

# Anterior tibiofibular gap in the sitting and standing positions in individuals with chronic ankle instability

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## Summary

We examined the anterior tibiofibular gap (ATFG) in chronic ankle instability (CAI) cases using ultrasound in the sitting and standing positions. Although the ATFG widening associated with ankle dorsiflexion was observed in both the Control and CAI groups, it was different in the measurement posture. Our report demonstrates the potential of using ultrasound to quantify the instability of the distal tibiofibular joint in CAI.

## Introduction

The ATFG widens with loading and ankle dorsiflexion/external rotation in healthy individuals with no previous ankle sprain experience [1]. This study aimed to quantify the ATFG in CAI cases and to explore the characteristics of distal tibiofibular joint dynamics after lateral ankle sprain.

## Methods

This study included 47 young adults. Participants were divided into the Control group (18 participants, 36 feet) and the CAI group (26 participants, 40 feet: 23 right feet and 17 left feet) based on the recommended criteria for CAI established by the International Ankle Consortium [2].

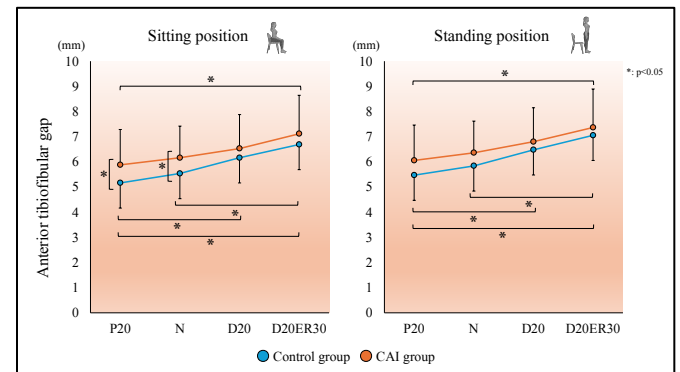
For the assessment of the ATFG, ultrasonography (SONIMAGE MX1, Konica Minolta, Japan) was used to measure the narrowest distance between the tibia and fibula, where the deepest and lowest layer of the anterior inferior tibiofibular ligament attaches [3]. The measurement postures of the participants were sitting and standing positions, and the ankle angles were set to four conditions: 20° plantar flexion (P20), neutral position (N), 20° dorsiflexion (D20), and D20+30° external rotation (D20ER30).

For statistical analysis, a one-way analysis of variance was performed to determine the difference in the ATFG between the ankle angles of the Control and CAI groups in the seated and standing positions, respectively. The Mann-Whitney U test was used to compare the ATFG in the Control and CAI groups at each ankle angle. As an additional analysis within the CAI group, the Mann-Whitney U test was conducted to compare the ATFG in the sitting and standing positions at each ankle joint angle. The significance level was set at 5%.

## Results and Discussion

The ATFG (mm) in the Control group were  $5.16 \pm 1.42$  at P20,  $5.54 \pm 1.43$  at N,  $6.16 \pm 1.31$  at D20, and  $6.69 \pm 1.37$  at D20ER30 in the sitting position, and  $5.47 \pm 1.48$ ,  $5.84 \pm 1.46$ ,

$6.48 \pm 1.45$ , and  $7.05 \pm 1.41$  in the standing position, respectively (**Figure 1**). The ATFG in the CAI group were  $5.88 \pm 1.41$ ,  $6.16 \pm 1.26$ ,  $6.53 \pm 1.35$ , and  $7.11 \pm 1.53$  in sitting position,  $6.06 \pm 1.39$ ,  $6.36 \pm 1.37$ ,  $6.80 \pm 1.46$ , and  $7.36 \pm 1.60$  in standing position, respectively. In the sitting position, the ATFG in the CAI group was more widened than in the Control group at P20 and N ( $p < 0.05$ , respectively). There were significant differences in the ATFG between ankle angles in the Control and CAI groups in both sitting and standing positions (Control group: P20 vs D20, P20 vs D20ER30, N vs D20ER30; CAI group: P20 vs D20ER30). Within the CAI group, there was no significant difference in the ATFG between sitting and standing positions.



**Figure 1:** ATFG in Control and CAI groups at each ankle angle.

Kobayashi et al. have reported that the distal end of the fibula is displaced laterally relative to the tibia in CAI cases [4], which may have been associated with the ATFG widening in the present results. The fact that no difference in the ATFG was observed between sitting and standing positions in the CAI cases in this study suggests that this malalignment of the fibula may be involved, which may cause hyper rotation of the talus and lead to instability of the talocrural joint.

## Conclusions

The ATFG was already widened in the CAI group in the sitting position with ankle plantar flexion, where the ATFG is minimal. Ultrasound could detect instability of the distal tibiofibular joint in CAI.

## References

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