

## From Middle-Age to the Golden Years: Medical, Surgical and Rehabilitation Considerations to Maintain Exercise and Sports Activities with Knee Osteoarthritis

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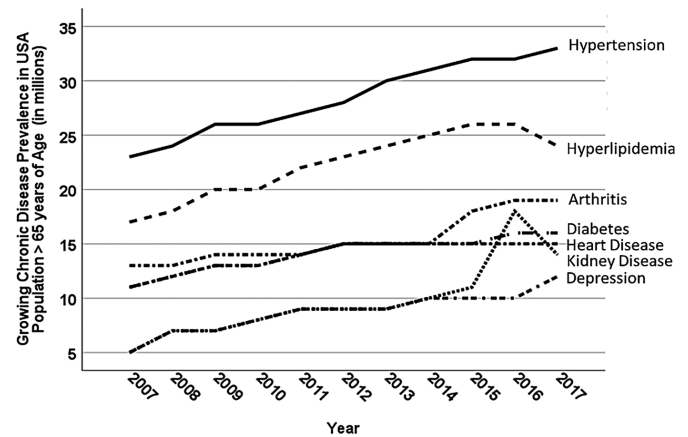
**Abstract.** The objective of the current concepts paper is increase the reader's awareness and understanding of medical, surgical, and rehabilitation considerations for middle-aged patients with knee osteoarthritis who desire to preserve knee joint function and quality of life as they continue exercise and sport activities into their «golden years».

**Key words:** osteoarthritis, knee joint, physical exercises, «golden years».

### Introduction

Historically, the «golden years» referred to the period of life between 51 years of age until the end of life [1]; representing the «late years» in someone's life during which they are considered «old» [2]. Some question if this term still belongs in our vocabulary because the lifespan and definition of retirement from one's vocation has changed over recent years with these years now generally beginning at age 65 and lasting until age 80 and beyond [3]. The former «golden years», which once lasted about one decade, can now last up to 30 or more years [4].

In addition to concerns related to past medical and surgical histories, there is growing concern about different age-related comorbidities (Figure 1), and the presence of any genetic predispositions [5]. Concurrently, an aging person who desires to become or remain athletically active may have concerns related to balancing leisure activities with feelings of boredom and possible musculoskeletal injury risk. In moving forward with selecting the best combination of activities, each individual person with a knee injury history or osteoarthritis diagnosis should deeply reflect about their past and current health issues and behaviors. Both surgical and medical health histories should be reviewed in addition to body composition (obesity, lean muscle mass), tobacco product or alcohol use behaviors, medication needs, existing exercise lifestyle (relatively active or sedentary), the presence of any chronic pain conditions, and the availability and use of community-based health and wellness support systems.



**Figure 1.** Chronic disease growth from the USA Medicare Database. Original figure based on data from O'Neill Hayes T, Gillian S. Chronic disease in the United States: A worsening health and economic crisis. American Action Forum. September 10, 2020 [5].

A growing concern for aging individuals is the variety of prescribed or over the counter medications that they may be using for various conditions. Polypharmacy is a growing aspect of modern medicine, that is directly connected to aging and the presence of one or more co-morbidities. Any medication that has a desired treatment effect is likely to also possess some undesired side effects, particularly with long-term use that might complicate or even decrease the healing process. In an aging population with a growing number of comorbidities that are being treated with prescribed medications, the increasing use of multiple prescription medications with adherence based solely on single disease use guidelines creates an increased likelihood for polypharmacy issues that may generate additional signs and symptoms, further complicating the treatment plan leading to adverse patient outcomes [6].

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An important factor to consider is which health-care team member oversees the total, detailed medication plan (prescription, over-the-counter medications, and even supplements) for the aging patient. When each medical specialist focuses exclusively on medication use only for the condition that they are directly treating, the likelihood for undesired side effects related to polypharmacy grows exponentially. Unfortunately, in the age of specialized and subspecialized care from a variety of independent health-care providers, lack of communication and cooperation could prove detrimental to patient health and musculoskeletal injury or condition treatment efficacy. The healthcare provided by different medical or surgical specialists intersect at their care for the individual patient. At these crossroads, it is essential that the right hand know what the left hand is doing, not leaving the aging patient to be the sole overseer of a potential plethora of overlapping medication side effects.

