

## RELATIONSHIP BETWEEN FOOT PROGRESSION ANGLE AND EXERCISE-RELATED LOWER LEG PAIN

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### INTRODUCTION

Exercise-related lower leg pain (ERLLP) is a common and enigmatic overuse problem in athletes and military populations [1]. Runners, track athletes and athletes participating in jumping sports are frequently diagnosed with ERLLP which is usually induced by repetitive tibial strain imposed by loading during intensive, weight bearing activities. Retrospective and prospective studies have identified a relationship between an increased subtalar eversion and ERLLP [2,3,4]. As highly potential risk factor, also an increased medial pressure distribution during the forefoot contact phase has been identified [4]. In clinical practice, an increased foot progression angle (abducted) is often linked with an increased eversion as it is suggested that the lower leg follows the direction of progression. Therefore, we hypothesize that ERLLP could be related to an increased foot progression angle which could relate to the increased eversion and the increased medial pressure distribution. However, to our knowledge, in the literature, the relationship between foot progression angle and ERLLP or the eversion excursion or the medio-lateral pressure distribution has not been investigated. Therefore, the purpose of this study was 1) to investigate the relationship between the foot progression angle and the amount of eversion and the medio-lateral pressure distribution and 2) subsequently gain insight in a potential underlying mechanism that might be implicated as precursor to ERLLP.

### METHODS

Subjects were 400 healthy undergraduate physical education students. 3D-gait kinematics combined with plantar pressure profiles were collected during barefoot running at a speed of 3.33m/s. The experimental set-up consisted of a 2m x 0.4m AMTI-force platform set into a 16.5m indoor running surface. Plantar pressure data were collected with a Footscan pressure plate (RsScan Int, 2m x 0.4m, 2 sensors/cm<sup>2</sup>, 480Hz, dynamic calibration with AMTI), mounted on top of the force platform. The foot progression angle was derived from the plantar pressure data and was defined as the angle between the direction of progression and the mid heel - head of metatarsal II axis. Kinematics were collected at 240Hz using 7 infrared cameras (Proreflex) and Qualisys software. Marker placement and modeling was based on that of McClay and Manal (1999). The eversion was calculated through positioning the rearfoot with respect to the lower leg and the excursion was measured around the sagittal axis through modeling with Visual3D (C-motion). Three valid right and three valid left stand phases were measured and analysed.

After the evaluation, all sports injuries were registered by the same sports physician during a certain period.

First, intrasubject variability of the foot progression angle of 30 healthy subjects was evaluated by means of Intraclass Correlation Coefficients (ICC) for three consecutive trials. Second, foot progression angle was correlated with the eversion excursion and the medio-lateral pressure distribution during the forefoot contact phase, which were both risk factors for ERLLP.

And third, Cox regression analysis was performed to test the effect of the foot progression angle on the hazard of injury.

### RESULTS AND DISCUSSION

Intraclass Correlation Coefficient showed low intrasubject variability (ICC=0.92), which demonstrates that positioning of the foot is very constant in barefoot running.

Pearson correlation showed no significant correlation between foot progression angle and the eversion excursion ( $R=.121$ ) and between foot progression and the medio-lateral pressure distribution during the forefoot contact phase ( $R=.116$ ).

During the follow-up period, 46 of the subjects developed ERLLP, of whom 29 subjects had bilateral complaints. So 75 symptomatic lower legs, 35 left and 40 right were classified into the ERLLP group. As control group, bilateral feet of 167 subjects who had no injuries at the lower extremities were selected. Cox regression analysis showed no significant differences between the foot progression angle between the uninjured and ERLLP group ( $P = .533$ ).

Our hypothesis that ERLLP could be related to an increased foot progression angle which related to the increased eversion and the increased medial pressure distribution can be rejected.

### CONCLUSIONS

Results of this study show that the foot progression angle is not a risk factor for ERLLP. In addition, the foot progression angle is not related to the amount of eversion or the medio-lateral pressure distribution during the forefoot contact phase. We therefore hypothesize that during the roll off, the lower leg is not following the direction of progression, but rather the direction of the foot axis. However, this should be investigated further.

### REFERENCES

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