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Balance Exercise for Fall Prevention in the Elderly

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BALANCE EXERCISE FOR FALL PREVENTION IN THE ELDERLY

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This Independent Study, submitted by Lorrina McClellan in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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(Graduate School Advisor)

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Date 4-30-96

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ABSTRACT

Falls are a very common and serious problem in the elderly population. Individuals who fall may suffer from physical trauma, psychological problems, and possible death. In the past, falls were thought to be an unavoidable occurrence that accompanied aging. Research has recently identified risk factors that may predict those who are at risk for falling. By recognizing and then modifying these risk factors, potential falls may be prevented. Examples of risk factors that occur with aging include visual impairments, vestibular decline, deterioration of muscle strength, decrease in joint flexibility, and the loss of sensation. Natural biological declines may have profound effects upon the balance control system and a possible fall could result. An excellent way to impede biological deterioration is through exercise. The purpose of this independent study is to write a literature review on how falls may be prevented in the elderly through recognizing and then modifying risk factors that may be enhanced through balance activities and exercises. An exercise video, available at UND PT Department in Grand Forks, North Dakota, was designed in conjunction with this literature review that will also educate elderly individuals on how to avoid falls through stretching, muscle strengthening, and improvement of balance.

CHAPTER I

INTRODUCTION

Falls are a very common problem amongst the elderly. According to recent literature, falls affect 30% of elderly persons living in the community and more than 50% of those living in institutions every year.[1] These victims may suffer from pain and physical trauma. A recent study indicated that approximately six percent of falls in the elderly result in fractures and soft tissue injuries.[2] The majority of falls do not cause serious injury; however, they may lead to immobility. Inactivity can lead to complications such as decubitus ulcers, deep vein thromboses, pneumonia, or urinary tract infections.[3] If such complications arise and are not treated, death may result. Current literature reports that falls are the leading cause of accidental death among people who are 75 years of age and older.[4]

Another consequence of falling is the fear of a repeated fall. A study by Tinetti et al[5] found that one-half of the participants had a fear of falling again, and one-fourth reported restriction of activities. This overwhelming fear of falling may destroy an individual's confidence in his/her physical abilities which may also lead to inactivity.[1] Sedentary lifestyle not only limits independence, but further compounds the problem by possibly leading to immobility complications.

Ultimately, a fall can decrease an elderly individual's quality of life through decreased independence due to trauma, pain, and fear.

Until recently, falls were thought to be an unavoidable occurrence that accompanied aging.[6] However, current research suggests that falls result not from increasing age but are the consequences of impairments or risk factors.[7-10] Several of these risk factors are modifiable, which indicates that future falls may possibly be prevented.[6] These risk factors can be classified as extrinsic or intrinsic.

Extrinsic factors are defined as potential problems outside of the individual, or environmental hazards, that may cause a fall. Some examples of extrinsic factors may include poor lighting, wet floors, slippery steps, improper fitting shoes or throw rugs.[11] These environmental hazards are easily eliminated once they are identified.[1]

Intrinsic risk factors are impairments or disabilities possessed by an individual. Several studies have identified intrinsic risk factors such as dementia, visual impairment, postural hypotension, gait dysfunction, medications, foot problems, muscle weakness, and balance problems. Specific intrinsic risk factors that lead to balance problems with age may include visual loss, reduced flexibility, and muscle weakness.[7-10]

Falls are a very common and serious problem in the elderly population. It has been suggested that falls may be prevented if risk factors in the environment and those possessed by the elderly population are eliminated.[1,11] By preventing

falls, an individual would be able to avoid physical trauma, feelings of insecurity, and decreased mobility.

The purpose of this independent study is to design an exercise video tape for elderly individuals who may benefit from balance enhancement. This paper is written as a supplement to the video* and will discuss the balance control system, aging and its associated risk factors, and the benefits of exercise.

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* Video is available at UND PT Department, Grand Forks, ND.

