Current Concepts Review

Activity Recommendations After Total Hip and Total Knee Arthroplasty

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- A formal unsupervised activity program should be recommended to all patients recovering from total knee arthroplasty (TKA) and total hip arthroplasty (THA).
- In a subset of all patients undergoing TKA or THA, studies have found that an unsupervised activity program may be as efficacious as supervised physical therapy (PT) after surgery. Certain patients with inadequate independent function may continue to benefit from supervised PT.
- For TKA, supervised telerehabilitation has also been proven to be an effective modality, with studies suggesting equivalent efficacy compared with supervised in-person PT.
- Following TKA, there is no benefit to the use of continuous passive motion or cryotherapy devices, but there are promising benefits from the use of pedaling exercises, weight training, and balance and/or sensorimotor training as adjuncts to a multidisciplinary program after TKA.
- No standardized postoperative limitations exist following TKA, and the return to preoperative activities should be dictated by an individual's competency and should consist of methods to minimize high impact stress on the joint.
- Despite traditional postoperative protocols recommending range-of-motion restrictions after THA, it is reasonable to recommend that hip precautions may not be needed routinely following elective primary THA.

Providing postoperative activity guidelines and rehabilitation programs to patients undergoing total knee arthroplasty (TKA) and total hip arthroplasty (THA) is important for patient recovery, yet there is a lack of consensus regarding optimal recommendations. Various activity and rehabilitation recommendations after total joint arthroplasty (TJA) range from unsupervised home exercises to supervised physical therapy (PT) programs[1]. TKA rehabilitation is focused on obtaining the maximum range of motion possible and improving knee strength, while THA rehabilitation is primarily focused on resuming proper gait mechanics and hip strength. Historically, the major concern of rehabilitation following THA is hip dislocation, while TKA patients are concerned with joint stiffness. However, both TKA and THA rehabilitation encourage early mobility to limit complications such as deep vein thrombosis (DVT) and pulmonary embolism (PE). This article provides a review of the available literature to offer the best clinical practice guidelines for activity and rehabilitation recommendations following TJA. We aimed to map the key activity interventions following TJA as shown in published studies to provide meaningful improvements in postoperative recovery[2,3]. We also incorporated relevant guidelines that are described in the American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guidelines (CPGs) as well as the American Association of Hip and Knee Surgeons (AAHKS) guidelines.

Disclosure: The authors indicated that no external funding was received for any aspect of this work. On the **Disclosure of Potential Conflicts of Interest** forms, *which are provided with the online version of the article*, one or more of the authors checked "yes" to indicate that the author had a relevant financial relationship in the biomedical arena outside the submitted work and "yes" to indicate that the author had other relationships or activities that could be perceived to influence, or have the potential to influence, what was written in this work (http://links.lww.com/JBJS/G239).

Total Knee Arthroplasty

For the purpose of clarity, we made a distinction between different types of postoperative activity programs identified in the literature. In this article, supervised PT refers to direct face-to-face observation of the patient by a trained physiotherapist during prescribed exercise, and unsupervised activity programs refer to patients completing prescribed exercises without the presence or observation of a physiotherapist. In the current study, we did not differentiate among home-based supervised PT, outpatient-based supervised PT, or telerehabilitation supervised PT. These supervised options fall under the category of "supervised PT." Telerehabilitation refers to PT completed using a videoconference software program with remote observation and supervision of prescribed exercise by a trained physiotherapist.

Unsupervised Exercise Recommendations

While studies have evaluated the effectiveness of postoperative PT as an intervention, limited literature has adequately evaluated specific exercises against a control. The AAOS has a set of postoperative exercise recommendations on their patient education platform that consists of quadriceps sets, straight leg raises, ankle pumps, and other straightening and bending exercises[4]. The AAHKS offers an additional online video module with similar exercise guidelines[5].

