Musculoskeletal Considerations of the Mature Athlete

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“Physical activity has more potential for promoting healthy ageing than anything else science or medicine has to offer today.”

Shepard
Objectives

- Understand the physiologic changes associated with aging.
- Appreciate the benefits of exercise in the older athlete.
- Discuss risks and injuries of competitive older adults.
- Discuss how diagnosing somatic dysfunction may be a challenge in the mature athlete.
- Learn when and how to use OMT in the mature athlete.
The Mature Athlete

- Al Geiberger joined the PGA Tour at the age of 50 and in his first year earned more than in any of his previous 28 years.
- John Campbell had retired from running on three occasions and before becoming a masters competitor has achieved the status of an international running superstar. He currently holds that masters marathon record of 2 h 11 min 4s, a world class performance at any age.
- At the age of 52, Dick Bass conquered Mount Everest, a climb of 8848 m.
- Hielda Crook did not take up serious exercise until the age of 70. since then, she has climbed Mount Whitney (4418 m) over 22 times.

The Mature Athlete

- Globally, we now find events organized exclusively for older athletes. These include Old-timers events, senior leagues, masters races, tri-masters events, and mature athletes leagues.

- Old vs. Young: Older competitors are pushed a little harder and stay in touch with the younger generation, while the young athletes are inspired by the efforts of their elders and also benefit from the social interaction.

- Older athletes serve as role models, reminding all of us of what can be accomplished if we accept no physical limits and perform to our limits.
Mature Athletes

- **History:**
  - The first World Senior Games were held in 1970 with 200 competitors taking part.
  - Nineteen years later, Eugene, Oregon, hosted the 8th World Veterans Games in which 4951 athletes from 58 countries gathered to test their athletic abilities.
  - It is rated as the largest track and field event in history. Participants ranged in age from 40 to 96, and when the event was over they had established over 124 world age class records.
Definitions:

- A *Competitive Athlete* is one who participates in an organized sport who requires systematic training and regular competition against others.

- *Masters athletics* is a class of sport for veteran athletes in the events of track and field, road running, and cross country running. The competitions feature five-year age groups beginning at age 35. Men as old as 104 and women in their 90s have competed.

Masters Athletes

- The World Association of Veteran Athletes was founded August 9, 1977, at the second World Masters Athletics Championships in Gothenburg, Sweden.

- WAVAVA, as it was known, later changed its name to World Masters Athletics and continues to be the sport's governing body.

- World Masters Athletics—WMA is the worldwide governing body for Masters athletics. It provides a global standard of rule modifications for athletes of a certain age. Each individual country governs its own affairs.

- WMA has been working to coordinate its outdoor championship schedule with the International Masters Games Association, which holds the multisport World Masters Games every four years.

- A major contribution of masters athletics was the introduction of the Age-Graded Tables, a set of "age factors" and "age standards" that, when multiplied by a time or distance, allow athletes of any age and event to compare their performances with that of any other athlete.
Currently the geriatric population comprises 12% of the population

Only 13% of those 65 years and older engage in vigorous physical activity 3 or more days a week

By 2030, 18% will be over 65 yrs of age

Obesity rates are increasing by 45% in adults over the age of 60.

Those over 85 are the fastest growing segment of the population

Approximately 2 million patients over the age of 65 seek medical attention for athletic based injury yearly

Epidemiology

- Since 1960, there has been a 30% decrease in CAD due to diet and exercise.
- The USPHS declared that exercise is one of the 5 priority areas to prevent pre-mature morbidity and mortality.

According to the AHA, physical activity, ranging from walking to vigorous exercise, has been linked to reductions in morbidity, mortality, functional decline, mobility, disability, and coronary heart disease, and to increases in active life expectancy and the likelihood of not being disabled prior to death.

The Mature Athlete

- Persons aged 75 years or older differ greatly from younger persons in 2 key areas that affect recommendations for exercise training:
  - the prevalence of asymptomatic CAD
  - the coexistence of other chronic conditions and physical limitations.