CHAPTER II

BALANCE CONTROL SYSTEM

Impairment of balance appears to be the most common cause of falling.[12] A universal definition for balance does not exist; however, few would argue that it is essential for activities such as sitting, standing, and walking.[13] For the purpose of this paper, balance will be defined as "the ability to control and maintain the center of body mass (COM) within the support base of the feet."[14] The COM is located slightly anterior to the first or second sacral vertebrae.[15] Thus, a fall may result if adequate postural control does not maintain the center of body mass within the support base of the feet during activities. Balance control and balance strategies are accomplished by three components: the sensory input, the nervous system, and the motor output.[13,16]

Sensory Input

Sensory input provides the nervous system with information concerning the body's position, motion, and where the body segments are in relation to one another.[13] The three sensory systems that guide balance are the visual, vestibular, and somatosensory systems.[13,16]

Visual information related to the position and motion of the body allows the individual to sense self movement and to perceive movement in the

environment. Visual inputs are an important source of postural control, but this input is not absolutely necessary. For example, a person is normally able to maintain his/her balance when his/her eyes are closed during stance or when entering a dark room. In addition, vision may be unreliable. For instance, a person in a vehicle stopped at a traffic light may misinterpret his/her vehicle as rolling backward when the adjacent vehicle moves forward. The automatic reflex is to step on the brake and to stop the car from rolling; however, there was no movement. Visual input may be misinterpreted by the brain; fortunately, sensory input is also provided by the vestibular and somatosensory systems.[13]

The second system that guides balance is the vestibular system that is located in the inner ear which provides the nervous system with information on head movements.[13,17] The vestibular system is sensitive to the position of the head in space and sudden changes in the direction of movement of the head.[13] It is a complex system consisting of two types of motion sensors called the semicircular canals and the otoliths. There are three semicircular canals whose role is to sense rotational movements of the head. The otoliths sense linear accelerations, such as head movements performed during deep knee bends.[17]

The vestibular system is both a sensory and motor system. Sensory system information regarding the position of the head and the direction of gravity is relayed to the nervous system. The nervous system then processes this information along with the information received from the visual and somatosensory system. As a motor system, the output of the vestibular system

is relayed through efferent spinal tracts to the ocular muscles and the spinal cord to implement two important reflexes. The vestibulo-ocular reflex enables one to have clear eyesight while the head is in motion. Corrective body movements that allow an individual to maintain his/her balance during stance and walking are implemented by the vestibulospinal reflex.[17]

The last system to be discussed is the somatosensory system which supplies information to the nervous system pertaining to the body's position and motion in reference to the surfaces that support the body.[17] Collected data from the somatosensory system is the most heavily weighed in the central nervous system (CNS) compared to the visual and vestibular systems. Somatosensory receptors include joint and muscle proprioceptors, cutaneous and pressure receptors which allow individuals to sense the type of surface on which they are standing and where they are in reference to the supporting surface.[13]

Nervous System

The sensory input from the visual, vestibular, and somatosensory systems is conveyed to the nervous system and is then relayed to the brain via the afferent nervous tracts that ascend through the spinal cord. These ascending pathways transmit the sensory input to the appropriate cortex areas of the brain. For instance, the visual input is relayed by the visual tract to the primary visual area in the occipital lobe of the brain. Vestibular information is transmitted to the brain via the vestibular nerve to the vestibular nuclei which are located in the

brain stem. The somatosensory information is carried by the ascending dorsal columns and medial lemniscal system to the somatosensory cortex in the brain.[13]

Once the specific area of the brain receives sensory information, it is necessary for the input to be interpreted for appropriate motor responses. These responses are formulated and then executed by the last component of the balance system which is the motor output.[13]

Motor Output

The motor output or muscular system is responsible for the correction of balance errors. Located in the frontal lobe of the brain, the motor cortex contains different processing areas which include the primary motor cortex, supplementary motor area, and the premotor cortex. These areas communicate with the sensory processing area in the parietal lob, the basal ganglia, and cerebellar area and are used to plan movement and to executive action. Motor output or balance corrections are finally achieved via the efferent spinal pathway called the corticospinal tract. The majority of the corticospinal tract originates at the primary cortex area and eventually synapses with motor efferent neurons that are responsible for muscle contractions.[13]

The balance system consists of three main components: the sensory input, the nervous system, and the motor output.[16] Sensory input gathers information about self movements, environmental movement, and supporting surfaces. The nervous system interprets the information and forms a motor plan,

which in turn is responsible for balance corrections.[13] In standing, these balance corrections are essential to avoid falling.