The surgeon evaluates the middle-aged athlete's arthritic knee through a comprehensive clinical examination for signs and symptoms, enquiring about what increases the patient's knee pain, swelling or stiffness, as well as possible contributing factors and their severity. Radiographs or magnetic resonance images (MRI) help to confirm the diagnosis only after the completion of a thorough history taking and skilled clinical examination. Lastly, any conditions of comorbidity or genetic predispositions that might complicate care should be documented. Patient chronological age often differs from their physiological age with some individuals seeming younger than their age, and vice versa. It is also essential that the knee surgeon have complete understanding of all medications that the patient is taking to determine how they might interact to adversely influence their treatment. Lastly, what is their activity level «comfort zone» and how might this be safely expanded to enhance quality of life.

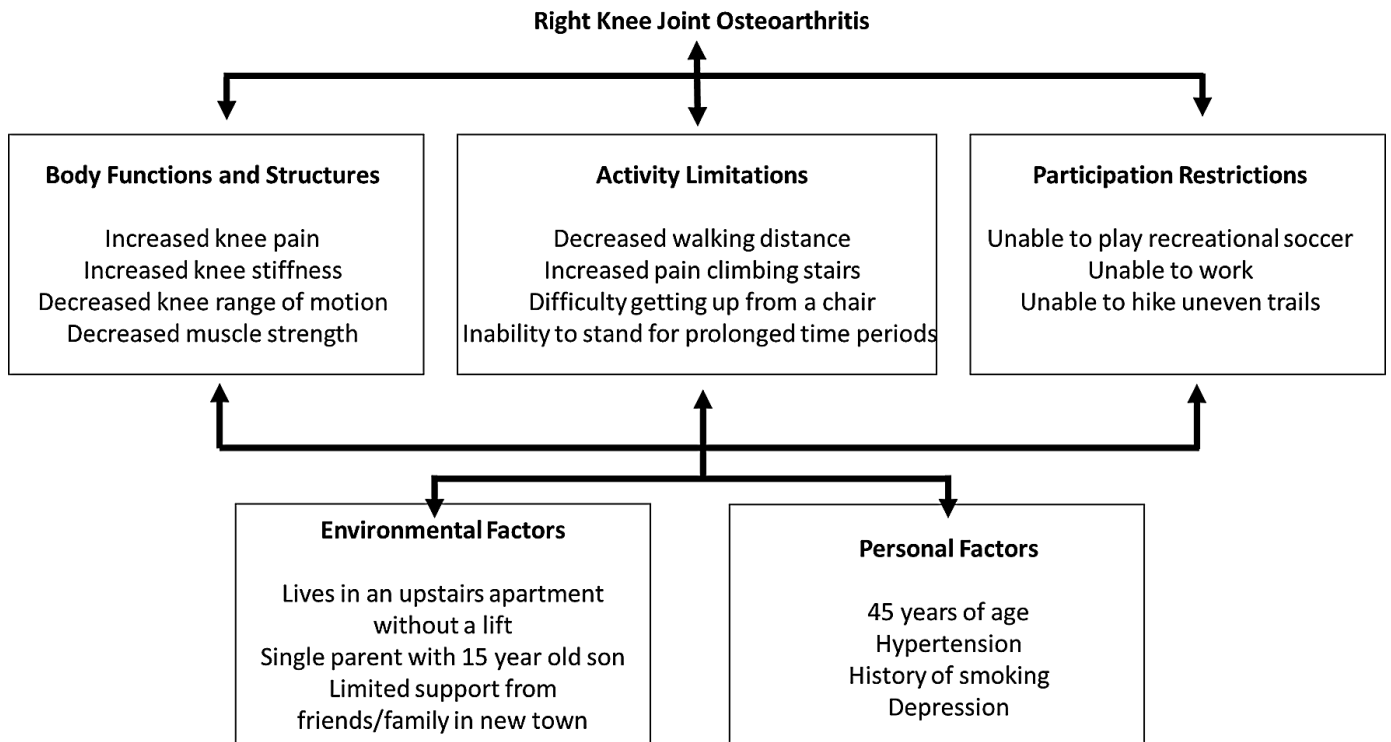
Contemporary healthcare literature suggests that following hip, knee or shoulder arthroplasty, patients can continue to participate in a variety of sports or other athletic activities provided that either impact loading forces are reduced, or that movements that exceed the limits of artificial joint liner stability zones are voiding, thereby reducing the wear and tear that leads to arthroplasty failure [7-10]. Regardless of the type of surgical or non-surgical care, it is important to understand that a surgical outcome and a patient outcome does not refer to the same thing. The surgical outcome refers solely to the details of the surgery that was performed such as knee joint alignment or leg length correction, fixation integrity, restoration of native joint congruity or replacement

