ANTERIOR KNEE PAIN (PATELLAR TENDONITIS) MANAGEMENT AND MODIFICATION IN BIKE FITTING FOR A TRACK CYCLIST

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An elite track cyclist experienced anterior knee pain in both knees over a 6 month period while training on his new bike and was diagnosed with patellar tendonitis. A bike fitting session was conducted followed by sprint performance on a trainer. When sprinting the cyclist slipped (7 cm ±1.7) forward from the initial position on the saddle leading to his knee joint shifting ahead of the pedal at 11 o'clock position and resulted in irritation and pain on the patellar tendon. An intervention was done to increase the handlebar height and to change the stem bar. It was then observed that the tendency to slip forward at sprints immensely decreased. The cyclist was then asked to familiarize themselves with the new bike setting for a period of 3 weeks and provide feedback where he reported that the pain had considerably reduced and he could regain his previous performance.

KEY WORDS: cyclist, anterior knee pain, bike fitting.

INTRODUCTION: Cycling was considered as one of the recreational sports in earlier days. With the introduction of various forms of competitive cycling, like long distance cycling, mountain cycling, track cycling, triathlon, etc., and with competitions being organized all over the world, the cyclists have been training hard to excel in this sport. As such, the rate of cycling related injuries seems to have increased in many sports medicine and training centers. Most of the common cycling injuries of the lower extremity are preventable (Gregor, Komi & Jarinen, 1987; Holmes, Pruitt & Whalen, 1991; Holmes, Pruitt & Whalen,1993; Holmes, Pruitt & Whalen,1994; Wanich, Hodgkins, Columbier, Muraski & Kennedy, 2007). Knee pain, patellar quadriceps tendonitis, iliotibial band syndrome, hip and low back pain (Mellion, 1994; Joseph, Ganason, Jalil, Aizam & Wilson, 2006;) are some of the common injuries in this sport. Injury in cycling could be caused due to permutations and combinations of inadequate planning and preparation (Mujika & Padilla, 2001), inappropriate dimensions of the equipment (Holmes et al, 1994; Sanner & O'Hallorna, 2000), poor muscular coordination and technique (Holmes et al, 1991; Sanner & O'Hallorna, 2000), and overuse (Barrios, Sala, Terrados, & Valenti, 1997; Clarsen, Krosshaug, & Bahr, 2010). To derive the best out of the cyclist, the coaches and the trainers should develop individualized and specific training (Jeukendrup, Craig & Hawley, 2000). At the same time the coaches/trainers/cyclists should seek the help of biomechanists in selecting appropriate equipment, setting up a bike fit based on the performance and physical characteristics of the cyclists ensuring proper rider position and pedaling mechanics (Burke, 1994). Ultimately the training and bike fit should focus on injury prevention (Mellion, 1991; Callaghan & Jarvis, 1996; Sanner & O'Hallorna, 2000).

Anterior knee pain and patellar femoral pain syndrome are the most common overuse injuries evaluated in various sports medicine centers. Overuse injuries may occur when tissues are damaged by sub-maximal to maximal loading. Training on new equipment always requires certain amount of adaptation before maximal loading in competition.

After procuring a new bike with same bike setup of his old bike, an elite track cyclist experience anterior knee pain in both knee for 6 months while training. He was diagnosed as suffering from Patellar Tendonitis on both knees. The purpose of this study was to localize biomechanical abnormalities associated with the cyclist and measure the success of an intervention to optimize performance.

METHODS: A bike fitting session was conducted to determine the cause of the anterior knee pain. The cyclist was asked to sprint with 80% of intensity on a trainer for duration of one minute. The sprinting motion recorded with camcorder and analyzed by Silicon Coach Pro 6.1.5. Measurements were recorded for every tenth seconds of sprint. The measure of knee angle at 6 o'clock position, confirmed that the cyclists' saddle height was good enough to get optimum force application with knee angle of 146°. The recommended knee angle is 140-145° (Flyger, 2006).

Figure 1: Measurement of seat height from sitting position.

RESULTS: The video of the cyclist was analyzed and the following observations were noted during the stationary cycling position.

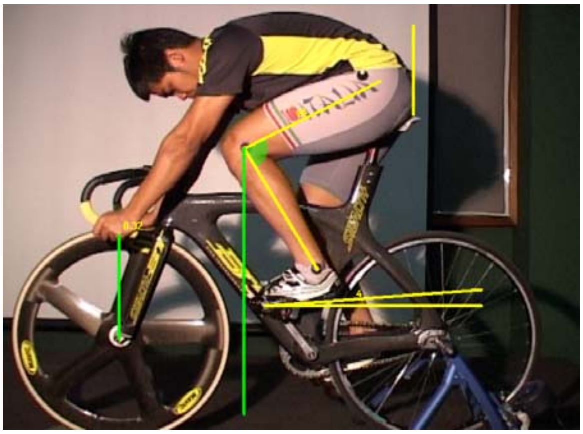

Figure 2: Normal speed position (Before).

