EFFECTIVE FUNCTIONAL EXERCISE PROGRAMMING FOR THE OLDER FITNESS CLIENT AFTER A TOTAL KNEE REPLACEMENT

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As people get older, many biological changes take place in the structure of their bones and joints. One change that can cause significant pain and loss of functional ability is degenerative joint disease, also known as osteoarthritis. Osteoarthritis (OA) is defined as the degenerative changes of the hyaline articular cartilage on the ends of bones that make up a joint (1,2,3). OA can cause the formation of divots and/or osteophytes (bone spurs) on the end of the bone within the knee joint (i.e., distal end of the femur and tibial plateau) (1,3). Walking and standing can cause compression of the joint and can put pressure on the osteophytes formation. As a result, the individual may experience pain and may potentially decrease his or her mobility in an effort to avoid the pain from the hyaline articular cartilage breakdown. Many older adults who experience this pain during standing and walking will elect to undergo a total knee replacement surgical intervention known as total knee arthroplasty (TKA). Personal trainers should be aware of the effects that are commonly experienced by people who have undergone this surgery as well as the interventions and exercises that can help these clients regain functionality.

TOTAL KNEE ARTHROPLASTY

TKAs have become a surgical intervention used to treat the development of osteoarthritis. In 2006, there were 516,000 TKAs performed in the United States (1). By 2030, the projected amount of TKA procedures will be around 3.48 million (1). Most candidates for TKAs are between 50 – 85 years old (2). TKA is a surgical intervention performed to alleviate pain from bone on bone compression of the knee. This pain may be a result of obesity, the constant wearing down of articular cartilage (development of OA), degeneration or injury to the meniscus, or rheumatoid arthritis, to name a few. The material used for a TKA is comprised of metal parts made of titanium or cobalt-chromium based alloys (2). The plastic parts are made of polyethylene and are a lightweight yet strong material (2). These materials are chosen because they are accepted by the body, duplicate the knee structure, are strong and flexible enough to take weight-bearing loads, will not typically break when stressed, and can last for many years (2).

The two types of fixations for TKAs are cemented and cementless. Cemented fixation uses fast curing bone cement called polymethylmethacrylate (2). Cementless fixation relies on new bone growing into the implant (2). The most common type of prosthesis is the fixed-bearing (cemented), where the upper portion of the polyethylene component of the tibia is attached to the underlying metal component that makes up the tibial plateau (2). The femoral component can smoothly roll on the surface without any friction (2). For clients who are younger and more active, there is the mobile-bearing prosthesis, which allows for a greater range of motion (ROM). The one drawback to a mobile-bearing prosthesis is that the patient must have good joint support in the ligaments (i.e., collateral ligaments). If the joint does not have good support from the ligaments, the occurrence of dislocation is higher (2).

For people with chronic OA, TKAs may relieve most of the pain they commonly experience, and result in improved quality of life. Research suggests that patients who are one month post-TKA show a significant deficiency in strength and functional ability in the knee extensors, flexors, hip extensors, and hip abductors (2,3). Quadriceps torque was reported as 60% below their original preoperative strength four weeks post-TKA (3). Even though traditional rehabilitation was initiated the day after the surgery, there is a significant torque deficit of voluntary quadriceps activation due to quadriceps atrophy and impaired motor unit recruitment (3). Patients that have gone through a TKA within the previous year have a 24.7% higher risk of falls (2). The reason for the risk of falls is likely because patients demonstrate increased postural sway, decreased knee proprioception (typically due to the loss of the meniscus, a major proprioceptive sensor in the knee), and decreased static postural control (2).

INTERVENTIONS

One of the interventions used to increase functional strength is neuromuscular electrical stimulation (NMES) (3). NMES electronically elicits muscle contraction leading to muscular hypertrophy (3). One study showed that NMES implemented 24 – 48 hr post-TKA surgery demonstrated improvements in walking and extensor lag and decreased the length of hospital stays (3). Licensed healthcare professionals (e.g., physical therapists, chiropractors, physicians, etc.) are usually the professionals that would implement NMES on a patient.

Other early interventions include strength training (focusing on the sagittal and frontal planes) with low weight which is targeted at the quadriceps, gluteal muscles, and hip abductors at a lower maximal intensity (i.e., 40% 1RM) (2). Home exercise programs are typically issued to patients who used similar exercises and stretching as they did during the supervised therapy in a physical therapy clinic (2). Many early rehabilitation strategies focus primarily on knee ROM and underemphasize resistance training for the knee and the hip (2). As a result, these patients may demonstrate weakness and impairments in activities, such as decreased gait speed and balance for up to a year after their TKA (6).