with an artificial device. Successful surgery might be confirmed with radiographic or MRI evidence of characteristics such as these. In contrast, patient outcomes come from additional multidimensional factors that can be complicated by any and all kinds of physical, mental, behavioral, environmental or personal health conditions or characteristics and how they might interact with joint function to influence the patient's quality of life. In summary, patient care outcomes are potentially influenced by a multitude of diverging and converging factors [11] (Figure 2).

From a rehabilitation and exercise or sport activity counseling perspective, the healthcare team needs to understand what risk factors are most likely to exacerbate the knee osteoarthritis progression. These factors may include physical factors such as poor knee joint alignment (frontal plane), poor shock absorption (aggregate lower limb and core muscle strength impairments), poor neuromuscular control (deficient responsiveness or automaticity), impaired balance (greater dependence on vision for proprioception), obesity (poor strength : bodyweight ratio), and behavioral factors such as overeating, being too sedentary, or continuing to participate in high frequency, high impact activities without paying attention to important natural biomarkers such as knee joint pain, swelling or stiffness.

Although severe knee osteoarthritis generally warrants total knee replacement, less severe, or some unicompartmental knee joint cases may benefit from other surgical or non-surgical options. The surgeon must determine which knee joint preservation path might work best for each patient. If frontal plane knee malalignment overloads one knee compartment. Then tibial or femoral osteotomy may be indicated. Following surgical knee malalignment correction, or in less severe cases, biological ortho-regenerative treatments including stem cells, plasma rich in growth factors, or exosome injections may help improve knee function and preservation [12,13]. Foods with greater nutrient than energy density in combination with vitamin C, vitamin D, omega 3 fatty acids, and collagen peptides nutraceutical supplementation may further support this goal [14,15]. Use of footwear that better distributes loading forces during exercise and sports activities can help improve knee function and quality of life.

To preserve both knee and patient function, the chronic pain that many experience from prolonged knee joint osteoarthritis and its sequelae must be effectively managed (Figure 3). Chronic pain represents a unique disease that warrants the development of a comprehensive understanding of causes, symptomatology, provocative and non-provocative activities [16]. Concurrently, what are the patient's