Physiologic Changes with Aging

- **Increased:**
  - body fat
  - systolic blood pressure
  - total peripheral resistance
  - insulin resistance

- **Decreased:**
  - height
  - weight
  - muscle mass
  - body water
  - bone density
  - flexibility
  - heart rate
  - baroreceptor activity
  - renal blood flow
  - creatinine
  - peripheral glucose uptake
  - standing balance
  - reaction time
Physiologic Mechanisms with Aging

- **The free-radical theory**
  - Free radicals are atoms or molecules that contain an unpaired electron and so are highly reactive.

- **The ageing programme theory**
  - This theory contends that the ageing process is actually programmed into each organism’s genetic make-up.

- **The neuroendocrine theory**
  - Any alterations in the controls exerted by this system will have far-reaching effects at the molecular, cellular, and organ levels.

Physiologic Mechanisms with Aging

- **The altered protein theory**
  - Proponents of this theory conjecture that, as we age, altered protein formation occurs.

- **The waste product accumulation theory**
  - This theory contends that with ageing there is a progressive accumulation of ineffective biological materials within each cell and that this ultimately impedes the optimal functioning of the cell.

- **The cross-linkage theory**
  - Intermolecular and intermolecular cross-linkages form to stabilize the macromolecules within cells.

- **The immunological theory**
  - Walford proposed that as we age alterations occur in our immunoregulatory genes such that organisms lose their ability to discriminate self from non-self.

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Aging vs. Lifestyle

- An inactive life-style is a far greater threat to continued health than the aging process!

- It is estimated that inactivity accounts for more than 50 percent of the structural and physiological decrements that can be demonstrated in a sedentary adult.

Aging vs. Lifestyle

- Kasch et al. conducted a study of the effect of exercise and inactivity on the aerobic power of older men.
- Despite the small number of subjects involved in this study, the results strongly suggest that inactivity makes a large contribution to the physical changes that we see in ageing individuals.

How is a Mature Athlete Different?

- Heart?
- Lungs?
- Metabolism and fluids?
- Bone and cartilage?
- Muscle?
- Hematologic?
- Skin, connective tissue, and nails?
- Neurologic?
- Psychological/ Behavioral?
The Heart

- Several authors have noted an age-related decline in cardiac ejection fraction at high workloads only.
- Ageing myocardium accumulates lipofuscin, the significance of which is uncertain.
- Amyloid is another protein which is found in the hearts of most people over 90 years of age but seldom in those under 60.
- The cardiac conduction system is also influenced by the ageing process. In general, collagen, elastin, reticulin, and a fatty tissues infiltrate the conducting tissues.

The Heart

- The pericardium is thicker and less compliant.
- The valvular structures experience collagen deposition and degeneration, lipid accumulation, and calcium deposition.
- The circumference of all four cardiac valves increase.
- On the whole, the observed cardiac changes serve to reduce myocardial compliance, reduce maximum attainable heart rate, decrease cardiac output, and lower $V_{O2\text{max}}$.
- A direct consequence of this is that the ageing heart must work harder to meet the metabolic demands of the body at any given workload.

The Cardiovascular Health Study, (the only population-based, longitudinal study of cardiovascular diseases in older adults), moderate exercise (approx 4 METS) 3 days a week throughout the year would increase the annual risk of MI only negligibly among older men and women.
Heart rate

- With aging there is also a decrease in the rate at which the heart rate returns to resting values following maximal and sub-maximal efforts.
- It would seem appropriate to allow masters athletes longer recovery times between intervals than would be allowed for younger athletes of similar fitness status.
Heart rate

- In people over 60 years of age, maximum heart rates can range from over 200 to as low as 105 beats/min. This is an enormous variation! In addition, individuals who are taking B-blockers have their maximum attainable heart rate pharmacologically suppressed.

- A better operating guide (than 220-age) is to advise participants to exercise initially at an intensity that permits them to carry on a reasonable conversation.
In athletes over 35 years of age atherosclerotic coronary artery disease is by far the most common cause of fatal events.

The incidence of sudden death during athletic activity is low, ranging from 1 per 13,000 man-hours of activity in cross-country skiing, to 1 in 396,000 man-hours of activity in jogging. The causes of sudden death in athletes are essentially the same as the causes of sudden death in nonathletes.

