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1


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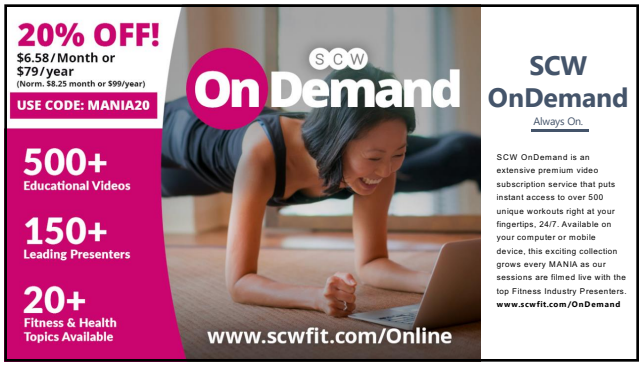
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4


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6

Balance for Active Aging

The term older adult defines individuals aged ≥ 65 yr and individuals aged 50-64 yr with clinically significant conditions or physical limitations that affect movement, physical fitness or physical activity and represents a diverse spectrum of ages and physiologic capabilities ACSM Guidelines for Exercise Testing and Prescription, 10th Edition.

5 Types of Aging

1. Chronological: Years
2. Functional: ADL's
3. Biological: Physical functioning
4. Psychological: Cognitive performance (neuroplasticity)
5. Social: Acceptance, self-efficacy

Older Adult Snapshot

- In the US, the older adult population is projected to more than double by 2060, from 48 million (2015 status) to 98 million
- Due in part to the increase in life expectancy from 68 in 1950 to 78.7 years old in 2018
- The gender gap in life expectancy is approximately 5-years with life expectancy of males at 76.2 and females at 81.2 as of 2018

Falls in the Elderly Statistics

- One in four Americans aged 65+ falls each year
- Every 11 seconds, an older adult is treated in the emergency room for a fall; every 19 minutes, an older adult dies from a fall.
- Falls are the leading cause of fatal injury and the most common cause of nonfatal trauma-related hospital admissions among older adults.
  - NCOA

Age-Related Decline

- After the age of 62 there's a marked decrease in walking speed associated with dysfunction, poor mental and physical health, a loss of independence and a higher mortality risk.
- Fatal falls due to dysfunction more than doubled between 2000 and 2012, while nonfatal falls increased by 23% - Burns, Stevens & Lee 2016
- 10% of all people older than 65 and 50% of those older than 80 have some form of cognitive impairment, ranging from mild deficits to dementia – Yaffe, Barnes, Nevitt, Lui, & Covinski, 2001
- Beyond the age of 50, there is a tendency of older individuals to lose muscle mass (sarcopenia). This is especially pronounced in women, who do not have enough testosterone to support the muscle mass. ACE PT manual, 5th Edition.
- A selective loss of fast-twitch motor units has been observed; this loss adversely affects the older adult's ability to execute movements quickly – Erim, Beg, Burke & De Luca, 1999; Luff, 1998, Roubenhoff, 2001

Noteworthy Highlights from the NSCA Position Standpoint for Resistance Training

- Studies show that up to 76% of muscle mass and 65% of muscle strength are attributable to heredity
- Developing a combination of strength, power and endurance is the best strategy for counteracting declines in muscular strength, mass, cardiorespiratory fitness, neuromuscular function and functional capacity in older people. Each client's program should strike an optimal balance among training variables (volume, intensity, frequency, exercise selection, exercise order) and work duration for both aerobic and resistance training.
- Functional training improves activities of daily living. Ideally fit pros should choose functional moves that follow movement patterns similar to the client's daily activities.
- With frail older adults, beginning exercises and those with functional limitations, using machine-based resistance equipment is an appropriate starting point. High-functioning older adults gain greater benefits using free weights.
- In the United States, 30% of older adults experience at least one fall annually; that percentage goes up to 50% for those over the age of 80. Older adults without a fall history report doing more aerobics and resistance training sessions than those that experience falls.
- Mental health disorders –such as dementia, depression and Alzheimer's disease –affects 20% of older men and women

Balance Terminology

- Balance – The process of controlling the body's center of mass COM with respect of it's base of support BOS, whether the body is moving or stationary
- Posture – The biomechanical alignment of the individual body parts and the orientation of the body to the environment
- Anticipatory Postural Control – Actions that are planned in advance
- Reactive Postural Control – Actions that cannot be planned in advanced due to the unexpected nature of an event
- Stability Limit – The maximum distance an individual is able or willing to lean in any direction without changing BOS
- Sway Envelope – The path of the body's movement during quiet standing
- Mobility – The ability to move independently and safely from one place to another – Fall Proof, Debra J. Rose

Postural Control Strategies

- Ankle Strategy – The postural control strategy in which the body moves as a single entity about the ankle joint
- Hip Strategy – The postural control strategy in which the upper and lower body move in opposite directions as a result of the hip muscles being activated to control balance
- Step Strategy – The postural control strategy used when the COM is displaced beyond the maximal stability limits or sway is too great to use a hip strategy – Horak & Nashner, 1986; Jensen et al. 1996

Multiple Systems Contribute to Balance and Mobility

- Sensory Systems – Anticipate changes that affect current and future actions as well as respond to changes that have already occurred
- Motor System – Acts on internally and externally provided sensory information
- Somatosensory System – Provides information about our spatial location and the movement of the body relative to the support surface
- Vestibular System – In conjunction with the visual system, helps us determine whether the world or our body is moving – Fall Proof, Debra J. Rose

Age Related Changes to the Balance Systems

- Age-related changes in the visual system adversely affect the older adult's ability to perceive or anticipate any changes in surface conditions or any hazards in the environment
- The vestibular system becomes critical for balance when the sensory information from the visual system is absent or when information from the visual and somatosensory system is distorted or in conflict
- Between the age of 50 and 70, muscle strength declines as much as 30%

Stability

- Synergistic action of the muscles, ligaments, and connective tissue to maintain or control joint position; must never compromise joint mobility.