A Delphi study by Westby et al., in 2014, attempted to integrate evidence into a comprehensive, best-practice recommendation by interviewing 2 expert panels[6]. Expert consensus agreed on the importance of functional exercises, specifically lower-extremity strength-training, home exercises, dynamic balance, stair climbing, and rising from and lowering to a chair. Unfortunately, treatment specifics, frequency, intensity, or progression were beyond the scope of the study. In summary, no explicit evidence-based exercise recommendations in the postoperative period for TKA are offered in the literature; however, the AAOS and AAHKS have provided resources for exercise recommendations to utilize in creating home programs for patients, which are presented in Table I.

Supervised Postoperative Physical Therapy

While specific guidelines for postoperative physical exercises are lacking, there is agreement that physical exercise aids in the recovery of patients undergoing TKA. The AAOS publication *Surgical Management of Osteoarthritis of the Knee: Evidence-Based Clinical Practice Guideline* recommended a supervised PT program within 2 months after surgery to improve physical function[2]. This recommendation was based on 2 studies[7,8]. The first study by Evgeniadis et al., in 2008, which involved 53 patients, demonstrated superior range of motion and physical function improvements with a postoperative supervised home PT program compared with no PT[7]. The second trial compared a group of 20 patients assigned to a month of intensive supervised PT and a group of 20 patients who received supervised PT once every 15 days[8]. The intensive supervised group demonstrated better balance and physical function than the less intensive group. However, these 2 trials cited in the AAOS CPG did not explicitly compare supervision with no supervision; consequently, exercise supervision requirements remain unclear from these guidelines.

A systematic review by Papalia et al., in 2013, analyzed 18 additional trials that attempted to determine the difference in clinical outcomes of unsupervised home-based exercise programs compared with supervised PT[9]. The authors agreed that unsupervised and supervised protocols did not show an overall significant difference in the outcomes. Since the review by Papalia et al., 8 additional randomized controlled trials (RCTs) comparing an outpatient supervised postoperative PT program and an unsupervised home-based exercise program also found no differences in outcomes[10-17]. Importantly, some of these RCTs set specific parameters that deemed the unsupervised exercise program a "failure" based on range-of-motion progress and encouraged participants to cross over to the supervised PT group, which may have contributed to outcome bias. The need to cross over to supervised PT suggests that certain patients may not tolerate an unsupervised home exercise program and should be enrolled in supervised PT.

For the patients who benefit from supervised PT, digital health technology is a rising phenomenon that may address issues of access[18]. An RCT comparing the use of an interactive virtual telerehabilitation system and conventional supervised outpatient PT in the treatment of 142 patients found no significant differences in outcomes between groups[19]. An RCT by Moffet et al., in 2015, randomized 205 patients to undergo either telerehabilitation or home-based face-to-face PT and indicated noninferiority of telerehabilitation[20]. In 2020, a trial of 306 patients compared the efficacy of virtual home rehabilitation and traditional home supervised PT or outpatient PT and found that telerehabilitation substantially lowered 3-month health-care costs while providing similar effectiveness[21]. Consequently, telerehabilitation can also be recommended as an effective alternative to formal supervised PT. However, it is important to consider the potential barrier to access for patients who do not have availability of sufficient network bandwidth or who are not technologically savvy.

In summary, it is reasonable to conclude that a physical activity program, regardless of the setting (supervised PT or unsupervised activities), is beneficial and should be recommended after TKA. There may be patients with select characteristics who will benefit more from supervised PT than unsupervised activity programs, and we have outlined these criteria in Table II.

Continuous Passive Motion

Continuous passive motion (CPM) devices work by providing regular, passive movement to the knee[22]. However, the AAOS publication *Surgical Management of Osteoarthritis of the Knee: Evidence-Based Clinical Practice Guideline* strongly discouraged the routine use of CPM after TKA[2]. This suggestion was based on evidence from 7 studies in which the use of CPM postoperatively during hospital stays was compared with no CPM[23-29]. The results indicated no difference in outcomes. Additionally, a study by Joshi et al., in 2015, found that CPM was associated

TABLE I Fundamental Exercises After TKA as Found in the AAOS and AAHKS Guidelines