Cardiovascular preparticipation screening of competitive athletes. A statement for health professionals from the sudden death committee (clinical cardiology) and congenital cardiac defects committee (cardiovascular disease in the young), American Heart Association. Circulation 1996;94:850–856
There is some evidence that demonstrates a trend toward a more widespread distribution of sudden death due to hypertrophic cardiomyopathy.

The distribution is across a broad expanse of ages from 7 to 78 years and continued to occur in midlife and beyond (including 20% after 65 years of age).

Similarly, heart failure–related deaths did not show statistically significant differences among the age groups with respect to occurrence and annual mortality.

Only with stroke were differences according to age identified, with significantly increased occurrence of death and annual mortality in the elderly.
The Pulmonary System

- There is a progressive deterioration in respiratory function that is directly attributable to the aging process. Consequently, aging athletes tend to experience breathlessness at lighter workloads than when they were younger.

- There is a progressive degradation of the collagen and elastin fiber content of the pulmonary parenchyma. As progressively greater amounts of elastic recoil are lost, the work associated with breathing increases.

- These weaker and stiffer muscles are less able to generate the aspiratory pressures needed to ventilate the lower lung lobes where blood profusion is the greatest. Consequently, respiratory gas exchange is less efficient.
The Pulmonary System

- Reduced inspiratory capacity
- Reduced forced expiratory volume in 1 second (FEV1)
- Increased residual lung volume
- Reduced total lung capacity
- Reduced tidal volume
- Reduced vital capacity
- Comparison of the world records for the marathon at age 40 (2h 11 min 4s) and age 80 (4 h 23 min 55 s) illustrates how significant these changes are in terms of performance!
VO2 Max

- Physiologists consider that an individual’s maximum oxygen uptake VO2max such is the single most reliable indicator of fitness.
- Evidence indicates that beyond the age of 35 there is an inevitable decline in an individual's VO2max such that by the age of 60 it is often reduced to 80 per cent of that at the age of 20.
- This represents a rate of decline of 0.5 to 1.0 per cent annually.
- For elite masters athletes the annual rate of decline may be as low as 0.1 per cent, a tenth of the rate seen in inactive people.

Maximum oxygen uptake (VO2max) and body composition have been shown to deteriorate with age. How much of the decline is attributable to aging and how much is affected by reduced physical activity is not known.

Fifteen well-trained master endurance athletes [62.0 +/- 2.3 (SE) yr] and 14 sedentary control subjects (61.4 +/- 1.4 yr) were reevaluated after an average follow-up period of approximately 8 yr to obtain information regarding the effects of physical activity on the age-related decline in maximal O2 uptake capacity (VO2max).

These findings provide evidence that the age-related decrease in VO2max of master athletes who continue to engage in regular vigorous endurance exercise training is approximately one-half the rate of decline seen in age-matched sedentary subjects.

1. Decline in VO2max with aging in master athletes and sedentary men M. A. Rogers, J. M. Hagberg, W. H. Martin 3rd, A. A. Ehsani and J. O. Holloszy Department of Medicine, Washington University School of Medicine, St. Louis, Missouri 63110.
2. Effect of age and training on aerobic capacity and body composition of master athletes M. L. Pollock, C. Foster, D. Knapp, J. L. Rod and D. H. Schmidt
A 1984 study published in JAMA demonstrated that older persons respond to prolonged, high-intensity endurance training with an increase in sensitivity to insulin and a favorable alteration in their plasma lipoprotein-lipid profile.

Effects of Endurance Training on Glucose Tolerance and Plasma Lipid Levels in Older Men and Women
Douglas R. Seals, PhD; James M. Hagberg, PhD; Ben F. Hurley, PhD; Ali A. Ehsani, MD; John O. Holloszy, MD
Fluid status

- Kenny and Anderson have demonstrated that aging athletes competing in hot and humid environments sweat the same volumes as younger competitors.
- When the environment is hot and dry, aging competitors produce substantially less sweat than their younger opponents.
- Aging is also associated with a reduced sensation of thirst.

