To return-to-play or not to return-to-play: Assessing quadriceps strain in a professional soccer player

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Background

In soccer, muscle injuries account for 25-31% of all injuries (Ueblacker, Muller-Wohlfahrt & Ekstrand, 2015; Ekstrand, Hagglund & Walden, 2011). Muscle injuries of the lower extremities dominate (92%), with injuries to the major muscle groups as follows: hamstrings (38%), adductors (23%), quadriceps (21%) and calf (13%) (Ekstrand et al, 2011). Soccer appears to be a sport particularly susceptible to quadriceps strains, considering that among collegiate sports, soccer has the highest reported rate of such injuries (Eckard, Kerr, Padua, Djoko, & Dompier, 2017).

Effective return-to-play strategies in professional sports not only save money, but also improve performance since the chance of reinjury and time away from competition is decreased. Thus, the decision to return to play made by the coach, trainer and healthcare professional is very important.

Data can aid this decision, especially if data from multiple sources are in agreement. An assessment of both structure (ultrasound) and mechanical output (force, speed or power) can provide valuable information. Ultrasound is used in the assessment of quadriceps strains (Ibounig & Simons, 2016), while lower extremity mechanical output is commonly assessed in isolated joint movements (e.g., isokinetics) (Fousekis, Tsepis, Poulmedis, Athanasopoulos, & Vagenas, 2011).

Considering that kicking is an important multi-joint movement of soccer, and that an explosive contraction of the quadriceps creates a risk of quadriceps strains, it is interesting to observe that such movements are not assessed. With the development of robotic technology such as the 1080 Quantum, movements specific to a given task can easily be simulated with documentation of mechanical output. A simulated soccer kick can be performed in such a system, providing coaches, trainers and clinicians valuable information of mechanical output (force, speed and power).

The purpose of this case study was to show how mechanical output of a simulated soccer kick in a professional soccer player supported by structural assessment (ultrasound) can be used in return-to-play decisions.

Methods

The patient is a 28-year old professional soccer player (left foot dominant) who reports some anterior thigh discomfort while kicking the ball. Based on self-reports, regular training was discontinued and the player performed low intensity training that did not involve kicking the ball. The day after he reported the discomfort, ultrasonography showed a microrupture of the left rectus femoris (Figure 1).

Other clinical tests included isometric hip flexion combined with knee extension, and passive knee flexion and hip extension. Both produced some discomfort in the same area as ultrasound and sonopalpation. Based on these findings, rehabilitation consisted of a two-week strength training protocol with focus on posterior chain and isolated quadriceps strength (isometric, concentric, eccentric and heavy slow resistance before plyometric training). The player also did light running and more intensive cycling during the same period, building to longer and more intensive running with sprint-training / high intensity and speed.

Figure 1. Ultrasound assessment of left rectus femoris at initial evaluation

Upon completion of the rehabilitation program, the player reported feeling good and ready to return to competition. As a part of the return-to-play process a kicking motion was done in 1080 Quantum to determine the force, speed and power of a simulated kicking action (Figure 2).

Figure 2. Simulated soccer kick in 1080 Quantum

The settings used were as follows: resistance mode (No Flying Weight), concentric and eccentric load (5 kg), concentric and eccentric speed (5 m/s). The results showed a decreased power capacity for the kicking leg. Specifically, peak power (average of three repetitions) of the left (kicking leg) was 18% less than the right (left: 341W; right: 417W) (Figure 3).