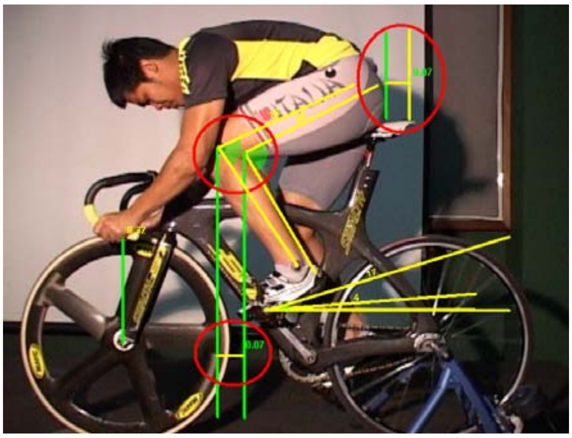

Figure 3: Sprinting position (Before).

The analysis revealed that the cyclist slipped (7 ±1.7 cm) forward from the initial position on the saddle causing his knee joint to also move 7 cm forward and parallel to the peddle at the 11 o'clock position. The knee joint flexion angle thus increased (82° to 88°) and also plantar flexion angle increased (4° to 17°) as a result from the sliding forward.

DISCUSSION: The slipping forward and changes in knee and plantar flexion angles resulted in irritation on the patellar tendon and caused excess torque at the knee joint and tendon strain when the rider started to push the pedals during the force application phase thus leading to a condition of Patellar Tendonitis. The subject was unable to undertake any training load above 80% of effort due to the severity of pain.

INTERVENTION: To solve the issue of slipping from the saddle, an intervention was made to increase the handlebar height (1 cm increase in height).

Figure 4: Normal speed position (after).

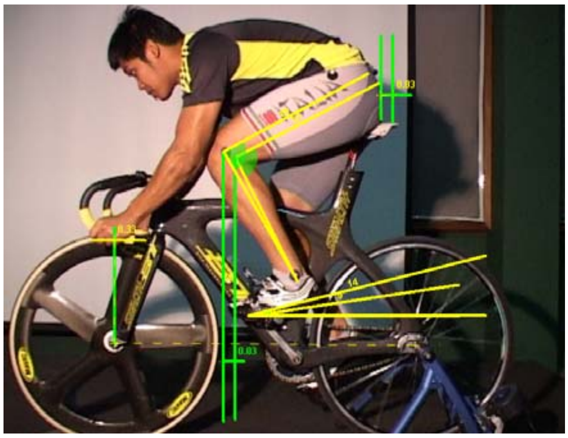

Figure 5: Sprinting position (after).

After the bike was modified to the new setting, sprint performances were analyzed. It was observed that the cyclist slipped forward only (3 ±1.2 cm) thus pushing his knee joint beyond the pedal (4 cm) and which decreased the parallel distance from the toe position.
To further reduce the slipping forward in the saddle, the subjects old cycle's stem bar (comparatively shorter than previous length 110 mm to 100 mm) was fixed on to the new bike. Replacing the old and accustomed stem bar which was shorter in width enabled the subject to remain on the saddle and to lock the elbow. This prevented the subject slipping down while doing sprints. This also enabled the quadriceps muscles to produce force almost in line with the toe and to the line of force application in relation to the pedal (11 o'clock position) and also facilitated the ankle joint to have a plantar flexion of 9° which eventually increased to 14° while sprinting.

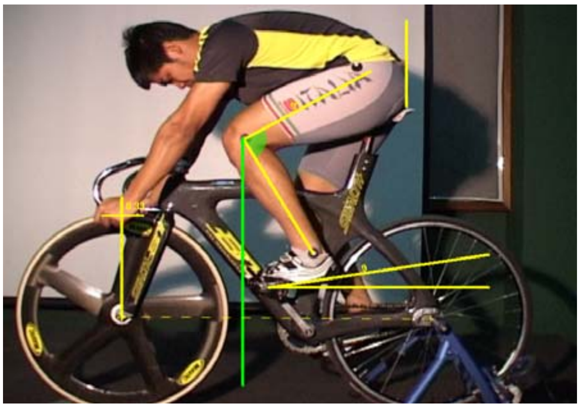

Figure 6: Sprinting position (After replacing it with old stem bar).

CONCLUSION: The modification in the bike set-up is expected to reduce the strain on the quadriceps muscle and to the knee joint that had influenced the knee joint pain. After three weeks of familiarization with the new bike setting, the cyclist reported that the knee pain had considerably reduced and the cyclist was in position to regain his performance.

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