Kenny, WL, Andersen, RK. Responses of older and younger women to exercise in dry and humid heat without fluid replacement, Medicine and Science in Sports and Exercise, 1988, 20, 155-60.
Osteoporosis

- The greatest threat to the skeletal integrity of the aging adult is osteoporosis.
- Men often do not appear to experience losses until the age of 50 and usually experience no sequelae until the eight decade of life.
- Women frequently begin losing bone mass in their early thirties. As a result of this earlier onset and higher rate of loss, by the time many women have reached their seventies they have lost more than 30 per cent of their total bone mass!

Osteoporosis

- The first indication of a problem usually occurs when the competitor experiences a fracture following a minimal trauma.
- Loss of bony mechanical strength is the greatest threat to individuals who have lived largely sedentary lives and begin training when they are 50 or older.
- Age does not appear to be a limiting factor in bone’s ability to respond to mechanical stresses.
- Regular physical activity not only slows down the rate of bony demineralization but to some extent may even reverse it.

Osteoporosis

- Bone density was studied in intercollegiate athletes and older athletic women.
- Eleven intercollegiate tennis players, 23 swimmers, and 86 older “athletic” women from 23 to 75 years of age were compared with age-matched nonathletic controls.
- Therefore the largest variance (increase) from age-matched controls occurred in the oldest “athletic” group.
- It is concluded from this cross-sectional study that a regularly maintained athletic program for adult women may reduce the rate of “normal” bone mass loss accompanying age, particularly postmenopausally. Whether this will also decrease the risk of nontraumatic fractures in later life has yet to be determined.
- Although exercise-induced BMD benefits are reduced after retirement from sports, former male older athletes have fewer fractures than matched controls.


Cartilage

- Research demonstrates that articular cartilage experiences a number of age-related alterations.
- The most important of these is the loss of tissue compliance that occurs as a result of the cross-linkage stabilization of collagen molecules.
- This stabilization renders cartilage increasingly brittle and less able to cope with repetitive stresses.
- Aging cartilage also contains less water and has increased concentrations of keratosulphate and chondroitin sulphate.

Skeletal Muscle

- Aging is accompanied by a loss of muscle tissue. At the cellular level there is a loss of muscle fibers and atrophic changes occur in those that remain.

- Larsson et al. have shown a selective atrophy of the type II (fast-twitch) fiber population, with the type I (slow-twitch) fiber population remaining fairly stable.

- Type I fibers are recruited extensively for the postural and low intensity activities that dominate the lives of most elderly people.

- Muscle remains biochemically stable during aging. The levels of both the aerobic and anaerobic muscle enzymes are consistent with those of younger individuals in terms of their activity per unit of muscle weight.

- With aging, there are fewer available muscle fibers in each motor unit and possibly fewer motor units.

Skeletal Muscle

- Strength decreases very slowly until approximately age 50 when it begins to fall off more rapidly. Despite this, the anticipated loss of maximum voluntary strength at age 60 should not normally exceed 10 to 20 per cent of an individual’s maximum strength.

- Young individuals acquire strength increases primarily through muscular hypertrophy, whereas older individuals appear to increase their strength mainly through improved motor unit recruitment.

- Aging athletes rely on using the muscle that they have more efficiently. The speed of muscular contraction is reduced in aging muscle, and this may in part result from a delay in nerve impulse transmission at the motor end-plate.

Skeletal Muscle

Damon has shown that the maximum velocity of muscle contraction possible against any given mass decreases with age.

This may be why power events are the area in which aging athletes have traditionally done the poorest in comparison with their younger opponents.

Leg Strength

- It has been reported that maximal strength peaks at 30 yr of age, plateaus, and remains relatively stable for the next 20 yr, with an age-related decline in strength becoming significant after age 50.

- In a study of male master runners, participants ($N = 107$, age range = 40-88 yr) were tested for maximal strength of the leg extensor muscles. A subgroup of 30 master athletes participated in muscle biopsy testing. The effects of age were addressed by subdividing the sample into five cohorts.

