Therapeutic Benefits of Exercise for Aging Adults

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Some Physical Changes as we Age

- Reduced functional capacity & ↓ VO2 max
- Altered body composition
  - Greater %body fat, especially centrally & visceral
- Decreased bone mineral density
  - Osteoporosis & osteopenia
- Increased risk for chronic disease & injury
- Sarcopenia - ↓ in muscle mass, esp. Type II or ftf
  - ↓ # motor & sensory neurons;
  - ↓ nerve conduction velocity
Which results in decreases in:

- strength & power
- fast & strong movements
- fine dexterity
- endurance of sustained power
- acceleration and deceleration of movements
- coordination

Sarcopenia

- Normal part of aging
  - beginning in 30s-40s, 10% decrease/decade
  - Accelerates after 50-70
    - Women after menopause
    - Men after 60; decline almost 2x that of women

- 70 y.o. female: 50-70% less strength than at age 30

Sarcopenia

- Age-related progressive & generalized loss of skeletal muscle mass resulting in:
  - marbling: fat infiltration into ms
  - muscle weakness and reduced activity level
  - increased prevalence of falls
  - declines in physical function & decreased independence
  - poorer Quality of Life

- Diagnosis: 2 of 3: low ms mass, low ms strength, low physical performance

- Major cause of disability & frailty in the elderly

Sarcopenia also results in:

- Lower basal metabolic rate
- Decreased bone density
- Reduced activity level and weakness
- Lower calorie needs

Increase in body ‘fatness’ linked to hypertension & abnormal glucose tolerance

*Evans WJ. Geriatrics. 1996 May; 51(5):46-7*
Prevalence of sarcopenia

- 5-13% in people 60-70yo in US
- 11-50% in people >80yo in US

Even conservative estimate, sarcopenia affects >50million people worldwide today and it will affect >200million in the next 40 years.

Sarcopenia-prevalence

- 35% older adults have moderate sarcopenia; 10% have severe sarcopenia

- Community dwelling older adults with sarcopenia
  - 22.6% women
  - 26.8% men

80 years+ with sarcopenia

- 31% women
- 52.9% men

Sarcopenia

- Multi-factorial, etiology unclear

- Some contributing mechanisms
  - Loss of alpha motor neurons
  - Decline in muscle cell contractility
  - Decline in sex steroid levels & growth hormone production
  - Inadequate dietary protein intake/other nutritional imbalances
  - Increase in production of catabolic cytokines
  - Oxidative stress
  - Inflammation

- Accelerated by chronic illness

- Clearly accelerated by physical inactivity***
At present, progressive resistance training is the best intervention shown to slow down or reverse this condition.

Inactivity

*CDC: physical activity=20 min of exercise 3x/wk*

- 2/3 people over 75 years of age do nothing in terms of physical activity
- 50% of people between 65-74 years of age do nothing
- 42% of people between 45 and 64 years of age do nothing
Physical Function

Community dwelling adults > 75 years of age:

- 16% could not lift 10 pounds
- 21% could not walk up 10 steps
- 29% could not walk \(\frac{1}{4}\) mile (1300 ft)
- 28% could not stoop, crouch, and kneel & recover

Vital & Health Statistics National Health Interview Survey 2002, CDC
Depending on degree of fitness, an episode of 1-2 days of bed rest can take up to 6 months to overcome in the inactive elderly client.
Inactivity

- 23% of deaths from leading chronic diseases are associated with sedentary lifestyles:
  - Osteoarthritis
  - Diabetes
  - Stroke
  - Osteoporosis
  - Sarcopenia
  - Osteoporosis
  - Peripheral Vascular Disease
  - Coronary Artery Disease
  - Depression
  - COPD
  - Obesity
--Congestive Heart Failure
“Physical activity and exercise are inversely associated with mortality and age-related morbidity.”

“Moderate levels of physical fitness decrease the risk of premature mortality regardless of whether individuals were unhealthy, have smoked, or had elevated cholesterol or blood pressure levels.”
“Muscle strength—the amount of force a muscle can produce—is highly associated with functional activities.”

STRENGTH IS FUNCTION

“Loss of strength is associated with slow gait speed, poor endurance, inability to rise from a chair, falls risk, incident disability, and frailty”

“Lack of leg strength was found to be the single most important predictor of the need for eventual institutionalization...the message is clear. If you want to avoid the nursing home, you’d better take good care of your legs.”
Some facts about how exercise can change/delay/reverse sarcopenia and resulting disability
Resistance training can effectively be used to counteract the effects of muscle loss.
Quality of life and function (through strength, endurance, and balance training) may be increased at any age as long as the exercise intensity, duration, and frequency are sufficient to consistently overload the system.
Overload Principle

- Tissue must be exposed to a load to which it is not normally exposed to improve in function.

- Once the body has adapted to the greater than normal stress or load, then a different stimulus (steadily progress intensity level) will be required to continue to make a change.

- Intensity must be sufficient to overload the system without over-straining them.