Exercise	Description
Bed-supported knee bends*	While lying supine with the leg bent and keeping the bottom of the foot flat to the ground, the patient slides the heel toward the buttocks and holds the knee in the maximally bent position
Cycling*	The patient uses a stationary bike
Quadriceps sets*	While lying supine with the leg extended, the patient tightens the knee to engage the quadriceps muscles; alternatively, the patient places a pillow under the knee, leaves the heel unsupported, and drives the knee down toward the floor through the pillow
Straight leg raises*	While lying supine with the leg extended, the patient raises the leg off the bed for a period of time
Walking*	The patient uses assistive devices as necessary
Ankle pumps†	While lying supine with the leg extended, the patient moves the foot up and down while engaging the calf muscles
Assisted knee bends†	While lying supine with the operatively treated leg bent and keeping the bottom of the foot flat to the ground, the patient slides the leg toward the buttocks and holds it maximally bent but uses a towel wrapped around the leg to pull the leg closer to the body
Knee straightening†	While lying supine with the leg extended but the heel of the foot held up by a small rolled-up towel, the patient attempts to drive the back of knee down toward the floor by engaging the quadriceps muscles
Sitting supported knee bends†	While in a seated position with the legs hanging, the patient places the unaffected foot behind the heel of the operatively treated leg and bends the knee as far back as possible
Sitting unsupported knee bends†	While in a seated position with the legs hanging, the patient bends the operatively treated knee as far back as possible until the foot is flat on the ground; the patient slides his or her body forward in the chair for a deeper stretch
Stair climbing and descending†	The patient uses assistive devices as necessary
Standing knee bends†	While standing with the aid of an assistive device, the patient lifts the operatively treated leg and bends the knee as much as possible
Calf raises‡	While standing with the aid of an assistive device, the patient lifts both heels off the ground and engages the calves; alternatively, the exercise is done on 1 leg
Mini-squats‡	While standing with the back against the wall, and with both feet shoulder width apart and about 18 inches (46 cm) away from the wall, the patient slowly lowers toward the floor into a squatting position and then stands back up; alternatively, an exercise ball is used between the back and the wall
Prone knee bends‡	While lying prone, the patient bends at the knee and brings the heel toward the buttocks to engage the hamstrings
Quadriceps Arcs‡	While lying supine, the patient places a foam roll under the knee and extends the leg up until the leg is straight and then returns to the starting position
Step-ups‡	The patient steps up and down onto a box 1 leg at a time; alternatively, once on the box with both feet, the patient lowers 1 leg off the front of the box while slowly bending the leg still planted on the box until the heel of the hanging leg touches the floor and then stands back onto the box. The patient can also lower 1 leg off to the side of the box as another alternative
Stretching‡	Stretching exercises for the quadriceps, hamstrings, calves, gluteus muscles, hip flexors, hip abductors, and hip adductors

*Indicates exercise cited in both AAOS[4] and AAHKS[5] guidelines. †Indicates exercise cited only in AAOS guideline. ‡Indicates exercise cited only in AAHKS guideline.

with a significantly longer length of stay and an additional cost of $235.50 per TKA[30].

Cryotherapy Devices

Cryotherapy, or the application of cold therapy to a region of the body, has been used in some countries as a therapeutic modality to mitigate pain, swelling, and inflammation of the tissues surrounding the knee joint postoperatively[31,32]. Cryotherapy offers short-term analgesia and may reduce consumption of pain medication and increase early range of motion[33]. Discordant evidence from RCTs has challenged the effectiveness of this intervention[34]. The AAOS CPG on surgical management of osteoarthritis of the knee[2] recommended against the routine use of cryotherapy devices after TKA surgery, citing 4 studies that showed no improved outcomes with cryotherapy in the general population[31,33,35,36]. A systematic review and meta-analysis of 11