- These data suggest that chronic endurance training can delay the age of significant decline in peak torque and changes in muscle morphology characteristics of the Vastus lateralis.
Hematology

Research strongly suggests that the hematological values of healthy subjects over the age of 85 are the same as those of young adults.

This includes values for blood volume, red blood cell count, hemoglobin, hematocrit, serum iron, erythrocyte sedimentation rate, and white blood cell count.

Connective Tissue

- Hamlin et al. found that collagen isolated from the tissues of a 40-year-old diabetic resembled those found in healthy individuals over 100 years old.
- The greater the amount of tissue rigidity required, the greater is the amount of cross-linkage.
- Many of the age-related alterations that occur in collagen are focused on the cross-linkages. As collagen ages, its molecular stability increases and so the tissues in which it lies becomes less compliant.
- Exercise seems to enhance the rate of collagen turnover. In this way, exercise shortens the life-span of collagen molecules and retards the process of cross-linking.
- Ageing connective tissues also experience a reduction in their water content.

Skin

- Skin ages as a result of:
  - intrinsic structural and functional changes
  - extrinsic influences: such as ultraviolet light, wind, and thermal stress.

- Many age-related changes occur below the skin surface and have direct applications to the ageing athlete.

- Thinning of the epidermal, dermal, and subcutaneous layers of the skin occurs with age.

Skin

- When exposed to minor mechanical trauma, aging skin will often tear at intensities that would leave younger skin unaffected. This should be kept in mind particularly when applying adhesive tape to the skin of an ageing athlete.

- After the age of 30, an individual loses approximately 2 per cent of his or her melanocytes annually.

- The ageing person will tolerate longer exposures to the sun before becoming sunburned. Yet, they are still experiencing ultraviolet-induced damage!

Flexibility

- Aging tendons and ligaments become progressively less compliant and increasingly more vulnerable to injury.
- Severely traumatized ligaments will never return to their original length, their stress-strain characteristics will be permanently disrupted, and microscope examination will reveal evidence of collagen fiber failure.
- Aging also appears to be associated with a reduction in the glycosaminoglycans concentration found in tendons.
- Inflexible people encounter greater resistance to work and so expend more energy to accomplish a given task.
- While the age-induced losses are permanent, the inactivity-induced losses are not.
- Failing to warm up is a mistake that the ageing athlete can’t afford to make and is often costly in terms of unnecessary time lost to injury.

Neurologic Changes

- A reduced rate of cerebral spinal fluid production and turn-over.
- Increased size of the brain’s ventricles.
- Decrease of brain weight by as much as 20 per cent between the ages of 45 and 85, most of which is attributed to a loss of extracellular fluid rather than neurons.
- Loss of 50,000 to 100,000 neurons daily from the cerebral cortex, spinal cord, and peripheral nerves.
- The senses are also affected by the ageing process.
  - Presbycusis.
  - Presbyopia.
- Older individuals have more trouble remaining asleep than falling asleep, they wake more often, and, once awakened, they remain awake longer than younger individuals.

Reaction Time

- One of the most valued of athletic abilities is an individual’s reaction time, and this clearly slows with advancing age.
- It should be noted that the reaction times of older athletes have been shown to be shorter than those of younger sedentary individuals, but not shorter than those of younger athletes.

Focus & Stress

- It seems that older athletes are less efficient at focusing their attention on a specific task during a stressful situation. Even the most highly skilled ageing athlete will probably experience performance deficits while competing in highly stressful situations.

- On the other side, the ageing athlete will have greater difficulty coping with novel situations that arise during competition.

Psychosocial issues

- Psychosocial issues play a major role in the performance of all athletes and are particularly relevant to the success and failure of the aging athlete.
- Aging competitors almost always have more financial, professional, social, and family obligations than their younger rivals.
- This translates into more distractions, disruptions, preoccupations, concerns, commitments, time compression, and fatigue.
- Pressured athletes often hurry their warm-ups, ruminate during their work-outs, and then cut their cool-downs short.