Balance Strategies

The observed balance corrections during standing are defined as balance strategies. Standing balance is essential for independent mobility and is maintained through the balance control system. Without adequate standing balance, problems may arise with mobility skills such as walking, standing, and stair climbing. According to Thapa et al,[18] postural sway is the corrective body movement which results from trying to maintain the COM within the support base of one's feet. It is usually measured during upright standing and reflects the body's effort to maintain balance. Thus, increased postural sway indicates poor balance. Research has found postural sway to be increased in elderly fallers.[10,19] Once an individual's balance is disturbed or sway is increased, there are three balance strategies that occur in order to regain balance. These include the ankle strategy, the hip strategy, and the stepping strategy.[13,17,20]

The ankle strategy returns the body's COM within the base of support (BOS) through movement about the ankle joints. If the COM is pushed or the body sways forward, the gastrocnemius, hamstrings, and paraspinal muscles contract to restore the COM over the BOS. When the body sways in a backward direction, the ankle strategy returns the COM within the BOS by activating the anterior tibialis, quadriceps, and abdominal muscles.[13]

The second way the body attempts to control the COM within the BOS is through the hip strategy. This strategy is implemented when a more forceful disturbance happens and results in movements occurring primarily at the hip.[20] During a forward sway, abdominal and quadriceps muscles are stimulated; whereas, a backward sway results in activation of the paraspinal and hamstring muscles in order to control the COM.[13]

The last balance strategy utilized is the stepping strategy which occurs when the COM is displaced outside the BOS. A step must be taken to regain balance due to the ankle and hip strategies not being adequate to return the COM within the BOS.[20]

Balance strategies are extremely important during stance. Without the ability to recover from perturbations in balance or the inability to attain the standing position, independent mobility may not be achieved. Independence in later life is an important aspect in maintaining a healthy lifestyle. However, as the aging process occurs, there is a gradual decline in the biological systems causing impairments that can affect balance. These natural declines and their effect on balance will be discussed in the next chapter.

CHAPTER III

AGING AND ASSOCIATED INTRINSIC RISK FACTORS

Growing older is inevitable and, unfortunately, imposes certain limitations on the body. This natural deterioration impairs biological systems which may lead to the increased risk of falls. Intrinsic risk factors for falling in the elderly may include deterioration of the visual, vestibular, somatosensory, nervous, and musculoskeletal systems.[21]

Vision

An individual's vision may experience changes as a result of aging. Some common changes and pathologies that occur with increasing age include presbyopia, glaucoma, cataracts, macular degeneration, and diabetic retinopathy.[21]

Presbyopia can be defined as age-related changes in the lens physiology beginning at the age of 50.[22] In this disorder, the lens of the eye becomes hard and inflexible, and the ciliary muscles that suspend the eye lose their tone. These changes make accommodation or focusing from far to near objects difficult. Depth perception may also be compromised by presbyopia which may cause problems in walking and climbing stairs. Commonly, these individuals receive bifocals which allow them to see near and far objects.[21]

Glaucoma is especially prevalent in the elderly and is one of the leading causes of blindness in people over 35. Blindness results due to the intraocular pressure becoming so great that the retinal artery is compressed, which deprives the eye of blood supply. If glaucoma is diagnosed early, it can be managed with medication and is usually preventable with a yearly eye examination.[21]

The most common visual problem in the aging are cataracts in which the lens becomes cloudy and cannot be penetrated by light rays. The individual who develops cataracts suffers from loss of acuity and a gradual darkening of vision. Usually, the central field of vision is initially impaired, then the peripheral vision may gradually be affected. If peripheral objects are distorted, activities such as community walking and stair climbing can be hazardous. Individuals with cataracts may benefit from surgical removal of them or correct eyewear.[21]

Macular degeneration is commonly seen in older individuals, but rarely results in total blindness.[21] There is a central loss of vision with degeneration of the macula which is an area on the retina that increases the acuity of images. However, the peripheral vision is not affected.[23] The most common form of degeneration occurs when a retinal blood vessel hemorrhages. Recent laser therapy has been performed successfully to destroy abnormal blood vessels of the retina. Surgical intervention may prevent central visual loss from occurring.[22]

Diabetic retinopahy has become the leading cause of blindness in the United States. People with diabetes can suffer from blindness secondary to small aneurysms and hemorrhages which clot in the retina, damaging and

blocking light rays from reaching the retina.[21] Laser therapy has shown promise in the treatment of this problem.[22]

Visual decline may occur as the result of aging causing decreased acuity, restriction of the visual field, and decrease in depth perception.[24] Tinetti et al[8] indicate that visual impairment can lead to falling. It has also been discovered that individuals rely heavily on vision with an increase in age. This indicates an individual who experiences visual decline must learn to rely more heavily on the vestibular and somatosensory systems.[13]