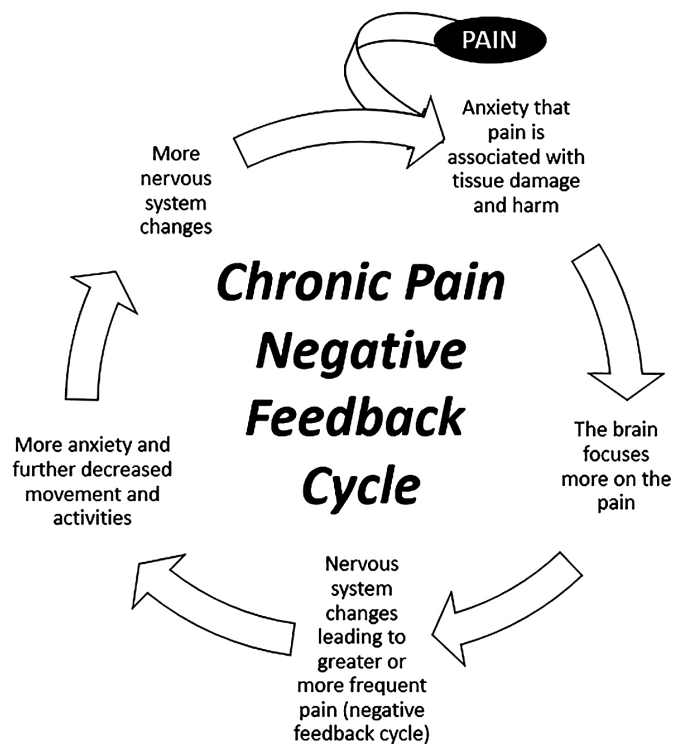


**Figure 2.** An example of factors that might influence patient treatment outcomes [In summary, patient care outcomes are potentially influenced by a multitude of diverging and converging factors [11].

expectations, and are they harmonious with their quality of life values, or are discrepancies evident that warrant further patient discussion and agreement to better preserve knee joint function. As part of chronic pain management, it is essential that task specific self-efficacy during essential tasks such as walking, climbing stairs, jogging or hiking, cycling, or swimming improve. To achieve this, a menu of different exercise or sport activity options should be developed that the patient can select from. In this way, they concurrently learn to better control knee symptoms and develop improved cognitive appraisal skills by listening to their body. For treatment success, exercise or sport activity frequency is key. Successful early exercise or sport activity frequency is more important than intensity or duration to develop the habits that lead to successful native or replacement knee joint preservation.

But what is the treatment objective? Continued high impact activities without load magnitude or loading frequency modification is likely to lead to the need for unicompartmental knee arthroplasty or TKA. However, with appropriate exercise or sport activity modification, native knee joint function can be better preserved or replacement knee joint longevity be prolonged. Although considered to be more related to adolescent athletes, something worth investigating is the relationship of the patient’s level of involvement in a particular exercise or sport activity

with their identification as a person [17-19]. For the aging patient to remove themselves entirely from an



**Figure 3.** For proper management, chronic pain warrants the development of a comprehensive understanding of causes, symptomatology, provocative and non-provocative activities.

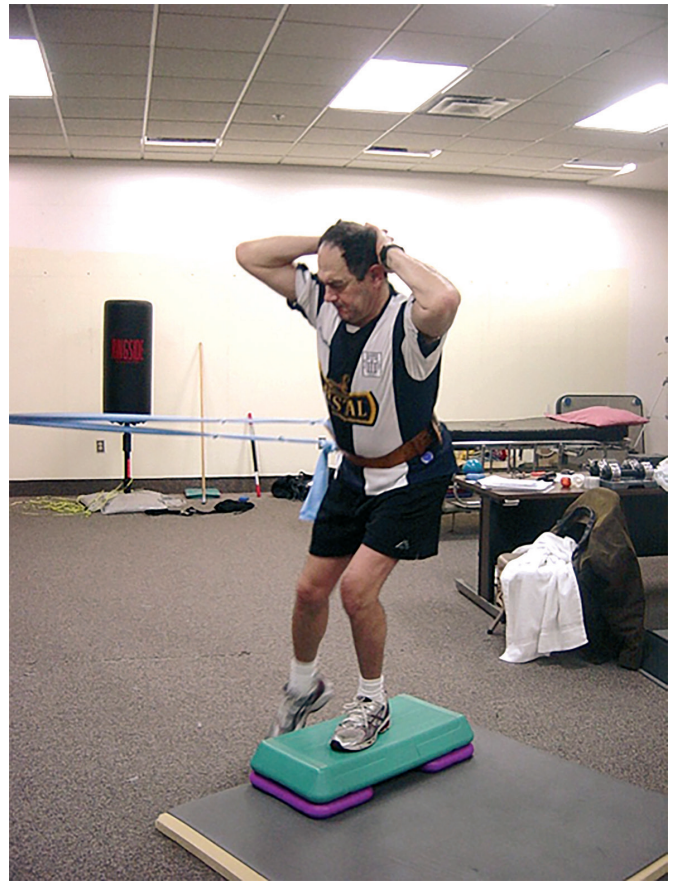
exercise activity or sport that they have played their whole life with high quality of life attributes, it may be too much to ask of them to completely discontinue it. This is currently a poorly understood area in the healthcare of aging adults. It behooves all healthcare team members to help the patient transition to a more sustainable, modified athletic self-identity to better preserve both their quality of life and knee joint longevity.