Psychosocial issues

Kavanagh and Shephard conducted studies on the participants at the 1985 World Veterans Games and found that the top three reasons for participating in the games were as follows:

- To belong to a group, 92.8 per cent;
- To enhance mood, 90 per cent;
- Fitness, 54 per cent

The aging competitor is generally more concerned with the psychosocial benefits of sports involvement than the physical benefits.

Psychosocial issues

- Individuals who do not begin competing until they are older often enjoy several years where their performances continue to improve.
- These people often describe themselves as feeling almost "immortal" because while everyone around them is physically deteriorating, they are actually achieving personal bests.
- When these individuals reach the point beyond which athletic improvement is no longer physically possible, they often undergo an intense grief reaction.

Psychosocial issues

- When athletes performance declines due to age, they convince themselves that all that is needed is to train harder, longer, faster, further, and more frequently.
- When athletes adopt this approach, they overtrain, their performances worsen, and their chances of becoming injured increase dramatically.

Athletes have difficulty accepting that they can no longer perform at a given level. It is in this state of mind that the grieving athlete is at the greatest risk of abandoning sport entirely. ‘I don’t want to be remembered as a has-been.’ Their athletic involvement is a highly valued component of their self-image and this is seriously threatened when an injury restricts their active participation.

Psychosocial issues

- Athletes who learn to accept aging are often the happiest because they have come to accept that the greatest satisfaction that any athlete can derive from a contest is to give his or her best effort, regardless of winning.

Injuries
Injuries

- Masters competitors are potentially the victims of two distinct types of injury:
  - those resulting from their current training and competing
  - those that occurred in their youth and return to haunt them.

Risk of Injury

Risk of injury increases with obesity, volume of exercise, and participation in vigorous exercise such as competitive sports, whereas higher fitness, supervision, stretching exercises, protective equipment such as bike helmets, and well-designed environments protect against injury.
Risk of Injury

- The most common risk of physical activity in adults is musculoskeletal injury.
- The incidence of injury can be as high as 55% in 8 weeks among women undergoing US Army basic training.
- In contrast, injuries are rare in research studies of supervised exercise training among older adults when individuals at high risk of injury are excluded.
- In a cohort study of community adults aged 20 to 85 years with above-average activity levels, 25% reported a musculoskeletal injury over 1 year, and one third of injured adults stopped exercising.
Risk of Injury

- Detailed guidelines for prescribing exercise in patients with and without cardiovascular disease are provided in the AHA Exercise Standards for Testing and Training.

- Recommendations are also available for the incorporation of resistance and flexibility exercise training.
Risk of Injury

- A Consensus Group from the AHA and the American College of Cardiology considered routine exercise stress testing before the initiation of a *vigorous* exercise program in healthy men >45 and women >55 years of age as a Class IIb Recommendation—(ie, a condition in which the usefulness and efficacy is not well established.)

Exercise and Physical Activity in the Prevention and Treatment of Atherosclerotic Cardiovascular Disease A Statement From the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity)
Vigorous physical activity acutely increases the risk of sudden cardiac death and myocardial infarction among individuals with both diagnosed and occult heart disease.

Atherosclerotic CAD is the overwhelming cause of exercise-related deaths in adults. The incidence has been estimated to be 1 exertion-related death per year for every 15,000 to 18,000 healthy adults.

Exercise also transiently increases the risk of acute myocardial infarction.
Define: “Vigorous”

Vigorous-intensity activities are those performed at a relative intensity of >60% of O2max (or absolute intensity of >6 METs). For example, brisk walking at 4.8 km · h⁻¹ (3 miles · h⁻¹) has an absolute intensity of 4 METs. In relative terms, this intensity is considered light for a 20-year-old healthy person but represents a vigorous intensity for an 80-year-old person.
Healing

- Research indicates that aging has a detrimental affect on the healing process.
  - The inflammatory phase.
  - The proliferative phase.
  - The remodeling phase.

- All three phases are detrimentally affected by the aging process. With aging there is dampening of the inflammatory phase. There is also a delay in the cellular migration, proliferation, and maturation that occur during the proliferative phase. Remodeling phase, collage is laid down less rapidly, in smaller volumes, and with altered binding patterns.