TABLE II Flowchart of Recommendations Following TKA and THA*

Postoperative Regimen	Description
TKA	
Unsupervised home activity program	Program: Exercise plan provided by surgeon on the basis of recommendations from AAOS and AAHKS (see Table I) Criteria: Should be given to all patients. For motivated, self-driven independent patients, this may be sufficient without the need for supervised PT
Supervised PT program	Initial criteria: Patients with initial inability to adhere to an independent home program, difficult social situations requiring supervised programs, patients with inadequate preop. independence and mobility requiring assistive devices, or patient preference Switch-over criteria: Recommend switching to a supervised program if range of motion is <70° at 2 wk postop., range of motion is <90° at 4 to 6 wk, or there is lack of progression with home program after 2 wk
Supervised home telerehabilitation PT	Criteria: Patients identified by surgeon who are unable to self-initiate an exercise program but are capable of using telemedicine technology; also beneficial for patients who are unable to attend or travel to outpatient PT or who have other medical conditions or social situations that preclude obtaining in-person therapy
Restrictions	No restrictions except to avoid high-impact activity (jumping, pivoting, or running); certain activities that may be considered high impact may be allowable on the basis of the patient's preop. level of competence.
THA	
Unsupervised home activity program	Program: Exercise program provided by the surgeon on the basis of recommendations from AAOS and AAHKS (see Table III) Criteria: Should be given to all patients; for motivated, self-driven independent patients, this may be sufficient without the need for supervised PT
Supervised PT program	Initial criteria: Patients with initial inability to adhere to an independent home program, difficult social situations requiring supervised programs, patients with inadequate preop. independence and mobility requiring assistive devices, or patient preference Switch-over criteria: Patient deemed unsafe for home discharge after 5 days of in-hospital PT, patient preference, or patients who are behind on recovery at 2 wk postop. as determined by surgeon
Hip precautions	For most patients, no precautions are necessary Exceptions: Patients with hyperflexibility syndromes, neuromuscular diseases, dementia, intraop. stability concerns, immediate periop. dislocation, certain cases of inflammatory arthritis, posttraumatic etiology for arthroplasty with high preop. level of hip mobility, revision arthroplasty, abductor weakness or incompetence, and prior hip surgeries other than arthroscopy

*AAHKS = American Association of Hip and Knee Surgeons, AAOS = American Academy of Orthopaedic Surgeons, and PT = physical therapy.

RCTs involving 793 TKAs found similar outcomes, noting no apparent lasting benefits from the use of cryotherapy[34]. Furthermore, cryotherapy does not come without risks and has the harmful potential to induce frostbite and skin necrosis if applied for too long or at overly low temperatures[33,37].

Pedaling Modalities

The circular motion of pedaling is thought to improve knee range of motion and strengthen the quadriceps while generating less than half the tibiofemoral force experienced while walking[38]. In 1 trial, a new 3-exercise pedaling-based protocol was compared with a standard 10-exercise nonpedaling protocol in the treatment of 60 patients during the acute postoperative setting following TKA[39]. The pedaling-based protocol showed significantly superior functional and patient-reported outcomes, with the most profound benefits seen at 2 days postoperatively. Additional benefits of the pedaling-based protocol included simplicity and the ability to be self-directed. Importantly, pedaling as an exercise in isolation is not recommended, as this activity alone does not retrain gait or achieve full extension[39]. These findings suggest that the use of a pedaling modality can be beneficial in the postoperative setting as an adjunct to activity programs.

Weight Training

Muscle weakness, especially in the quadriceps, is particularly concerning after TKA because of its association with functional activities (i.e., walking and stair climbing) and loading distribution[40,41]. Quadriceps strength deficits following TKA also have long-term consequences, including the progression of osteoarthritis in the nonoperatively treated, contralateral knee[42,43]. Quadriceps strengthening exercises are one of the most effective interventions for improving muscle strength and functionality. A study by Unver et al., in 2016, compared 60 patients who were managed at least 4 years postoperatively with an 8-week home-based unsupervised activity program with or

without the addition of weight training[44]. The results demonstrated that the weight-training group had significantly greater improvement in muscle strength and functional activities.