Mobility

- Synergistic actions of skeletal (joints) and neuromuscular systems to allow uninhibited range of motion around a joint or body segment; must never compromise joint stability. ACE Small Group Training Manual

Stability Mobility Relationships of Joints

Joint	Function
Foot	**Stability**
Ankle	**Mobility**
Knee	**Stability**
Hip	**Mobility**
Lumbar Spine	**Stability**
Thoracic Spine	**Mobility**
Scapulothoracic	**Stability**
Glenohumeral	**Mobility**

Four Overriding Considerations

1. Avoiding cardiovascular risk
2. Avoiding orthopedic risk – falls risk
3. The need to preserve muscle tissue
4. The rate at which older individuals adapt to training – Foster et al., 2007

Movement Considerations

- Longer Warm-up
- Slower rotation
- Less than 2 minutes on knees
- More time getting up and down
- Joint replacements
- Hydration & sleep
- Balance
- Weight baring on hands

Environmental Considerations

- Tripping hazards:
  - Cluttered floor
- Room temperature:
  - Too hot? Too cold?
- Lighting:
  - Visual challenges?
- Music:
  - Hearing challenges?

Fullerton Advanced Balance Scale

1. Stand with feet together and eyes closed
2. Reach forward with outstretched are to retrieve an object (pencil)
3. Turn in a full circle in right and left directions
4. Step up onto and over a 6-inch bench
5. Walk with feet in a tandem position
6. Stand on one leg
7. Stand on foam with eyes closed
8. Jump with both feet for distance
9. Walk while turning the head
10. Restore balance after backwards disturbance

Balance Exercise Benefits

- Balance – Static: Helps students/clients increase their internal awareness and control of their postural sway (Indicator for falls risk)
- Balance – Dynamic: Increasing the multi-sensory conditions will mimic ADL's balance needs and neuromuscular efficiency

Base of Support

1. Staggered Stance
2. Straddle Stance
3. Tandem Stance
4. Single-legged Stance

Balance Progressions

Balance Exercise	Increased Balance	Progression 1.	Progression 2.	Progression 3.	Progression 4.
Support	Supported position to unsupported	Seated	Light Chair Contact	Free Standing	One Legged

Movement Progressions

Description	Level 1	Level 2	Level 3
Vary dynamic movements that challenge COG	Tandem Walking	Braided Walking	Backwards Walking
Challenge Postural Muscle Groups	Stand with feet flat on the ground	Stand only with heels touching ground	Stand with only toes touching ground
Gradually reduce sensory input	Stand with eyes open	Stand with one eye closed	Stand with both eyes closed
Gradually increase movement speed	Complete 20 side steps in 20 seconds	Complete 20 sidesteps in 15 seconds	Complete 20 sidesteps in 10 seconds
Add weighted resistance to challenge balance and stability	Stand in tandem while holding a single dumbbell at side	Stand on one foot while holding a single dumbbell at side	Stand on one foot while reaching down to pick up a KB from floor
Complete exercises on progressively unstable surfaces	Stand on firm floor	Stand on foam pad	Stand on a balance board or BOSU

Base of Support for Dynamic Movement Sequences

BOS	Wide to Narrow Stance	Wide Stance	Narrow Stance	Tandem Stance
ARMS	Adding upper body movement to increase reaction time to COG changes	Natural Arms	Controlled Arm Movements	Flowing Arm Movements
Legs	Adding weight shifts & leg moves to increase reaction to COG changes	Weight Shift L/R	Toe Taps in multiple directions (one leg grounded)	Lifted leg in multiple directions (one leg grounded)

Visual and Vestibular Progressions

Balance Exercises	Increased Balance Challenge	Progression 1.	Progression 2.	Progression 3.	Progression 4.
Visual Gaze	Vestibular Training	Gaze Forward	Gazing R/L	Gazing multiple directions	Eyes Closed

Commonly Used Physical Performance Tests

Measure and Description	Administration Time	Cut-point Indicative of Lower Function
Senior Fitness Test 1. 30s chair stand 2. 30s arm curls 3. 8ft up and go 4. 2-minute step test 5. Chair sit and reach 6. Back scratch	30 minutes total Individual items range from 2-10 minutes each	$\leq 25^{th}$ percentile of age-based norms
Short Physical Performance Battery A test of lower extremity functioning that combines scores from usual gait speed and timed tests of balance and chair stands; scores range from 0 to 12 with higher score indicating better function	10 minutes	10 points
Usual Gait Speed Usually assessed as the better of two trials of time to walk a short distance (3-10m) at a usual pace	<2 minutes	1m 8 s -1
6-minute Walk Test Widely used as an indicator of cardiorespiratory endurance; assessed as the most distance an individual can walk in 6 min. A change of 50m is considered a substantial change	< 10 min	$\leq 25^{th}$ percentile of age-based norms
Continuous Scale Physical Performance Test Two versions – long and short – are available. Each consists of serial performance of daily living tasks, such as carrying a weighted pot of water, donning and removing a jacket, getting down and up from the floor, climbing stairs, carrying groceries and others, performed within an environmental context that represent underlying physical domains. Scores range from 0 to 100 with higher scores representing better functioning	60 min	57 points