- There appears to be no age-related decline in the rate of fracture healing.

How do we deal with Injuries in Mature Athletes?

- What are the co-morbidities?
- Gait, balance, or foot issues
- Soft tissue injuries / overuse
- Somatic Dysfunction & Postural Imbalance
- Need for assistive devices
- Functional deficits
Rehabilitation

- Knortz has pointed out that immobilized geriatric patients are at a **dual disadvantage** in terms of muscle fiber alteration.

- Not only do they continue to experience the selective fast-twitch fiber atrophy that occurs with aging, but they also experience slow-twitch fiber atrophy in response to their immobility!

Rehabilitation

- Rehabilitating an injured athlete is perhaps the most important aspect of treatment.
- The aging athlete’s physiology results in slower healing and the rehabilitation program must be adjusted accordingly.
- As a general guideline, when estimating the rehabilitation time required for an older athlete twice as much time should be allowed for someone aged 60 as for someone aged 20.
- An athlete aged 75 or more will probably require three times the standard time.

Medications

- A number of pharmacokinetic changes are associated with the age of process.
  - Reduced absorption
  - Altered distribution
- Thus water-soluble medications will be distributed over a smaller volume and will have a greater effect for a given dose.
- Fat-soluble medications will be dispersed over a larger body volume and so have a diminished effect for a given dose.
- Plasma binding proteins
- Reduced renal clearance---aging is clearly associated with a loss of renal tissue and a reduced glomerular filtration rate.
- Reduced hepatic clearance
- Reduced cell receptors
NSAIDs

- **First**, NSAID-induced gastrointestinal complications occur more frequently in older people, particularly women or individuals with a history of peptic ulcers.
- **Second**, aging is associated with an increased incidence of adverse reactions to NSAIDs.
- **Third**, the anti-inflammatory and analgesic effect of NSAIDs may mask the warning pains that an individual normally recognizes as suggesting that it is time to stop.

OMT in the Mature Athlete

- Mature athletes tissues are less flexible, more fibrotic and stiff. This effects how mature athletes are examined, and treated.
- Mature athletes have acute and chronic problems and respond slowly.
- Depending on the clinical situation, it may be necessary to avoid or modify the use of HVLA techniques in the mature athlete.
- The practitioner may find that the musculoskeletal changes associated with aging and the precaution previously noted, make OMT modalities such as counterstrain, muscle energy, soft-tissue, myofascial release, and articulatory and joint play techniques preferable choices.

Considerations: Somatic Dysfunction

- Standing screening exam, gait, balance
- Look for a postural pattern
- Palpate/evaluate for the area of greatest restriction
- Find related tenderpoints
- Develop an objective prior to embarking on OMT
- Gentle, frequent treatment
Goals of OMT in the Mature Athlete

- Prevent secondary disabilities; restore functional ability
- Postural drainage.
- Respiratory assistance.
- Stretching tight fascial sheaths.
- Mobilize and move fluids; blood, lymph, CSF, urine, digestive fluids.
- Aid digestion and elimination.
- Relive pain.
- Restoration and maintenance of autonomic balance.
- Increase the patient’s feeling of well-being.
- Maintenance care

OMT Pearls:

- **Technique Considerations:**
  - HVLA epigastric thrust works the best due to traction
  - Counterstrain: may be difficult when they don’t relax well.
  - Muscle energy: athletes tend to push too hard
  - Cranial: can help at any age.
  - Direct Myofascial release: is slow and needs appropriate force (“tough” tissue)
  - Articulation: combine with MET in the “tight spots.”

- **Positional Considerations:**
  - Side lying techniques and seated techniques are helpful.
  - Lying prone can aggravate necks unless you have a face cradle.