Balance and Sensorimotor Training

A major consequence of knee osteoarthritis is instability, which affects sensorimotor and postural control and can impair the ability of patients to perform activities of daily living[45]. Evidence shows that TKA can restore some sensorimotor and functional abilities; however, balance and motion planning may be negatively affected postoperatively if not properly addressed[46]. Balance training exercises can be employed to aid in the recovery of these deficits[47]. Two RCTs demonstrated greater improvement in physical performance when balance training was combined with a conventional supervised PT program[48,49]. Additionally, a systematic review by Moutzouri et al., in 2016, analyzed 6 studies, involving 409 patients, that investigated the effectiveness of sensorimotor training as part of rehabilitation[46]. The sensorimotor conditioning investigated by most studies consisted of exercises involving twisting, changing direction, sudden start-stops, and negotiation of unstable surfaces and obstacles[47-53]. One of the studies used the Nintendo Wii Fit video game platform to assist in balance training, and a second study utilized the Biodex Stability System, a multiaxial standing platform to assist with postural stability[47,51]. All studies included in the review supported the use of sensorimotor training to augment rehabilitation protocols as clinical performance-based outcomes showed improved functional ability and balance[46].

Postoperative Restrictions

Currently, there are no specific restrictions on lower-extremity position or movement following TKA. Traditionally, patients are advised that returning to low-to-intermediate impact sports—cycling, walking, swimming, and golf—is possible within 3 to 6 months without risk for complications, while high-impact sports should be discouraged and high-contact athletic activities should be avoided[38,54-56]. High-impact activities are discouraged by many surgeons because of concern for accelerated prosthesis wear, periprosthetic osteolysis, and failure[57]. However, a recent literature review concluded that some types of high-impact sports, such as power walking, hiking, tennis, or jogging, are possible after TKA for certain patients[58]. Although the long-term effects of these high-impact sports on TKA outcomes remain uncertain, these studies have indicated that participation may be possible. As Kuster et al., in 2000, described, it is also important to consider the level of prior experience and how an individual will perform in that particular sport[59]. For example, activities such as skiing, hiking, or tennis would be less harmful to the knee joint if performed recreationally as opposed to as an endurance activity.

A biomechanical study by Lee, in 2014, presented some potential concerns with kneeling postoperatively because of an increased risk of contact pressure in the knee and potentially accelerated polyethylene wear[60]. However, there is insufficient clinical evidence available to make recommendations for or against it at the present time. In summary, no standardized postoperative limitations exist following TKA, and return to preoperative activities should be dictated by the competency of the individual and consist of methods to minimize stress on the joint.

Total Hip Arthroplasty

Unsupervised Exercise Recommendations

The AAOS has a set of postoperative exercise recommendations on its internet-based patient education platform[61]. These primarily consist of ankle pumps and rotations, knee bends, buttock contractions, abduction exercises, standing knee raises, quadriceps sets, and straight leg raises. The AAHKS also has an online video module that discusses similar exercises after THA[62] (Table III).

Additionally, the AAOS CPG on management of osteoarthritis of the hip identified 3 high-quality studies that showed improved early functional outcomes with the use of postoperative exercises[3]. The first trial involving 106 patients demonstrated a short-term benefit at 15 days postoperatively after the participants completed a protocol consisting of exercises aimed at strengthening the gluteal and thigh muscles[63]. A second trial involving 68 patients, who were randomized to treatment with or without a "walking skill training" protocol initiated 3 months postoperatively, demonstrated immediate benefits from exercises such as sitting down and standing up from a chair, lunges, single-leg stance, standing on a foam balance pad, stepping up and down, stair climbing, stepping over obstacles in a course, throwing a ball, walking, and stretching[64]. The third trial with 73 patients, involving progressive resistance training, showed a benefit in functional outcomes despite showing no benefit in the primary outcome of leg strength[65]. Although there is no consensus on specific exercise recommendations in the postoperative period for THA, bodies such as the AAOS and the AAHKS, and protocols outlined in various trials, have provided some resources for exercise recommendations.

Supervised Postoperative PT

The available literature on postoperative supervised PT for THA offers diverse interventions, lacks large sample sizes, and has a potential risk of bias. Consequently, the results from several systematic reviews have failed to provide sufficient evidence-based conclusions about its effectiveness[66-69].

