoperative Physiotherapy in Total Hip and Knee Arthroplasty : Are They Used in Daily Clinical Practice ? 2014; Maugeri IFS, Scientifico I. C Er ® a C Er. 2016;(April 2011).
22. Saueressig T, Owen PJ, Zebisch J, Herbst M, Belavy DL. Evaluation of Exercise Interventions and Outcomes after Hip Arthroplasty: A Systematic Review and Meta- analysis. JAMA [Internet]Netw Open. 2021;4(2):1–20. 2005;20(1):66–71. Available from: https://www
23. Nelson M, Bourke M, Crossley K, Russell T. Outpatient physiotherapy rehabilitation for total hip replacement: Comparison from Available from: https://journals.lww.com/clinicalevidence/2021/11000/Heterotopic_Ossificati
Rehabil. 2018 Nov 2;25:613–22.
24. Matheis C, Stöggl T. Strength and mobilization training within the first week following total hip arthroplasty. J Bodyw Mov Ther [Internet]. 2017; Available from: http://dx.doi.org/10.1016/j.jbmt.2017.06.012
25. Yin H, Chen B, Xu Z. A Systematic Review and Meta-Analysis on Randomized Control Trials for Preoperative Rehabilitation in

Patients Planning for Joint Replacement Surgery for Better Outcomes. 2022;2022.
26. Winther SB, Foss OA, Klaksvik J, Husby VS. Pain and load progression following an early maximal strength training program in total hip- and knee arthroplasty patients. J Orthop Surg. 2020;28(2):1–7.
27. Zhang Y, He W, Cheng T, Zhang X. Total Hip Arthroplasty: Leg Length Discrepancy Affects Functional Outcomes and Patient's Gait. Cell Biochem Biophys [Internet]. 2015;72(1):215–9. Available from: https://doi.org/10.1007/s12013-014-0440-4
28. Measure FI. Effect of obesity on inpatient rehabilitation outcomes following total knee arthroplasty. 2007;182–90.
29. Matter DG, Contreras JS, Rossi MD. Patient Perceived Outcomes After Primary Hip Arthroplasty. 2011;348–54.
30. Murphy WS, Klingenstein G, Murphy SB, Zheng G. Pelvic Tilt Is Minimally Changed by Total Hip Arthroplasty. Clin Orthop Relat Res [Internet]. 2013;471(2):417–21. Available from: https://doi.org/10.1007/s11999-012-2581-3
31. Unver B, Kahraman T, Kalkan S, Yuksel E, Karatosun V. Reliability of the six- minute walk test after total hip arthroplasty. HIP Int [Internet]. 2013 Jun 8;23(6):541–5. Available from: https://doi.org/10.5301/hipint.5000073
32. Trudelle-Jackson E, Smith SS. Effects of a late-phase exercise program after total hip arthroplasty: A randomized controlled trial. Arch Phys Med Rehabil. 2004;85(7):1056–62.
33. Naylor JM, Hart A, Mittal R, Harris IA, Xuan W. The effectiveness of inpatient rehabilitation after uncomplicated total hip arthroplasty: a propensity score matched cohort. BMC Musculoskelet Disord [Internet]. 2018;19(1):236. Available from: https://doi.org/10.1186/s12891-018-2134-3
34. Unlu E, Eksioglu E, Aydog E, Aydoǵ ST, Atay G. The effect of exercise on hip muscle strength, gait speed and cadence in patients with total hip arthroplasty: A randomized controlled study. Clin Rehabil. 2007;21(8):706–11.
35. Monaghan B, Cusack T. Effectiveness of delayed rehabilitation programmes in patients following total hip replacement. 2014;
36. Krastanova MS, Ilieva EM, Vacheva DE. Rehabilitation of Patients with Hip Joint Arthroplasty (Late Post-surgery Period - Hospital Rehabilitation). Folia Med (Plovdiv). 2017;59(2):217–21.
37. Rahmann AE, Brauer SG, Nitz JC. A Specific Inpatient Aquatic Physiotherapy Program Improves Strength After Total Hip or Knee Replacement Surgery: A Randomized Controlled Trial. Arch Phys Med Rehabil [Internet]. 2009;90(5):745–55. Available from: https://www.sciencedirect.com/science/article/pii/S0003999309001440
38. Minns Lowe CJ, Barker KL, Dewey ME, Sackley CM. Effectiveness of physiotherapy exercise following hip arthroplasty for osteoarthritis: A systematic review of clinical trials. BMC Musculoskelet Disord. 2009;10(1):1–14.
39. Guedes RC, Dias JMD, Dias RC, Borges VS, Lustosa LP, Rosa NMB. Total hip arthroplasty in the elderly: impact on functional performance. Rev Bras Fisioter. 2011;15(2):123–30.
40. Gremeaux V, Renault J, Pardon L, Deley G, Lepers R, Casillas JM. Low-Frequency Electric Muscle Stimulation Combined With Physical Therapy After Total Hip Arthroplasty for Hip Osteoarthritis in Elderly Patients : A Randomized. YAPMR [Internet]. 2008;89(12):2265–73. Available from: http://dx.doi.org/10.1016/j.apmr.2008.05.024
41. Vincent KR, Vincent HK, Lee LW, Weng J, Alfano AP. Outcomes After Inpatient Rehabilitation of Primary and Revision Total Hip Arthroplasty. Arch Phys Med Rehabil. 2006;87(8):1026–32.
42. Hoogeboom TJ, Dronkers JJ, Van Den Ende CHM, Oosting E, Van Meeteren NLU. Preoperative therapeutic exercise in frail elderly scheduled for total hip replacement: A randomized pilot trial. Clin Rehabil. 2010;24(10):901–10.
43. Winther SB, Foss OA, Husby OS, Wik TS, Klaksvik J, Husby VS. A randomized controlled trial on maximal strength training in 60 patients undergoing total hip arthroplasty: Implementing maximal strength training into clinical practice. Acta Orthop. 2018;89(3):295–301.
44. Wallis JA, Taylor NF. Pre-operative interventions (non-surgical and non- pharmacological) for patients with hip or knee osteoarthritis awaiting joint replacement surgery - a systematic review and meta-analysis. Osteoarthr Cartil [Internet]. 2011;19(12):1381–95. Available from: http://dx.doi.org/10.1016/j.joca.2011.09.001
45. Curry AL, Goehring MT, Bell J, Jette DU. Effect of Physical Therapy Interventions in the Acute Care Setting on Function, Activity, and Participation After Total Knee Arthroplasty: A Systematic Review. J Acute Care Phys Ther [Internet]. 2018;9(3). Available from: https://journals.lww.com/jacpt/Fulltext/2018/07000/Effect_of_Physical_Therapy_In terventions_in_the.2.aspx

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