INTRODUCTION

Lateral ankle sprain (LAS) may be caused by abnormal inversion and internal rotation of the ankle. LAS reportedly occurred in both ankle plantar flexion [1] and dorsiflexion [2] positions. However, these studies did not differentiate talocrural and subtalar joint kinematics. Although characteristics of talocrural and subtalar joint kinematics in dorsiflexion and plantar flexion were reported recently using a fluoroscopy-based measurement technique [3], ankle kinematics in response to rotation has not been presented. Therefore, the aim of this in vivo weightbearing study was to reveal detailed kinematics of the ankle during ankle internal rotation in dorsiflexion and plantar flexion.

Many texts state the talocrural joint is stabilized by maximal contact area between the talus and mortise at maximal dorsiflexion or "a closed-packed position"). Thus, it is assumed that subtalar joint motion during ankle rotation in dorsiflexion should be greater than talocrural joint motion. Conversely, talocrural joint motion may be greater during ankle rotation in plantar flexion. We hypothesized the subtalar joint demonstrates greater internal rotation and inversion in dorsiflexion, whereas the talocrural joint demonstrates greater internal rotation and inversion in plantar flexion.

METHODS

Ten healthy male subjects with a mean age of 21.8 ± 2.6 years were enrolled in this IRB-approved, cross-sectional study after signing the approved consent form. Selection criteria were; (a) no history of lateral ankle sprain and giving-way in the last 6 months, (b) absence of mechanical or functional ankle instability.

Patients stood in a lunge position with the forward foot fixed onto a tilted footplate on an automated turntable. The turntable rotates to one direction, and automatically reverses to the other whenever a predetermined torque is detected. Single fluoroscopy was utilized for passive weightbearing ankle rotation. This information will be used in future studies involving mechanical or functional ankle instability.

RESULTS

Talocrural kinematics in plantar flexion demonstrated greater internal rotation and inversion (Int rot; -5.37 ± 3.87 to 7.30 ± 2.33, Inv; -1.07 ± 2.84 to 2.13 ± 0.59) than in dorsiflexion (Int rot; 0.96 ± 3.87 to -0.78 ± 3.30, Inv; -2.41 ± 4.51 to -1.65 ± 3.15) (Figure 1). Subtalar kinematics in dorsiflexion demonstrated greater internal rotation and inversion (Int rot; -4.76 ± 3.79 to 6.17 ± 1.54, Inv; -5.42 ± 2.80 to 9.59 ± 3.78) than in plantar flexion (Int rot; -2.38 ± 4.64 to 1.40 ± 2.31, Inv; 0.46 ± 5.43 to 3.60 ± 5.62) (Figure 2). No other differences were observed in talocrural, subtalar or AJC kinematics.

DISCUSSION

The purpose of this study was to reveal ankle rotational kinematics in dorsiflexion and plantar flexion. During ankle internal rotation in dorsiflexion, the subtalar joint demonstrated greater internal rotation and inversion. Conversely, the talocrural joint demonstrated greater internal rotation and inversion during ankle internal rotation in plantar flexion. This suggests that characteristics of abnormal kinematics after LAS may be different between in dorsiflexion and in plantar flexion. Furthermore, with this technique, differences in kinematics between mechanical instability and functional instability may be clarified.

SIGNIFICANCE

This result provides detailed joint kinematics in normal ankle weightbearing rotation. This information will be used in future studies involving mechanical or functional ankle instability.

REFERENCES