The AAOS CPG on management of osteoarthritis of the hip provided moderate evidence suggesting that supervised PT after THA can improve early function to a greater extent than no PT[3]. The AAOS recommendations are based on 5 high-quality studies that evaluated the effect of supervised postoperative PT on outcomes. Three of the 5 studies identified a greater benefit of supervised PT compared with unsupervised home exercises[63-65]. The other 2 studies identified no major differences[70,71]. Of those 2 studies, one was a trial conducted by Galea et al., in 2008, involving 23 patients in which an 8-week unsupervised exercise program was compared with an outpatient supervised PT program[70]. The second study[71] was a 5-year follow-up study of the original clinical trial by Heiberg et al.[64].

TABLE III Fundamental Exercises Following THA as Found in the AAOS and AAHKS Guidelines

Exercise	Description
Bed-supported knee bends*	While lying supine with the leg bent and keeping the bottom of the foot flat to ground, the patient slides the heel toward the buttocks and holds the knee in the maximally bent position
Cycling*	The patient uses a stationary bike
Hip abduction and adduction*	While lying supine, the patient abducts the leg out to the side as far as possible and then adducts the leg to return to the starting position; alternatively, this exercise is performed while the patient is standing with the aid of an assistive device or the patient may perform this while lying on his or her side with the lower leg bent under the leg being exercised
Quadriceps sets*	While lying supine with the leg extended, the patient tightens the knee to engage the quadriceps muscles; alternatively, after a pillow is placed under the knee with the heel left unsupported, the patient drives the knee down toward the floor through the pillow
Resistive band hip abduction*	The patient places 1 end of a resistive band around the operatively treated leg and the other end of the band around a stationary object at his or her side; while standing with an assistive device, the patient brings the operatively treated leg out to the side to engage the hip abductor muscles
Straight leg raises*	While lying supine with the leg extended, the patient raises the leg off the bed for a period of time
Walking*	The patient uses assistive devices as necessary
Ankle pumps†	While lying supine with the leg extended, the patient moves the foot on the involved side up and down while engaging the calf muscles
Ankle rotations†	While lying supine with the leg extended, the patient moves the ankle on the involved side inward toward the uninvolved foot and then outward away from the uninvolved foot
Buttock contractions†	While lying supine with the legs extended, the patient tightens the buttock muscles and holds to a count of 5
Resistive band hip extensions†	The patient places 1 end of a resistive band around the operatively treated leg and the other end of the band around a stationary object in front of him or herself; while standing with an assistive device, the patient brings the leg backward to engage the buttock and hamstring muscles
Resistive band hip flexions†	The patient places 1 end of a resistive band around the leg and the other end of the band around a stationary object behind him or herself; while standing with an assistive device, the patient brings the leg forward to engage the hip flexors and quadriceps
Stair climbing and descending†	The patient uses assistive devices as necessary
Standing knee raises†	While standing with the aid of an assistive device, the patient lifts the operatively treated leg toward the chest no higher than the waist to engage the hip flexors and then returns the leg back down
Standing hip extensions†	While standing with the aid of an assistive device, the patient lifts the operatively treated straight leg backward slowly to engage the buttock and hamstring muscles and then returns it back straight
Bridges‡	While lying supine with the arms at the side and the feet shoulder width apart, the patient places both feet flat and slides them toward the buttocks; once the feet are as close to the body as possible, the patient drives the hips into the air while using the feet and hands planted on the flat surface for support; this is an advanced exercise that is typically started 6 to 8 wk after surgery
Calf raises‡	While standing with the aid of an assistive device, the patient lifts both heels off the ground and engages the calves; alternatively, the exercise is done on 1 leg
Mini-squats‡	While standing with the back against the wall, with both feet shoulder width apart and about 18 inches (46 cm) away from the wall, the patient slowly lowers toward the floor into a squatting position and then stands back up; alternatively, an exercise ball can be used between the back and wall
Prone knee bends‡	While lying prone, the patient bends at the knee and brings the heel toward the buttocks to engage the hamstrings
Quadriceps arcs‡	While lying supine, the patient places a foam roll under the knee, extends the leg up until the leg is straight, and then returns to the starting position.
Stretching‡	Stretching exercises for the quadriceps, hamstrings, calves, gluteus muscles, hip flexors, hip abductors, and hip adductors

*Indicates the exercise was cited in both AAOS[61] and AAHKS[62] guidelines. †Indicates the exercise was cited only in AAOS guideline. ‡Indicates the exercise was cited only in AAHKS guideline.