To preserve knee joint integrity during the transition from middle-age to the elderly years, there is a need to modify exercise activities or sports away from a purely performance-based perspective with the primary focus on neuromuscular quickness or power, to more of a «joint-centric» focus with greater emphasis on endurance and the duration of maintaining a pain-free joint. In association with this, personal quality of life factors may need to be revisited to re-establish the risk: benefit ratio of each exercise activity or sport. It is important that the patient knows the risk of continued participation without necessary modifications. The patient is more likely to be satisfied with the sustainable, quality of life path they have taken if their expectations have been met.

The rehabilitation team must restore lower extremity and trunk mobility in «positions of functional movements», correct or otherwise manage strength impairments, correct movement and balance impairments, restore composite lower extremity dynamic stability and neuromuscular control responsiveness/automaticity, improve sports movement specific agility, and restore metabolic energy system resilience and integrity (Figure 4).

All healthcare team members should understand that the outcome for any patient represents the intersection of numerous potentialities. Although the surgical outcome is a very important one, it represents only one of many influences. The characteristics of the type of surgery, the selected technique, and the components used in the surgery in effect represent only the very beginning of a functional recovery marathon race where multiple factors including rehabilitation, additional exercise activity or sport training, and other patient behaviors combine to generate early (2 years), mid-range (5 years) and long-term ( $\geq 10$  years) patient outcomes. In summary, the surgical outcome and rehabilitation is to the patient outcome as arriving at Mount Everest base camp (5364 m) is to summiting the peak of Mount Everest (8849 m).

A key element during both surgical and rehabilitation program planning is to have a comprehensive understanding of the individual patient's expectations to better identify which surgical or non-surgical approach and rehabilitation progression should



**Figure 4.** To correct or otherwise manage strength impairments, correct movement and balance impairments, restore composite lower extremity dynamic stability and neuromuscular control responsiveness/automaticity, improve sports movement specific agility, and restore metabolic energy system resilience and integrity the rehabilitation team must restore lower extremity and trunk mobility in «positions of function».

maximize treatment efficacy. Each patient may identify their own set of essential activities that positively contribute to their overall quality of life. Factors that are important to know prior to surgical planning are the patient's exercise or activity history, their need for and access to social or family healthcare support networks, the likelihood that the intervention will be successful (improve overall general, physical, and mental health, decrease fall risk, lower blood pressure, reduce bodyweight, improve heart function, etc.). Physiotherapists have a wide variety of thermal, electrical, sonic, and mechanical methods to help supplement improved tissue healing and joint function [20-22], however, in most instances, by far the most important factor that contributes to positive health outcomes is healthy exercise activity and lifestyle behaviors.

The most important positive behavior to embed in a sustainable fashion as a regular habit are exercise

activities («exercise is medicine»)[23]. The American College of Sports Medicine has established the Exercise is Medicine Global Health Initiative [12]. Older adults should engage in moderate exercise and strength training each week and the best exercise modes for seniors to prevent health problems and preserve independence are aerobic activity and muscle-strengthening [24]. Thompson et al. [23] developed recommendations for how to best integrate physical activity or exercise counseling during office visits. When no time is available because of having a busy clinic schedule, plans should be made to discuss exercise activity options at the next visit and a preprinted handout should be issued. If the physician has one minute available, they should acknowledge the patient's current activity levels and stress their relationship importance to health concerns or conditions. If the physician has two minutes available, they should review key messages with the patient about the importance of physical activity and offer a brief exercise prescription with resources that list community partners or support groups, programs, and online options. If the physician has 5 minutes available, they should assess the patient's true readiness for change, engage them about ideas and how to overcome real and perceived barriers to start becoming more active, provide a more detailed plan and resources to support that plan.

