Articular Cartilage Mechanisms, Regeneration and Outcome: Past Present and Future in the Athlete

The inherent nature of the game is played at the extremes of intense performance and at times is a high-impact contact sport associated with significant acute and chronic joint contact forces with potential detrimental effects to the joint surface. Articular cartilage injury is observed with increasing frequency in many athletes and is commensurate with the competitive level. Due to the limited spontaneous regeneration of articular cartilage injuries often lead to significant symptoms under the continued high demands of football ultimately resulting in the decrease in performance or the inability to play. This session amplifies the need to help advance the science and the understanding of articular cartilage injury and degeneration in the athlete as well as the options for its treatment and prevention. The approach to the athlete always uses the “Spectrum of Care” Paradigm. Prevention, Performance optimization, Injury care, rehabilitation and restoration and return to sport, prevention of re-injury and osteoarthritis and keeping the aging athlete healthy through exercise, These are the hallmark principles that illuminate the importance of these collaborative relationships.

During this session we will demonstrate how evidence based medicine (EBM) and innovation drives clinical decision making and practice with vice versa. The Scientific Evidence Base for Cartilage Injury and Repair in the Athlete frequently injure the Anterior Cruciate Ligament (ACL) and menisci. These injuries and the inherent risk of the game create an overall prevalence of knee articular cartilage lesions of 36% to 38%. The resultant for athletes with articular cartilage lesions is often challenging because of the high demands placed on the normal, repaired and regenerated tissue by the game over time. These cartilage defects in athletes can be treated with Microfracture, Mesenchymal Augmentation, Stimulation and Scaffolds (MASS) techniques, osteochondral auto or allogeneic tissues and autologous chondrocyte implantation. There is increasing and robust scientific evidence for cartilage repair in athletes, with more extensive information available for microfracture and autologous chondrocyte implantation than for osteochondral grafting. The ultimate challenge is the quality of the repair tissue; Repaired and or regenerated cartilage must closely must resemble and function like hyaline cartilage may be the most significant factor for the return to sport.

So what do we do for the specific athlete with a spectrum of cartilage deficits? How do we select the best specific option and at what timing? We will present the best available evidence for cartilage surgery and treatment selection, evaluate specific patient profiles for professional and recreational athletes, and propose a treatment algorithm for the treatment of focal cartilage lesions in athletes.

Once the intervention is completed attention to detail of post operative protocols, rehabilitation, and restoration of function, return to sport participation and competition and prevention of future injury and or progression towards osteoarthritis is essential. This necessitates a multidisciplinary approach to rehabilitation, especially in the transition from therapy to performance, training and playing in games. Return to sport is always a “significant challenge” as it should be recognized that not all players will return to sport after articular cartilage repair. Factors that must be considered are return rate, time to return and durability after return. The average return rate to sport after Articular Cartilage repair is 79% without a significant difference in return rate or postoperative level of play between cartilage repair techniques. The range of time to return varied between 7 to 17 months, with the longest time is for autologous chondrocyte transplantation (ACI). These parameters and expectations by the patient, athlete and coach must
considered in all clinical decisions. Advanced sport-specific and a multidisciplinary phasic rehabilitation were able to reduce recovery time. The durability of results was best after ACI, with up to 96% continued sport participation after more than 3 years. There are several factors that determine favorable and successful return to sport. These include player age (younger), time between injury symptoms and treatment (less time), competitive level of participation, (higher) defect size (smaller), and repair tissue morphology (hyaline or hyaline like). Sports and exercise participation after cartilage repair can and will facilitate joint restoration, functional recovery and fitness levels.

Although the spectrum of care approaches listed above are hopeful, the probability of developing Osteoarthritis in soccer players is 5 – 12 times more frequent than in the general population. It is also highest for the most elite athletes. It is also responsible for retirement in about a third of professional players and diagnosed 4-5 years earlier. This process is a spectrum of degeneration and loss of volume or chondropenia that ultimately leads to frank osteoarthritis The etiology is multifactorial and involves the demands of the game, biochemical, biomechanical, inflammatory, nutritional and aging factors. As a result, athletes, particularly those with a history of knee injury, have an earlier onset and higher prevalence of osteoarthritis that would be expected based on their age. In essence these are “old knees in young people”. It remains a major cause of disability from the sport of football (soccer). This is our call for concern!

Therefore the ultimate goal is a prevention paradigm. Prevention of the injury, whether acute or overuse, prevention of chondropenia and osteoarthritis and the progression over time. Injury prevention has been a major focus of through development of the PEP Program (Prevent Injury and Enhance Performance program) and then the evolution to the FIFA 11+ program. The PEP program was designed to reduce ACL injuries and several studies including a level I randomized control trial have documented significant reductions when this program is successfully utilized as a warm up. The evolution to the FIFA 11+ program now includes focus on not only knee, but also muscle, groin and ankle injury. Significant reductions in severe, overuse and knee injuries have been demonstrated in controlled trials Therefore injury reduction is not only possible, it can and should be a reality and part of any program. These programs are time efficient, easy to do, and are free of expense!

The natural course progression is that articular cartilage defects are to become osteoarthritis over time. The next step is how to prevent this progression?

Although recent treatments for damage to articular cartilage have been successful in alleviating symptoms, more durable and complete, long-term articular surface restoration remains the unattained. This hopeful and futuristic approach looks an at both new ways to prevent damage to articular surfaces as well as new techniques to recreate biomechanically sound and biochemically true articular surfaces once an athlete injures this surface. This “holy grail “objective should be to produce hyaline cartilage with a well-integrated and flexible subchondral base and the normal zonal variability. Newer surgical techniques, some already in clinical study, and others on the horizon offer opportunities to improve the surgical restoration of the hyaline matrix often disrupted in athletic injury. These include new scaffolds, single-stage cell techniques, engineered allogeneic tissues, the use of mesenchymal stem cells, and gene therapies.

The last step of the prevention paradigm is to prevent the progression of Osteoarthitis severity over time. There are a number of non-operative interventions have shown early promise in mitigating cartilage symptoms and in preclinical studies have shown evidence for the potential disease modification, chondrofacilitation and chondroprotection. These include the use of stem cells, glucosamine, chondroitin, and other neutraceuticals, viscosupplementation with hyaluronic acid, platelet-rich plasma, and pulsed electromagnetic fields

In conclusion, the approach to the athlete always uses the “Spectrum of Care” systematic paradigm. Prevention, Performance, Injury care, rehabilitation and restoration and return to sport, prevention of re-injury and osteoarthritis and keeping the aging athlete healthy through exercise. The main objective is to
identify the scope of these problems; develop multidisciplinary solutions with the major goal of prevention for now and the future. It was Einstein that said, “It is the intelligent that can solve problems but the genius will prevent them.”

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