TABLE IV Activity Options After TKA or THA and Grades of Recommendation

Intervention	Recommendation	Grade of Recommendation*
Recommendations after TKA		
Unsupervised home-based exercise program	For	A
Postop. supervised PT	For	B
Continuous passive motion	Against	A
Cryotherapy	Against	B
Pedaling modalities	For	B
Weight and/or resistance training	For	B
Balance and/or sensorimotor training	For	B
Recommendations after THA		
Unsupervised home-based exercise program	For	A
Postop. supervised PT	For	B
Cryotherapy	For	B
Postop. hip precautions	Against	B

*According to Wright[88], grade A indicates good evidence (Level-I studies with consistent findings) for or against recommending intervention; grade B, fair evidence (Level-II or III studies with consistent findings) for or against recommending intervention; grade C, poor-quality evidence (Level-IV or V studies with consistent findings) for or against recommending intervention; and grade I, insufficient or conflicting evidence not allowing a recommendation for or against intervention.

Contrary to the AAOS CPG on management of osteoarthritis of the hip, a separate systematic review by Coulter et al., in 2013, that analyzed 5 RCTs comprising 234 patients found that physiotherapist-directed rehabilitation exercises were similarly effective in improving strength, speed, and cadence whether performed as unsupervised at-home exercises or in the supervised outpatient setting[67]. Galea et al., in 2008, was the only trial from the AAOS CPG on osteoarthritis of the hip that was also included in this systematic review[70]. In addition to Galea et al., 1 additional trial cited in this systematic review specifically compared supervised PT and an unsupervised home exercise program and found greater improvement only in abduction torque in the supervised outpatient group[72]. The other 3 trials compared an unsupervised home-based exercise program and no intervention at all, supervised outpatient PT and no intervention, or an unsupervised home-based exercise program and a control group who performed isometric and range-of-motion exercises[73-75]. The conclusions from these 3 trials showed superior outcomes from either unsupervised home-based exercise programs or supervised PT programs compared with the control group.

An additional RCT involving 120 patients, which was published in 2017 after the review by Coulter et al.[67], further supported the finding that an unsupervised home exercise program was just as effective as supervised PT[76]. There were no significant differences in any functional outcomes between the 54 patients who received supervised PT and the 54 patients who participated in unsupervised home exercises. In short, the available literature suggests there is likely a modest benefit to therapy in the postoperative period for THA; however, supervised versus unsupervised PT does not seem to play a role in patient outcomes. Nonetheless, it is understood that some select patients may benefit more from supervised PT than from unsupervised activity programs, and we have outlined these criteria in a flowchart in Table II.

Cryotherapy

Although the AAOS does not provide recommendations on cryotherapy use following THA, several recent studies have investigated its use to reduce blood loss and decrease pain[77-79]. A systematic review by Ni et al., in 2015, of 3 RCTs involving 122 THAs found that cryotherapy did not decrease postoperative blood loss[77]. Additionally, the cryotherapy group only had decreased pain on postoperative day 2, while this benefit was not seen on postoperative day 1 or 3. On the contrary, a reduction in postoperative blood loss was actually found in a separate study of 28 patients who were treated with cryotherapy following THA, but no reduction in pain scores was observed[79]. In conclusion, cryotherapy in the acute setting following THA may reduce postoperative blood loss but is unlikely to reduce pain. Due to its noninvasive and relatively inexpensive nature, cryotherapy may be a therapeutic option to consider in acute postoperative rehabilitation.