If they display relevance to the patient, exercise activities that combine safe joint and heart function benefits such as walking, hiking, cycling, running, swimming, golf, pickleball, doubles tennis, yoga, Tai Chi, Ai Chi, or dancing can be effective, particularly if a social support group is also developed [25]. Whichever exercise activities are selected, joint mobility in positions of function should be maintained, and the frequency, intensity, duration, and total volume should be sufficient to match physiological and psychological goals and needs (fulfillment, competition, stress reduction, etc.). Almost always okay are; golf, walking, swimming/aquatic exercises, bicycling (with restrictions), hiking (with restrictions), doubles tennis, pickleball, singles tennis (with restrictions), dancing (with restrictions), elliptical trainers, yoga, Tai Chi (or Ai Chi). To avoid burn out from doing the same exercise or sport activities year round, patients should consider creating exercise activity or sport seasons with changes taking place to simulate those of seasonal activities in their own country, region or locality. In addition to physiological changes, this also provides the opportunity for the establishment of different support groups

In addition to sports, patients should also perform sensorimotor system training for fall risk reduction; somatosensory system training for dynamic knee

joint neuromuscular control; joint mobility activities to maintain flexibility in positions of function, core strengthening, and essential anerobic and aerobic energy system training in non-weightbearing or limited weightbearing forms for a minimum of 2-3 weekly session. An essential part of selecting the best exercise activities or sports is to be aware of the patient's interest in learning new things, or how to best modify existing activities to better preserve health and knee joint function. Whenever possible, they should participate in the decision-making process, understand the risks of performance, and be able to adjust to second or third activity alternatives to better accommodate for any increase in knee joint signs or symptoms. The patient's capacity for modifying activities as needed to accommodate for minor sign or symptom exacerbations is related to successful exercise activity or sport participation longevity and knee joint homeostasis [26]. To mitigate complacency and boredom, and to keep motivation levels high, it is important for the patient to have future goals or desires whether they be related to a particular event (5k fun walk, summiting a mountain) or competition (pickle ball tournament). An important consideration to exercise activity or sport planning is the individual patient's pre-knee osteoarthritis activity history. Building upon past experiences can help with program sustainability, provided muscle memory is optimized and joint loading magnitude and/or frequency is modified to better preserve health. Whether undergoing a surgical or non-surgical joint preservation intervention, being active, but not abusive to the native or replacement knee joint is important. Highly repetitive, high magnitude knee joint loads are not a good idea [27].

In summary, the surgical and rehabilitation teams should establish effective dialogue to become more aware of each patient's unique characteristics, expectations, quality of life enhancers [28]. Counseling about exercise activities or sports should build on past successes, modifying activities to control joint loads when necessary. Patients who are interested in learning new exercise activities or sports should be encouraged to do so provided they have a firm understanding of the risk: benefit ratio and are aware of how to adjust participation options when knee joint signs or symptoms arise. To control for the potential negative influences of polypharmacy, at least one medical team member should oversee all medications and supplements taken by the patient. Building from past exercise activity or sport successes with continuing active joint use, but not abusive joint loading can serve as the foundation to a sustainable therapeutic movement/ activity plan as the patient transitions from middle-age to the elderly years,

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**Від середнього віку до «золотих років»: медичні, хірургічні та реабілітаційні міркування для підтримки фізичних вправ і спортивної діяльності при остеоартрозі колінного суглоба.**

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**Резюме.** Метою поточної роботи є підвищення обізнаності та розуміння читачами медичних, хірургічних та реабілітаційних міркувань для пацієнтів середнього віку з остеоартрозом колінного суглоба, які бажать зберегти функцію колінного суглоба та якість життя, продовжуючи фізичні вправи та спортивну діяльність у свої так звані «золоті роки».

**Ключові слова:** остеоартроз, колінний суглоб, фізичні вправи, «золоті роки»