Patients may go through multiple phases of rehabilitation in physical therapy, which can last up to eight months, but will ultimately vary between individual cases. Because of limitations of insurance benefits, many patients are discharged from physical therapy before total lower kinetic chain strengthening can be finished. As a result, it becomes the job of the patient to strengthen certain areas such as the gluteal muscles (i.e., gluteus maximus, gluteus medius, and gluteus minimus) on their own. When the patient is discharged from physical therapy, they are encouraged to continue an exercise program at home or at a health club.

PERSONAL TRAINING FOR THE TKA CLIENT

Some clients who have had a TKA procedure may prefer to continue their exercises while being supervised by a competent and certified health and fitness professional. This could be a great opportunity for personal trainers to make a significant impact in their client's overall functional capacity after their rehabilitation is complete. The personal trainer should be aware that a client who has undergone a TKA might still suffer from decreased functional capacity due to decreased glute, hip, and quadriceps strength. According to research, a decrease in hip abductor strength post-TKA can result in a decrease in stair-climbing ability and trunk stabilization, and can lead to an increase in compressive forces through the contralateral (non-affected) knee (5). Another impairment that is noted for clients after a TKA is difficulty in balance and loss of proprioception (4). Research has shown a combination of functional and balance training six months after surgery can increase gait speed and stair-climbing ability, and also decrease the risk of falls, weight-bearing asymmetry (i.e., relying on the uninvolved knee instead of using both knees for functional walking), and gait compensations due to lower extremity weakness (4).

Personal trainers should not be intimidated by working with a client who has undergone TKA. Adding gluteal strengthening and balance training to the exercise programs for these types of clients may help to increase their activities of daily living (ADL) and recreational abilities. The client should be able to see and feel their progress as physical activities become easier and less physically straining for them. By tracking this progress, it can help motivate the client to continue working with the personal trainer, thereby increasing the likelihood of retaining this client for a long time. The personal trainer should conduct a thorough movement assessment to examine how the operated knee is moving relevant to the other joints in the lower kinetic chain. It is important that the personal trainer recognize any dysfunctions at other joints in the lower kinetic chain, such as the lumbo-pelvic-hip complex or the foot and ankle joints. During the movement assessment, the personal trainer should focus on identifying the possible causes of movement dysfunctions, such as overactive and underactive muscles, reduced flexibility, and decreased core conditioning, and adjust programming accordingly.

CONCLUSION

TKAs are a common surgery for the treatment of OA in the knee. Strengthening of the lower extremities is crucial to return the client to his or her prior level of function. Quadriceps training is important to increase functional mobility. However, a considerable focus in the client's programming should be placed on strengthening the gluteal musculature. The combination of quadriceps, hip abductor, and hip extensor strengthening in the lower kinetic chain can help to produce a smooth, synchronized, and prolonged endurance capacity during functional tasks (4,5,6).

RESISTANCE BAND WALKS – FRONTAL PLANE (SHACKLE WALKS) (FIGURE 1)

FIGURE 1. RESISTANCE BAND WALKS – FRONTAL PLANE (SHACKLE WALKS)

Resistance band walks are a great way to activate the gluteus medius muscle group (hip abductors). To perform the shackle walk, place a resistance band around the lower leg halfway between the knees and the ankles (start with light resistance and increase as necessary). Have the client assume a semi-squat position and walk sideways keeping the feet facing forward. Have the client lead with the knee followed by the ankle without turning the foot toward that side. The client should walk 8 – 10 ft to one side while maintaining the semi-squat position, then walk back to the opposite side. Form is very important in this exercise; the personal trainer should monitor the client during the movement to make sure the knees do not collapse inward, the trunk does not sway toward the opposite side, and the foot does not turn outward. If any of these compensations are detected, then the resistance may be too great.

RESISTANCE BAND WALKS – SAGITTAL PLANE (MONSTER WALKS) (FIGURES 2 – 3)

FIGURE 2. RESISTANCE BAND WALKS – SAGITTAL PLANE (MONSTER WALKS)

FIGURE 3. RESISTANCE BAND WALKS – SAGITTAL PLANE (MONSTER WALKS)

Similar to shackle walks, monster walks activate the gluteus medius, gluteus maximus, and rectus femoris muscles. The knees should be bent slightly as the client gets into a semi-squat position. The feet should be straight and the upper back should be as erect as possible without any arching at the lumbar spine. The client should take larger than normal steps straight ahead for 8 – 10 steps and then repeat going backward. Again, the personal trainer should monitor the client for proper form. If compensations such as arching of the lower back, narrow strides, or excessive trunk rotation are observed, reduce the resistance of the band.