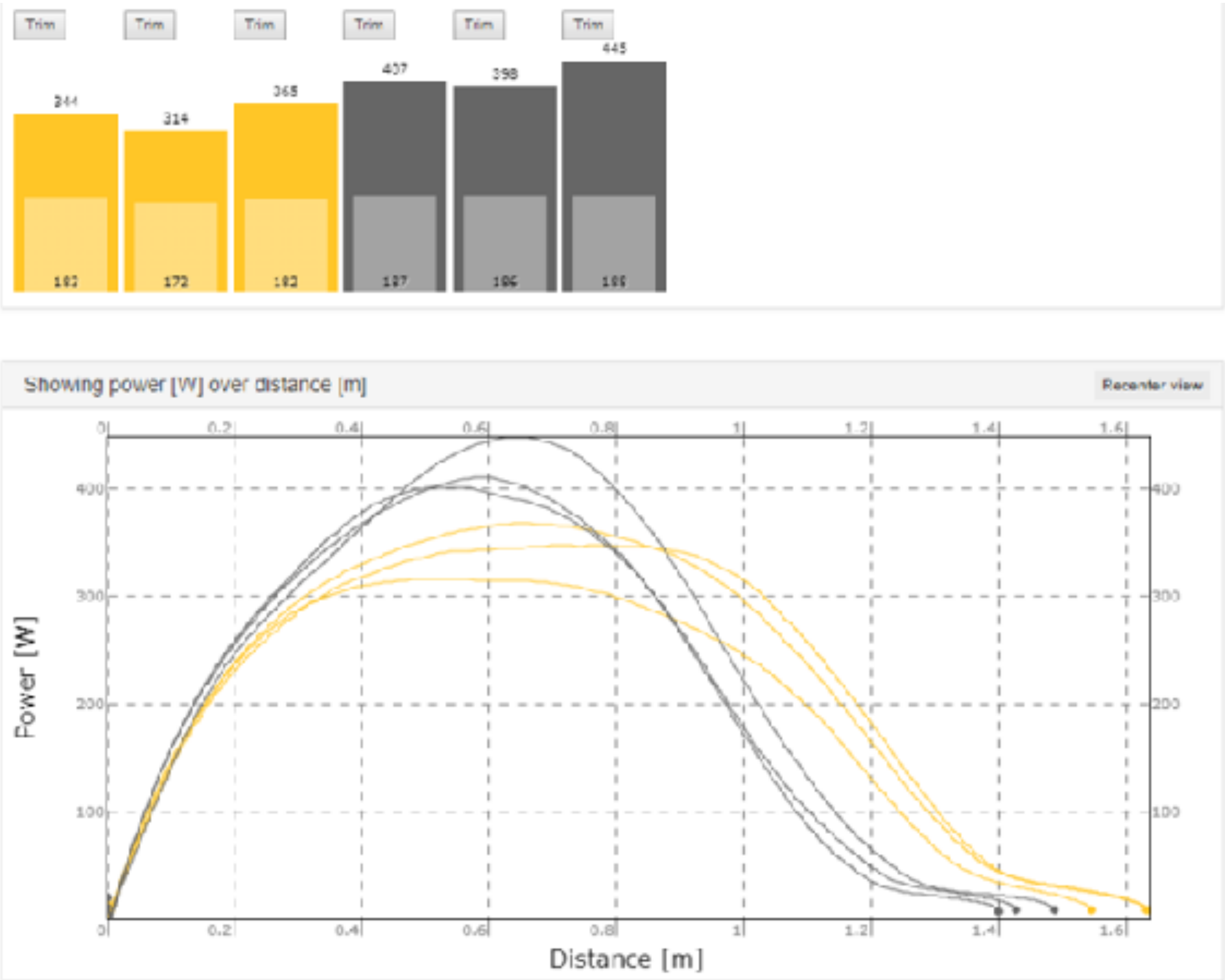

Figure 2. Simulated soccer kick in 1080 Quantum

Based on these findings the physical therapist recommended against returning to play, even if player reported "feeling 100%." Since the rehabilitation was performed at an external clinic, the player did not follow the advice of the physical therapist. After 15 minutes of the game, the player injured himself after performing a powerful kick. Structural assessment (ultrasound) performed the day after showed a partial rupture of the left rectus femoris (Figure 4).