Vestibular System

The vestibular system is also subjected to decline with age, as studies have indicated that there is a 40% loss of the vestibular hair and nerve cells by the age of 70.[25] Balance dysfunction usually does not occur with vestibular losses unless the visual and somatosensory systems are impaired also.[13] Sensation of self motion is an important role of the vestibular system; thus, it is not surprising that patients with vestibular disorders often have abnormal perceptions of self-motion. Those individuals who suffer from severe vestibular dysfunction may perceive that the "room is spinning around."[17] Due to this type of misperception, it is easily understood how a person could possibly lose his/her balance and sustain a fall. A vestibular disorder that may have a profound effect upon balance is Meniere's disease.

Meniere's disease is a common inner-ear disorder that usually affects men and women ages 40 to 60 and impairs the vestibular and hearing systems.

In a classical episode, individuals may experience reduction in hearing, dizziness, and postural imbalance which may last two to four hours. In more severe cases, disequilibrium or violent vertigo may last anywhere from 30 minutes to 24 hours. Individuals may feel unsteady for days or weeks before this sensation eventually subsides. After many years, the symptoms of vertigo may gradually diminish in frequency and severity. In later stages of the disease, some individuals fall suddenly without warning. Treatments of this disease may include medication, psychological therapy, or vestibular nerve transection.[17]

Somatosensory System

Research indicates that somatosensory losses are experienced in the older individual. Vibratory sensation and joint position sense have ben found to be reduced in 30% to 50% of normal older individuals.[26] These types of impairments are also experienced by elderly individuals with diabetes. Individuals who suffer from diabetes may not be able to distinguish important information about the surface they are accommodating. If this somatosensory information is not perceived correctly, falls may occur secondary to delayed balance strategies.[27]

Musculoskeletal System

As the individual ages, biological decline is experienced in the musculoskeletal system, specifically, a decrease in flexibility. There are two important factors that reduce flexibility. The first factor is the change that occurs in collagen, which is defined as a "fibrous and supportive protein that is found in

skin, bone, ligaments, and cartilage."[28] With age, collagenous fibers become irregular in shape and formation. The fibers lose their parallel alignment and become cross-linked in formation decreasing the mobility in muscles and tendons which may lead to decreased range of motion.[21] Restriction of joint mobility can result in loss of balance when trying to perform functional activities.

The second factor that may reduce flexibility in older individuals is decrease in activity or a sedentary lifestyle.[21] According to Rooney,[29] two-thirds of all adults age 65 or older are irregularly active or inactive. This lack of activity causes collagenous adhesions to develop more readily and the result is further muscle tightness. If muscles are short or positioned at an abnormal angle, the body may tend to move in that direction. Balance is specifically affected by muscular tightness of the hip flexors, hip external rotators, knee flexors, and plantarflexors which causes muscles to lose their mechanical advantage and, in turn, may lead to a fall.[21]

Declines in muscle strength, averaging one percent per year after the age of 30, have been reported for every muscle group tested.[30] Strength loss has been attributed to a decrease in the total muscle mass, decrease in number and size of type II muscle fibers, and loss of motor units.[31-33] The knee extensors, hip extensors, and ankle dorsiflexors are most likely to show a decrease in strength and are important in correction of disturbances through balance strategies.[21] Consequently, a fall may result without adequate strength to correct the loss of balance that may be experienced in daily mobility.

Aging can result in biological decline that is observed in the visual, vestibular, somatosensory, and musculoskeletal systems. Numerous studies have identified these impairments as risk factors for falling.[8,9,34] A review of the literature reveals that intrinsic risk factors may be enhanced or modified through exercise, thus possibly preventing falls.[35-37] The benefits of exercise on the biological systems will be discussed in the next chapter.

CHAPTER IV

BENEFITS OF EXERCISE

A sedentary lifestyle and inevitable biological decline may impose physical limitations among elderly individuals. These limitations may lead to loss of balance and possibly a fall. Research indicates that older individuals may improve their lifestyle and slow biological decline through physical exercise.[36,37] Enhancing physical limitations that affect balance may possibly prevent future falls.[1,34,38] This evidence supports the need for the balance exercise video for fall prevention which was completed in conjunction with the literature review. Ultimately, the goal of the video is to improve an individual's flexibility, muscle strength, balance, and confidence, all of which are essential for performing activities of daily living (ADLs).