- Overloading requires recovery time.
Physical Stress Theory

- Changes in relative stress causes a predictable response in all biological tissue
  - Levels of stress below maintenance levels - decreased tissue tolerance to stress (atrophy)
  - Maintenance levels - do not change tissue (no change)
  - Stresses that exceeds maintenance levels - increased tissue tolerance to stress (hypertrophy)

Progressive Resistance Training =PRT

- The load is systematically increased as the person is able to work against a heavier load
東京舉行老年人健美比賽
新唐人綜合報導
Recommended Exercise Prescription
70-80% 1RM

- Rated as “somewhat hard” to “hard” Borg RPE
- Significant strength gains even in very old &/or frail & well tolerated in these groups
- Results in substantial strength gains in relatively short period of time
- High intensities yield greater effects than low or medium intensities.
Recommended Exercise Prescription

Exercise to Fatigue:

8-12 reps

- Quality vs quantity
- “Average person performing good quality exercise @70-80% 1RM will experience momentary muscle fatigue from the 8th-12th repetition.”
- Fatigue (momentary muscular fatigue):
  - form deteriorates
  - unable to complete full available functional ROM
  - unable to maintain slow speed
1 set

“Research demonstrates that a single set of exercise to momentary muscle fatigue provides equal strength gains to exercise performed using 2 or 3 sets of exercise and significantly enhances physical performance.”

Speed

- Rate of control of movement
- “Be able to stop on a dime” without overflow
- Slower movement better for strength gain
- Quicker, more likely to substitute
Exceptions:
should exercise
@ Lower Intensity: 30-60% 1RM

- Acute Myocardial Infarction 0-6wks
- Progressive degenerative neuro disorder (MS)
- Rheumatoid Arthritis
- Acute musculoskeletal conditions (tendonitis)
- Extremely frail or deconditioned
- CHF
- Caution with post-surgical healing tissue
30-60% 1RM

- Described as “fairly light” to “somewhat hard”
- Exercise to mm fatigue, 12-25 reps
Contraindications to PRT

- Recent fracture (unstable)
- Advanced, decompensated CHF
- Cancer (tumor in target area)
- Recent, unstable MI
- Acute illness
After Exercise

- Need 48 hrs rest to recover;
  - so approx. 2-3x/wk

- Expect Delayed Onset Muscle Soreness from:
  - Microscopic trauma (inflammation)
  - Stretching of joint capsules
  - Accumulation of lactic acid
  - Not reduced by stretching before &/or after exercise
Some Benefits of Resistive Exercise
Responses to Resistive Exercise

- ▲ lean ms mass and hypertrophy; fat may be replaced by lean ms mass; ▼ total & intra-abdominal fat
- ▲ Type I fibers #, as well as aerobic capacity
- ▲ joint mobility & flexibility
- ▼ pain and disability in patients with OA
- Improves/maintains bone mass
- Improves quality of gait/gait speed
- Decreases HR, diastolic BP

PHYSICAL CHANGES WITH AGING

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Responses to Resistive Exercise

- ↓ reaction time
- improved speed of movement
- ↑ neuromuscular control & postural control, esp. static balance
- ↑ gait velocity
- Decreased incidence of falls
Responses to Exercise

- Release of endorphins & endogenous opiates
- ↓ depressive symptoms & anxiety
- Better sense of well-being & decreased stress
- Improved cellular sensitivity to insulin so ↓ risk of developing type 2 diabetes
- Improved Quality of Life
- Reduces disability and need for nursing home placement
“PRT has been shown to produce large increases in strength and moderate increases in bone mineral density, lean body mass, insulin sensitivity, and sub-maximal and maximal endurance.”

Cochrane Review

“Older adult patients are likely to benefit from supervised PRT …are likely to show meaningful strength gains, along with decreases in physical disability…

substantial improvements in key functional activities including ADLs, gait speed, and the ability to get out a chair…

larger changes in strength should be expected with higher intensities of PRT.”

APTA 2010, http:ptjournal.apta.org
The need to challenge more

- Who makes the greatest changes? Frail
- Frail have most to gain and make greatest gains.
- 174% mean strength gains in older adults 90+yo
  (first week 50% 1RM); 80% 1RM; 8 wks
- 227% gains in knee flexor strength; 107% gains in knee extensor strength
- 4/6 non-ambulatory subjects became ambulatory
Strong dose-response relationship between RT and strength gains & between strength gains & functional improvements
You are never too old to exercise

- Old old (>75yo) who exercise: disability postponed & independent living maintained
- 90 yo who had PRT showed ↑ in functional activity performance and gait speed
“All adults should avoid inactivity, that some physical activity is better than none…For most health outcomes, additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, and/or longer duration.”

Concerns
“No study showed that strength training was detrimental to older adults.”

“Adverse effects were typically not reported. [However, if reported], joint and muscle pain most common adverse event.”

*Muscle soreness usually dissipates with continued PRT.*

“If exercise could be packed into a pill, it would be the single most widely prescribed and beneficial medicine in the nation.”

Dr. Robert Butler
Past Director of the National Institute on Aging
“If exercise were a drug, doctors couldn’t keep it on the shelf. Exercise is truly the best drug ever, and the incredible part about the exercise story is that this ‘drug’ is free and it has virtually no side effects.”

PT 2011 Annual Conference Matt Jones & Bill Rogers
Thank You!