

Response to Opponent's Questions on the PhD thesis "Gait analysis and musculoskeletal modeling used in athletes recovery from Achilles tendon rupture"

Dear Dr. habil. ANDOR Krisztián

Thank you very much for your questions, they were immensely helpful. I have included the questions immediately after this letter and responded to them individually.

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Response to the Questions

Question:

1. In the Data analysis part, “To detect significant differences between the normalized waveforms of injured and uninjured sides, the open-source (www.spm1d.org) one-dimensional statistical parametric mapping was (SPM1d 0.4) applied to independent two-sample t-tests”. Why did you apply this specific method?

Answer:

SPM1d is a package for one-dimensional Statistical Parametric Mapping. It uses random field theory to make statistical inferences regarding registered (normalized) sets of 1D measurements. Many biomechanical measurements may be regarded as ‘n-dimensional m-dimensional’ (nDmD) continua, where n and m are the dimensionalities of the measurement domain and dependent variable, respectively. Common examples include: joint flexion (1D1D), ground reaction force (1D3D), plantar pressure distribution (2D1D). In this thesis, the joint angles, ground reaction forces and plantar pressure data were collected for the Achilles tendon rupture patients, thus I use the SPM1d statistical analyses package via Matlab to detect the differences in a continuous period, in order to reveal which period during the stance phase showed be noticed, not only a time point. Some previous biomechanical studies also used this method, please see below:

Wim, S., Herssens, N., Van de Walle, P., Steven, T., & Ann, H. (2020). Trunk biomechanics during walking after sub-acute stroke and its relation to lower limb impairments. Clinical Biomechanics, 105013.

King, E., Richter, C., Franklyn - Miller, A., Daniels, K., Wadey, R., Moran, R., & Strike, S. (2018). Whole - body biomechanical differences between limbs exist 9 months after ACL reconstruction across jump/landing tasks. Scandinavian journal of medicine & science in sports, 28(12), 2567-2578.

Question:

2. In the “Plantar pressure collection” part, why the foot was divided into 7 anatomical sub-areas, including big toe, other toes, medial forefoot, central forefoot, lateral forefoot, midfoot and heel. How did the plantar pressure system test the plantar pressure under different regions?

Answer:

The plantar was divided into several regions in this thesis in order to help to recognize the abnormal plantar pressure distribution and the center of pressure offset between the injured and uninjured sides. The distribution of barefoot plantar pressure is measured using the Novel EMED system (Novel gmbh, Munich Germany). This pressure plate, placed on the walkway level with the floor, contains an array of 6,080 high-quality capacitance sensors. Each sensor has a surface area of 0.25 cm² and can record pressure from 0 to 127 N/cm² during posture or comfortable

cadence locomotion. The data is collected at approximately 50 samples per second. Using the Novel software, peak pressure, pressure-time integral, and maximum force are quantified for different regions of the foot.