According to Brown and Holloszy,[37] joint restrictions may be improved in the older adult through an exercise program that includes stretching. The stretches need to be performed slowly due to collagen being less mobile and responding slower to stretching in the older adult.[21] Stretching incorporated in the video is designed to enhance joint mobility and prevent flexibility from being lost (see Appendix, Table 1). Adequate range of motion (ROM) is crucial for performing daily activities and employing necessary balance strategies.

Current research suggests that the loss of muscle strength can be slowed with regular physical activity that includes some form of resisted exercise.[30,39] In an eight-week study conducted by Fitatrone and associates,[40] ten long-term care facility residents performed knee flexion and extension exercises three times a week. The average strength gain in the participants was 174% and total mass increased an average of nine percent in the quadriceps indicating strength benefits may occur within elderly individuals.

Whether using an individual's body weight or external resistance, exercise programs have shown strength gains in elderly men and women who live independently or in institutional settings.[41] In the produced exercise video, the participant's own body weight is used as resistance for muscle strengthening (see Appendix, Table 2). Balance exercises performed in the video concentrate on strengthening the knee extensors, hip extensors, and ankle dorsiflexors. Whipple et al[9] reported that these muscle groups are commonly weak in individuals who have sustained a fall. These particular muscles are also essential in the execution of the ankle, hip, and stepping balance strategies. The goal of incorporating strengthening activities in the video is to assist with the performance of daily activities and to enhance the execution of balance corrections to help prevent falls.

Standing balance may be improved in older individuals by performing balance exercises. According to Ledin and associates,[35] elderly individuals may improve their balance by performing balance exercise for as short as nine

weeks. Evidence indicates that a majority of falls commonly occur during single leg support, such as walking and stair climbing.[42] With this in mind, several of the balance and cool down exercises in the video are performed standing on one leg (see Appendix, Tables 2 and 3). The activities performed by the participants were designed to be challenging yet safe. A sturdy chair was present throughout the video, and the participants were allowed to use it for support if they felt unstable or insecure. Eliminating or decreasing the use of the chair for balance support can modify the difficulty of the exercise program.

Literature suggests that people tend to restrict their activities after falling.[5] Individuals may lose confidence in their physical abilities or they may develop a fear of falling. Fear reduces quality of life by decreasing independence. It is well recognized that exercising increases self esteem and physical and emotional confidence.[40] The aim is that people who are introduced to the balance exercise video will also benefit form increased confidence in their physical capability.

The exercise video was designed to enhance joint flexibility, muscle strength, and balance, all of which may decrease with age. By improving these physical impairments and confidence, the goal is that future falls may be prevented. The video can be incorporated in a variety of settings for ambulatory individuals of any age who suffer from balance problems. To ensure safety, it is suggested that people who utilize this video initially receive adequate supervision and that they should not experience any pain or discomfort during

the routine. If these symptoms are experienced, it is recommended that a physician be consulted immediately. It is also advised that the video be performed two to three times a week initially.

CHAPTER V

CONCLUSION

Falls occur rather frequently in the elderly and cause numerous problems, such as trauma, pain, fear, or possible death. Numerous studies have been conducted in the past decade, and it is now understood that falls do not necessarily accompany aging itself.[1] If an older individual sustains a fall, it may be due to extrinsic or intrinsic risk factors. Biological decline related to aging may affect vision, vestibular system, flexibility, and muscle strength which may contribute to balance problems.[21] This natural deterioration can lead to impairments in the balance control system which may result in loss of balance or a fall. Recent literature indicates that biological decline may be slowed through physical exercise which may enhance balance.[38,39] This evidence supports the need for the balance exercise video for fall prevention which was produced in addition to this literature review.

Restriction of joint range of motion (ROM) and muscle tightness and a sedentary lifestyle are common in the elderly, causing difficulty with skills such as standing, walking, and stair climbing.[21] The exercise video focuses on stretches for the entire body, with emphasis on the hip flexors, hip external rotators, knee flexors, and plantarflexors.

Deterioration of muscle strength may also accompany aging and a sedentary lifestyle. Various strengthening exercises selected for the video target the hip extensors, knee extensors, and ankle dorsiflexors. Current research indicates that these muscle groups are weak in older individuals who have fallen.[21] Weakness in these muscle groups may hinder the ability to implement ankle, hip, and stepping strategies, which are essential for balance corrections and avoiding falls.