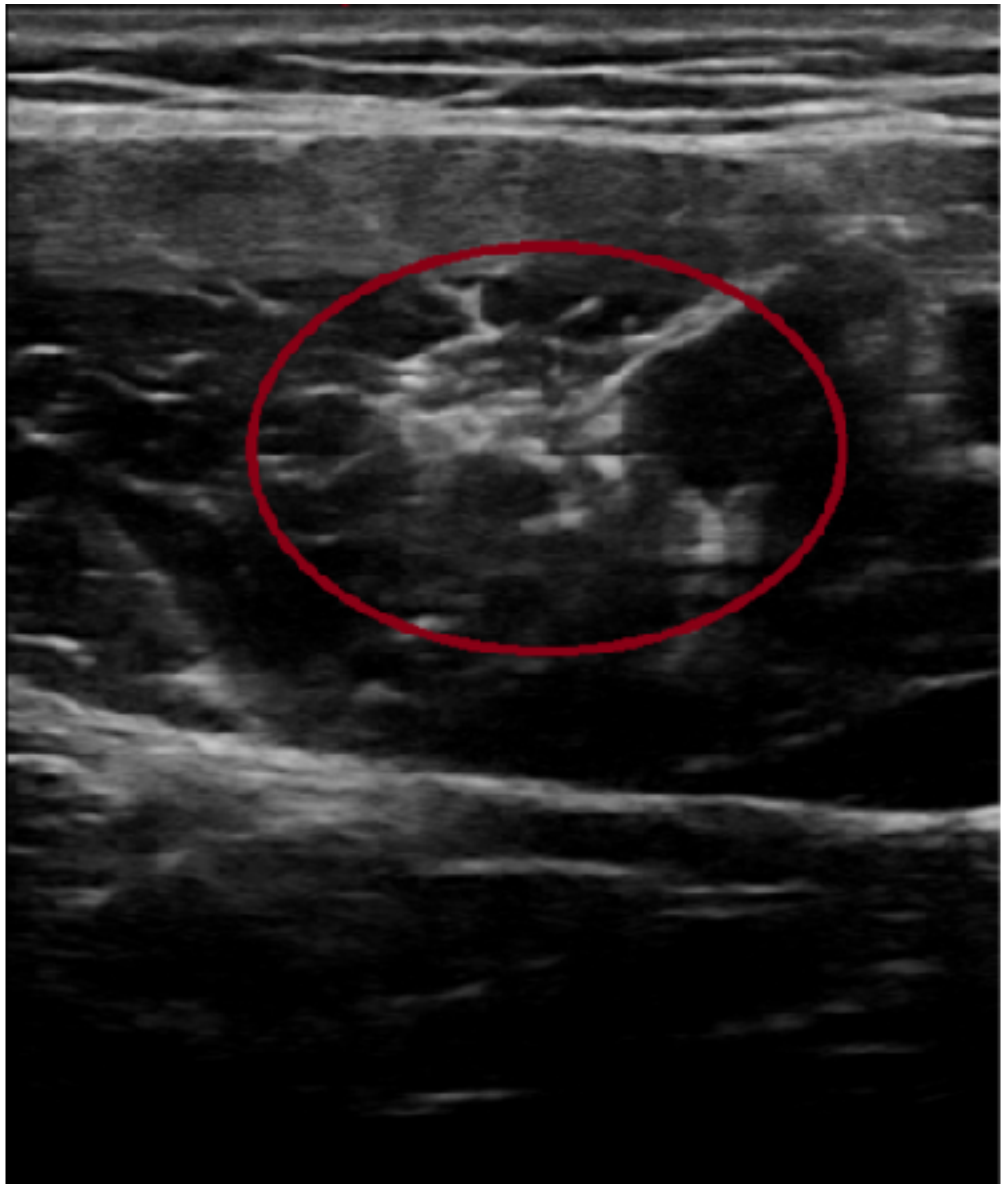

Figure 4. Ultrasound assessment: Left rectus femoris, one day after re-injury

Discussion

The current case study shows how mechanical output of a simulated task relevant to injury and complaint can be used in the return-to-play strategy of a soccer player with a rectus femoris strain. The 18% difference observed in the current case study is substantial, especially considering the left is the dominant (kicking) leg and expected to have greater power. However, we do not have baseline data to prove this assumption.

Even if no pain is reported and the subjective report is "I feel 100%," this type of data can not only be used to guide return-to-play, but also educate players as to why they cannot return to competition based on their self-assessments. Furthermore, with the advent of new technology such as 1080 Quantum, movements with a high degree of specificity to the task can be performed in a controlled test. This has the potential to provide more specific information than isokinetic dynamometers, which are restricted to being able to perform few isolated joint movements (i.e., knee flexion and extension). An isokinetic dynamometer may have been able to detect these differences. However, the 1080 Quantum is a more flexible solution that can be adapted to many different movements, since the robotic technology is embedded in a cable system. This expands the assessment of movements targeted in the rehabilitation or training program to those specific to the task, and not just the isolated joint movements commonly tested.

We have to be aware there are obvious shortcomings to this case study. We cannot assume the reduced power was the cause of injury. However, the test provided valuable information that can guide decisions on return-to-play. Furthermore, the rehabilitation was done at an external clinic, which speaks to the necessity of test results being clearly communicated to the coaching staff so that they can make informed decisions about return-to-play. Placing this responsibility solely on the player, who wants to play, is a risk.

Conclusion

Mechanical output (peak power) from a simulated soccer kick provides important information that can be used in the return-to-play process, and possibly prevent reinjury in patients with rectus femoris strains.

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