Postoperative Restrictions

The most common approaches to primary THA are the direct anterior, anterolateral, direct lateral, posterior, and modified posterior approaches[80]. Regardless of the approach, patients undergoing THA are at a small risk for prosthetic dislocation. Traditional postoperative protocols have described strict restrictions in hip motion and a variety of precautions to reduce the likelihood of dislocation. However, modern surgical techniques allow for increasingly less invasive approaches, soft-tissue repair, the use of large-diameter femoral heads or dual

mobility constructs, and technology and imaging that helps to improve implant positioning[81]. These developments provide increased stability of THA components across surgical approaches, which challenges the recommendation for current postoperative motion restriction and has created debate among surgeons and researchers[81,82].

Multiple studies have assessed dislocation rates after THA, comparing different approaches with one another. A systematic review from 2016 analyzed 6 studies comprising 1,122 THAs that included both posterior and anterolateral surgical approaches. The results indicated that more liberal postoperative precautions do not increase dislocation rates regardless of surgical approach. Instead, fewer restrictions increased patient satisfaction and resulted in faster resumption of activities[81]. Although 2 of the studies from that review did have exclusion criteria and/or indications to switch to restrictions, which included prior ipsilateral hip surgery, inflammatory arthritis, THA secondary to osteonecrosis or trauma, hyperflexibility syndromes, neuromuscular compromise (i.e., Parkinson disease and Alzheimer disease), and recurrent dislocations[83,84]. A separate study, published in 2019, randomized 408 patients to a restricted (supine sleeping) or nonrestricted sleeping group following THA using the posterolateral approach[85]. They found similar rates of early dislocation between groups. Another RCT evaluating the effects of sleep restrictions in 587 patients who underwent a posterior approach THA found no difference in dislocation rates between the groups at 15 weeks postoperatively[86]. The unrestricted group endorsed less difficulty in returning to daily functions, but the study included only primary THAs for noninflammatory arthritis without a history of hip surgeries and excluded patients who had intraoperative concerns for instability or perioperative dislocations. A different study, similarly evaluating the effect of hip precautions in 237 participants following THA, found that patients recovered at a similar rate regardless of hip precautions without an increase in the complication rate; however, the study also excluded those with previous hip surgery or severe dementia[87]. In summary, it is reasonable to recommend that hip precautions may not be needed routinely following elective primary THA for noninflammatory arthritis, regardless of approach.

Conclusions

There is a lack of consensus regarding the best combination of postoperative rehabilitation interventions in TJA with respect to the type, setting, frequency, intensity, and duration of therapy. Despite this discordance in the literature, there is converging evidence from many studies and reviews that show the benefit of a postoperative activity program regardless of the structure and setting following TKA and THA. Table II provides a flowchart guide to assist surgeons in determining the appropriate postoperative activity regimens for patients undergoing TJA. The flowchart begins with an option for an at-home unsupervised exercise program and provides certain criteria to help select patients who may require increased levels of support, such as supervised telerehabilitation and supervised in-person PT. In addition, Table IV provides grades of recommendations for the various activity options after TKA and THA, according to the article by Wright[88]. Several supplemental modalities, including pedaling exercises, weight training, and balance and sensorimotor training, have demonstrated therapeutic benefits as adjuncts to a multidisciplinary program after TKA. This review provides a comprehensive, evidence-based resource of recommendations that clinicians can use to help guide the decision-making process in providing activity recommendations for their patients following TKA and THA.

Future Directions

Future studies investigating the difference between various types of postoperative supervised PT programs (those conducted at home, outpatient centers, and rehabilitation facilities and by virtual telerehabilitation) would be beneficial. An RCT comparing postoperative supervised PT programs with unsupervised activity programs and with no postoperative activity programs would also provide valuable information for patients and surgeons. However, it may be difficult to perform such a study as most providers would not feel comfortable providing patients with no activity or PT recommendations. Additionally, long-term studies of the survival of implants in patients who are involved in high-impact activities compared with those involved in low-impact activities would provide valuable data as the average age for patients undergoing TJA is decreasing. ■

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