EXERCISE BALL WALL SQUATS (FIGURES 4 – 5)

Lower extremity strengthening is important to work as a whole for improved functional integration of ADL tasks (e.g., stair climbing, rising from a chair, getting out of a car, etc.). Exercise ball wall squats are a good way to work the entire kinetic chain. The emphasis should be placed on the downward phase (the eccentric phase) of the squat. The client should be instructed to descend slowly toward the floor until the thighs are parallel with the floor, or as close to parallel as the client is capable. The client should be cued to keep their back flat against the ball and to tuck their glutes at the end of the downward phase. There should be a 2-s delay (isometric contraction) before the upward phase (concentric) is initiated. The feet should be positioned shoulder-width apart, knees pointed straight ahead, head in a neutral position, shoulders down, and navel drawn in to activate the core muscles.

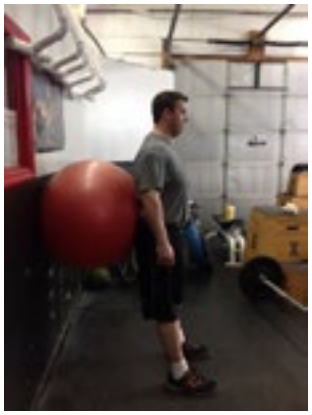

FIGURE 4. EXERCISE BALL WALL SQUAT

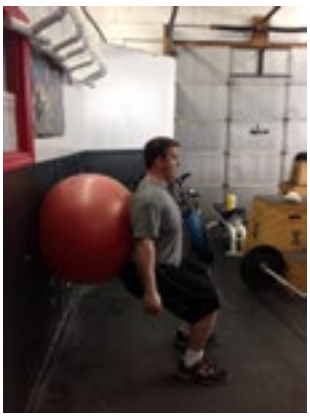

FIGURE 5. EXERCISE BALL WALL SQUAT

SINGLE-LEG BALANCE WITH TOUCHDOWN (FIGURES 6 – 7)

The client should first start the exercise with the non-involved leg. This can provide a framework on how the exercise should feel when they are performing it on the repaired leg. The client should start the movement by drawing in the navel (activation of the core muscles) and isometrically contracting the gluteal muscles. They should then shift the weight on the stance leg and bring the opposite foot off the ground. The client should bend the knee and assume a semi-squat position. The client should balance on the stance leg for 15 – 30 s, then return the foot to the ground, switch sides, and repeat. Once the client masters that technique, the personal trainer can progress them to adding in the touchdown. The touchdown starts with the single-leg balance. When the core is activated and steady balance is accomplished (> 30 s of steady single-leg balance), the client should flex at the hip while keeping their spine erect and reach down to touch their knee with the opposite hand of the stance leg, or reach beyond the knee if the client is capable as seen in Figure 7. If the stance leg is the left, then the touchdown hand is the right. Single-leg balance should be done for 3 sets of 5 holds (30 s). Single-leg balance with touchdowns should be done for 3 sets of 10.

FIGURE 6. SINGLE-LEG BALANCE WITH TOUCHDOWN

FIGURE 7. SINGLE-LEG BALANCE WITH TOUCHDOWN

AEROBIC ENDURANCE EXERCISE

Aerobic exercise is important to incorporate into a client's program after they have undergone a TKA procedure. Most health clubs and gyms will have a variety of cardio machines to choose from (i.e., treadmill, elliptical, stationary bike, rowing machines, recumbent bike, etc.). One bout of 30 – 60 min of cardio activity at an intensity of 50 – 75% heart rate reserve (HRR) should be incorporated into the client's program 2 – 3 times per week. Another option is to have the client walk 25 – 50 min, 2 – 3 times per week on flat terrain. The personal trainer can incorporate interval training in conjunction with the client's strength and conditioning program during the workout session. Depending on the client's level of fitness, a cardio-based interval can be anywhere from 2 – 10 min in duration. The number of cardio intervals within the client's strength program should range between 1 – 6 intervals, depending on the client's conditioning level.

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TABLE 1. SAMPLE STRENGTH AND CONDITIONING PROGRAM FOR A TKA CLIENT

EXERCISE	SETS	REPS	REST
Resistance band/shackle walking (frontal plane)	3	5 (each rep consists of walking 8 – 10 steps left and right)	30 – 60 s
Resistance band/monster walking (sagittal plane)	3	5 (each rep consists of walking forward and backward 8 – 10 steps)	30 – 60 s
Exercise ball wall squats	3	10	30 s
Single-leg balance	3 (each leg)	5 (each rep is 30 s)	30 – 60 s
Aerobic endurance activity (treadmill, elliptical, bike, etc.)	1	30 – 60 min; if interval training, perform 2 – 10 min per bout of interval	15 – 25 s between aerobic activity