

# Apple Cart

a core concepts musculoskeletal health group newsletter

## Back to Sports: Advanced Knee Rehabilitation

Knee Injury is one of the most common injuries sustained in sports. It can be in the form of meniscal or ligamentous injury, the most notorious being the Anterior Cruciate Ligament (ACL) tear. As a result of such injuries, athletes often get frustrated as they are unable to perform at their best or even engage in the sport itself. More often than not, athletes do not manage their injuries well and many will attempt to return to sports much earlier than optimal and usually end up worse than before.

Bringing a competitive athlete from injury back to sports requires much more planning than just restoring range of motion and strength. It requires a good understanding of the healing processes, in depth knowledge of strength and conditioning as well as biomechanics of the body in relation to each sport, and the most important of all, the ability to implement the rehabilitation process systematically and appropriately. It is a science all to itself.

There are three phases in the rehabilitation process; healing and restoration phase, strength and conditioning phase, sports conditioning phase. Healing and restoration phase usually takes about four to six weeks and aims to get the athlete back to full range of motion and normal gait. Strength and conditioning phase takes another six to eight weeks with the aim of helping the athlete regain about 80% strength, and at the same time progressively improve their cardiovascular endurance. Finally,

the sports conditioning phase aims to improve agility, balance, power and coordination. The phases are not distinct but overlap. With a thorough rehabilitation process, the athlete would be able to return to his sports with a firm foundation in all the key components of physical fitness, allowing him to ease into his sports training with confidence.

### Healing and restoration phase (Week 0-4)

Aims:

- Reduce swelling and effusion to a minimum.
- Restore normal gait pattern.
- The management of a knee immediately post-operatively focuses on the reduction of swelling and effusion and restoration of range of movement. Exercise such as isometric knee extension is introduced as well to reduce the rate of muscle atrophy and improve muscle control. Key issues of note:
- Terminal extension of the knee is often underemphasized. It is important to achieve terminal knee extension (or hyperextension) within the first 2 weeks so as to be able to regain normal gait as soon as possible.
- The application of neuromuscular stimulation to the quadriceps muscle would be useful as it has been shown to improve muscle strength and reduce the rate of atrophy.<sup>1</sup>

### Strength and Conditioning phase (Week 4-12)

Aims:

- Full range of motion and minimal swelling
- Unilateral knee exercises
- Achieving 80% muscle strength of the non injured knee.

Once the swelling has reduced significantly, full extension restored with flexion achieved to about 100-120 degrees, and normal gait almost regained, the athlete is then put through other strengthening exercises which can include cycling, leg press, step downs, mini squats (0-45 degrees flexion). All these exercises should be done with both legs, with emphasis on smoothness of execution of movement. The athletes are loaded with low weights at first and then progressed gradually to higher weights with low repetitions. Cardiovascular endurance exercises are also started at this phase.

Unilateral knee exercises can be started once the athlete has sufficient muscle control to do a single knee squat of 0-45 degrees flexion. Once the quadriceps and hamstring muscles of the operated knee can achieve about 80% strength of the uninvolved knee, it is time to move on to the next phase. The strength of the knee can be easily gauged by testing the knee on a leg press machine, comparing the weights that be achieved by each knee on a single set of 15 repetitions. A much more accurate test of the strength of the muscles can be done using the isokinetic machine.

The isokinetic strength test<sup>2</sup> is widely



Figure 1: Agility Ladder

used in sports clinics to evaluate the strength of muscles pre and post-operatively. However the main drawbacks of the test are that the data does not accurately determine the different performance between athletes of varying skill levels and do not correlate strongly with functional tasks.

### Sports Conditioning Phase (Week 12 onwards)

#### Aims:

- Achieve 90-100% muscle strength in quadriceps and hamstrings
- Achieve 90-100% in functional testing.
- Athlete is able to perform sports specific movements with ease.

Once the athlete can achieve 80% of quadriceps muscle strength and good control over single leg exercises, the next step will be to do functional tests to gauge the performance of the knee. Functional tests have been devised for athletes who had ACL reconstruction done. The tests include jumps, hops, agility and quickness in navigating turns. Various components of physical fitness listed above are tested i.e. agility, balance, power and co-ordination. As such, the tests are also suitable to be applied to chart the progress of athletes recovering from post-operative meniscal repair, menisectomy, and other ligamentous injury. Being functional, the tests would also be more meaningful as they mimic the movements that would be performed during the sport itself. At this phase, the athletes will be continuing to increase the basic muscle strength through the similar exercises listed in phase 2. These strengthening exercises will form the foundation from which the athletes will be trained in the other components.

#### Balance



Figure 2: Depth Jump

Balance is a state of equilibrium, the ability to control the body's position at rest or in motion. The athlete starts his balance training through balancing on 1 leg on a flat surface before progressing to balancing on unstable surface such as a wobble board. Subsequently, single leg hopping exercises will be introduced and progressed to multi-directional movements, where the level of difficulty is increased.

#### Power

Power is essential in sports such as basketball and soccer where the athlete jumps or sprints explosively frequently during the game. This power can be trained in various ways.

- Doing heavier weight training quickly with low repetitions can help to train the muscles to generate large forces in a very short time. These exercises can be performed on a leg press, leg extension or keiser machine.
- Doing sports specific training such as sprints, jumps repeatedly
- Plyometric exercises<sup>3,4</sup>, such as depth jumps, leg bounding and hopping have been shown to improve muscle motor performance. Plyometrics refer to exercise where the muscle is loaded with an eccentric action (landing from a jump), followed immediately by a concentric action (jumping up again).

#### Agility

Agility is the ability to change direction of the body quickly and effectively and very crucial if the athlete needs to evade the opponent during a game or prevent himself from being injured. The athlete is put through various drills



Figure 3: Isokinetic Strength Test

on the agility ladder involving twisting, turning and zig-zag movements.

#### Co-ordination

Co-ordination is the ability to execute a series of movements smoothly and accurately and requires the use of our senses. Complex sports specific movements such as dribbling on the move, evasion techniques and dodging are broken down into simpler movements and drilled before combining them to perform the more complex sports movement.

#### Return to Sports

An athlete that has undergone a thorough and complete rehabilitation program customized to his needs would then be much more confident and ready to his sports.

#### References

1. Snyder-Mackler L, Delitto A, Bailey SL, Stralka SW. Strength of the quadriceps femoris muscle and functional recovery after reconstruction of the anterior cruciate ligament: a prospective, randomized, clinical trial of electrical stimulation. *J Bone Joint Surg Am.* 1995;77(8):1166-1173.
2. Hislop HJ, Perrine JJ (1967) Isokinetic concept of exercise. *Phys Ther* 47: 114-17
3. Bartholomeu SA. Plyometrics and vertical jump training. University of North Carolina, Chapel Hill
4. Blackley JB, Southland D. The combined effects of weight training and plyometrics on dynamic leg strength and power. *J Appl Sports Sci Res.* 1987 1: 14-16

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