CALF MUSCLE AND ACHILLES TENDON GLUCOSE UPTAKE IN CHRONIC UNILATERAL ACHILLES TENDON PAIN

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SUMMARY
Muscles are supposed to take up glucose in proportion to the work done but injury may change the metabolism of muscles and tendons. We measured glucose uptake in calf muscles in patients with chronic unilateral Achilles tendon pain. Glucose uptake behaved similarly to the maximal plantarflexion force being smaller in injured leg than in healthy leg before rehabilitation. After rehabilitation MVC in the injured leg increased significantly (P<0.01) and similar tendency was observed in the calf muscle glucose uptake. In tendon there were no observable differences in glucose uptake in our preliminary sample.

INTRODUCTION
Skeletal muscle glucose uptake and metabolism is useful in determining whole body glucose metabolism due to exercise and insulin stimulation [1]. High resolution Positron Emission Tomography (PET) can be used to image and quantify skeletal muscle glucose uptake as a result of muscle contraction [2]. Skeletal muscle glucose uptake is increased during exercise due to a coordinated rise in glucose delivery rate, surface membrane glucose uptake, and intracellular substrate flux through glycolysis [3]. The purpose of the current study was to investigate the glucose uptake in human calf muscles in cases of chronic unilateral Achilles tendon pain as a result of submaximal isometric exercise.

METHODS
Ten subjects with chronic unilateral Achilles tendon pain and no major musculoskeletal condition in the other leg over last 12 months volunteered for this study that was approved by the ethics committee of the relevant health care district. Measurements included maximal isometric plantarflexion force from each leg, electrical activity of leg musculature using surface electromyography (sEMG) from both legs, magnetic resonance imaging (MRI) and positron emission tomography (PET). After obtaining the maximal voluntary contraction (MVC) for ankle plantarflexion for both sides, subjects were asked to perform submaximal isometric contractions at 30% MVC target force level one leg at a time. 150 MBq of fluorodeoxyglucose ($^{18}$F-FDG) was injected as the subjects warmed up for the task. On completion of 50 contractions alternately from each leg in 10 sets of 5, subjects immediately underwent PET scanning for glucose uptake imaging. It was followed by MRI while the body markers for PET remained in place (Figure 1). First measurements were followed by a 12-week eccentric exercise training for the injured leg and the subjects were tested again at the end of the intervention.

Figure 1: Coronal plane view of PET image superimposed on MRI to show glucose uptake in different tissues.

Victorian Institute of Sport Assessment-Achilles (VISA-A) questionnaire was employed as an index of the severity of the Achilles tendon pain.

RESULTS AND DISCUSSION
MVC was significantly higher (P<0.01) in the healthy leg compared to the injured leg before the intervention began. However, the force increased significantly (P<0.01) in the injured leg as a result of exercise intervention (Figure 2). In all
examined muscles the glucose uptake tended to be higher in the healthy leg muscles before the exercise training program while the Achilles tendon glucose uptake was quite similar in both legs (Figure 3).

Figure 4 shows the pattern of glucose uptake in the muscles of the injured leg after performing exercise at 30% of the MVC both before and after the rehabilitation period. The uptake is slightly increased in all the investigated muscles after the intervention while the tendon uptake remained similar.

No significant differences in the VISA-A scores as a result of eccentric rehabilitation were observed (65±18 vs. 79±18).

CONCLUSIONS
The glucose uptake was similar in all three muscle compartments of the triceps surae muscle. The healthy leg had a higher MVC that was reflected as a higher glucose uptake when compared to the injured leg. In tendon there were no observable differences in glucose uptake in four analyzed subjects.

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REFERENCES