- **Particular Patient Considerations:**
  - They all have bad feet and knees. “Treat the feet” Think: Shock absorption.
  - Stopping their sport to heal is “not an option”
  - Work around their stiffness, *it doesn’t improve that much.*
  - Patients with cervical stenosis require 2-3 pillows or folded towels under their neck.
  - Trochanteric bursitis and ITB tension is common. SIJ’s are very stiff.
  - Hip extension restriction may be both DJD and psoas hypertonicity.
TREATMENT CONCEPT

- A fused joint is not painful
- A joint with normal motion is not painful
- A joint with a restriction of normal motion or excessive motion is!
- Determine which segment is too loose and which is too tight.
- The objective is to restore normal physiologic motion
- Dr. Kappler: “Improve the patient’s motion (function) within their pre-existing structure!”
If I could only treat 3 regions....

- **Rib 2-4 dysfunction**
  - Epicondylitis
  - Neck Pain
  - Hand paresthesias

- **Flexed upper lumbar & Psoas spasm**
  - Low back pain

- **Extended dysfunction in the T-L junction**
  - Tight lat. Dorsi, and QL
  - Shoulder pain, stiffness
  - LBP
If I only knew 3 techniques...

- Supine Rib Counterstrain
- Psoas Muscle Energy
- Patient Astride table / Walk around
If I only had 3 minutes……

- Seated Articulatory
- HVLA: T-L junction
- Psoas Muscle Energy: Supine
- CS- Rib supine
How do I code it?

- 99213: E/M code with -25 modifier
- 98926: 3-4 region OMT

**IMPRESSION**

1) Achilles tendonitis
2) Mechanical LBP
3) Somatic Dysfunction
   - Lumbar
   - Thoracic
   - Rib

**PLAN**

1) RICEM
2) Tulis heel cups
3) Ibuprofen 600mg p.o tid x 14d
4) Hamstring & calf stretches
5) Decrease running 10%
6) OMT
   - HVLA, DA- Thoracic
   - CS- Rib
OMT and Exercise

- Mental, physical, and emotional benefits
- Exercise can facilitate the healing process initiated by OMT
- Decreased functional capacity occurs with aging
- Exercise can modify risk factors for disabling diseases
- Exercise may actually slow biologic aging
- Exercise prescription (active and passive exercises)
  - Address functional impediments
  - Progressive resistance and isometric exercises
  - Stretching
  - Balance-enhancing activities

The Training Program

Consider:
- Injuries
- Hydration
- Nutrition
- Medication
- Warm-up activities
- Safety
- Medical Conditions
- Functional Compensations

The Environment

- **Intrinsic environment**
  - structure, strength, flexibility, endurance, balance, physical and emotional state)

- **Extrinsic environment**
  - weather, geography, equipment, facilities, competition, timetable
Warm-up & Cool down

- Warm-up activities should include motions that occur in the activity / sport being played.
- Warm-up should precede any prescribed exercise program.
- Warm-up improves circulation by arterial dilatation.
- Warm-up in the elderly takes longer.
- Break a sweat.
- Cool down, check pulse rate, hydrate, carbs.
Stretching

- Stretch muscles when they are warm
- Hold static stretches > 1 min
- Limit the use of ballistic stretches, in older athletes
- Dynamic ROM activities work well
- Controversial if stretching alone prevents athletic injury
Postural Balance & Proprioception

- Make a “short” foot
- Stand on one leg
- Arms out, eyes open
- Arms crossed, eyes open
- Arms crossed, eyes closed
- Repeat on wobble board
- Work on balance beam
- Mini-Trampoline
- Sport Specific Movements
Physical activity, ranging from walking to vigorous exercise, has been linked to reductions in morbidity, mortality, functional decline, mobility, disability, and coronary heart disease.

A well-defined collection of structural and physiological changes occur with ageing and many of these alterations are associated with decline in psychosocial environment very different from that of his or her younger opponents.

The structural and physiological changes associated with an inactive life-style may be the greatest health threat facing our ageing population.
Summary

- The ageing competitor appears to be less able to handle the stresses associated with performing in the heat, the cold, or at altitude, but the age-related changes that are involved here are not nearly as important as the effects of diminished cardiovascular fitness, disease processes, and acclimatization.

- If we follow this advice it may be possible to live up to the motto of the American Health Foundation which states:
“The art of living consists of dying young, but as late as possible. It appears that participating in a sports program is one way to truly add life to your years.”
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