A series of exercises are performed in the video which concentrate on improving balance. Previous studies indicate that balance can be improved by performing balance activities.[35] If recommended by a health care professional, the video can be used by individuals who need balance enhancement. The exercises become progressively more challenging, and an individual or therapist can modify the difficulty of the entire routine by varying the assistance of a chair.

Falls in the elderly can be prevented once the cause is identified. If an individual suffers from balance problems secondary to loss of flexibility and muscle weakness, the produced video can be an excellent reference tool. By using the video, common conditions of aging can possibly be delayed and, in turn, may prevent a potential fall. Falls may seem to be a small mishap; however, they can compromise a person's independence, lifestyle, and health. These potentially life threatening accidents may ultimately be avoided with adequate awareness and proper intervention.

APPENDIX

Table 1.—Warm-up Session

All of the following exercises are performed standing and a chair is used for assistance when appropriate. Each is executed five times and held for three seconds.

Exercise	Purpose
1. Cervical rotation, sidebending, flexion, extension	Cervical stretching
2. Shoulder shrugs	Shoulder/scapular stretching and strengthening
3. Upper extremity PNF D_1 and D_2 patterns	Shoulder/scapular stretching and strengthening
4. Back extensions	Abdominal stretching
5. Lunges with a chair	Hip flexor and plantarflexor stretch
6. Trunk sidebends with a chair	Lateral trunk stretch
7. Leg extensions and abduction with a chair	Hip extensor and abductor strengthening
8. Mini squats with a chair plantarflexor	Knee extensor and strengthening

Table 2.—Balance Exercises

Each of the following exercises are performed six times.

Exercise	Description	Purpose
1. Tipping airplane	Sitting: put arms out to the side at shoulder height. Tip upper body to the right. Slowly return to sitting position, then repeat to left side.	Sitting balance and trunk stretching.
2. Elevators with chair	Sitting: stand up stopping at mid range for two seconds, then stand. Proceed to partial sit, stop at mid range and hold for two seconds, then sit completely.	Strengthening for plantarflexors, knee flexors, knee extensors, and hip extensors.
3. Half Jills	Standing: lift right arm above head to comfortable position, then safely swing right leg out to the right side. Hold for two seconds, then return to starting position. Repeat with left extremities.	Strengthening for shoulder abductors, scapular up/down rotators, hip ab/adductors. One-legged balance exercise.
4. Triangle with foot	Standing: gently touch toes of right foot on the floor to the front, side, and back. Repeat with left foot.	Strengthening for hip flexors, hip abductors, and hip extensors. One-legged balance exercise.
5. Chorus line	Standing: lift right knee to 90° angle. Straighten right leg out in front of you, then point your toes. Return knee to bent position and lower leg to floor. Repeat with left leg.	Strengthening for hip flexors, knee extensors, and plantarflexors. One-legged balance exercise.

Table 2.—Balance Exercises (Cont.)

Exercise	Description	Purpose
6. Superwoman	Standing: with both hands on a chair, lean toward the chair. Straighten your right leg behind you, then lift your arms (if able) out to the side. Hold for five seconds, then repeat with left leg.	Strengthening for knee extensors knee flexors, shoulder abductors, and elbow extensors. One-legged balance exercise.
7. Flamingo	Standing: stretch right arm over head at a comfortable level. Lift left knee to 90° angle if able. Lower arm and leg, then repeat with opposite extremities.	Strengthening for hip flexors, hip abductors, shoulder abductors, and scapular up/downward rotators. Coordination and one-legged balance exercise.

Adapted from: Perkins-Carpenter B. How to Prevent Falls: A Comprehensive Guide to Better Balance. New York, NY: St. Martin's Press; 1989.

Table 3.—Cool Down Session

Cool down exercises are performed at a slower pace and executed five times.

Exercise	Description	Purpose
1. Steps with lift	Starting with right leg, take three steps forward. On the third step, lift left knee to 90° angle. Lower Leg and take three steps back, then lift right knee to 90° angle. Repeat four more times.	Balance activity. Cool down for lower extremities.
2. Give yourself a hug	Stand with a wide base of support. Bend knees slightly, then straighten. When reach standing, give yourself a hug. Move closer together and repeat.	Balance activity. Upper extremity and upper back stretch.

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