

Hong Suk Baik, MD^{1,†}, Hyeong Min Jeon, Ph.D.^{1,2,†}, Sung Hyun Lee, MD, Ph.D.^{1,*}, Kyunghoon Min, MD, Ph.D.^{1,*}¹Department of Rehabilitation Medicine, CHA Bundang Medical Center, CHA University School of Medicine, Seongnam 13496, Korea²Digital Therapeutics Research Team, CHA Future Medicine Research Institute, Seongnam, Republic of Korea University School of Medicine, Seongnam 13496, Korea

†These authors contributed equally to this work as co-first authors

*Correspondence: (Kyunghoon Min) Department of Rehabilitation Medicine, CHA Bundang Medical Center, CHA University School of Medicine, 59Yatap-ro, Bundang-gu, Seongnam, Gyeonggi-do, 13496, Republic of Korea, Email minkhrm@gmail.com; (Sung Hyun Lee) Department of Orthopedic Surgery, CHA Bundang Medical Center, CHA University School of Medicine, 59Yatap-ro, Bundang-gu, Seongnam, Gyeonggi-do, 13496, Republic of Korea, Tel +82 31 780 1872, Email kensin06@chamc.co.kr

Introduction

- Lateral ankle sprain (LAS) is a prevalent injury that often leads to altered motor control.
- This study compared lower extremity kinematics and sagittal plane moments during gait between LAS patients and healthy controls

Methods

Study design & Study participants

- Retrospective preliminary case-control study.
- Patients with MRI-confirmed grade 1-2 ankle sprain after single trauma (N=3)
- Age-matched healthy controls (N=6)

Measurement method

- Kinematic data : Eight 3D motion cameras (Qualisys)
- Kinetic data: Two force plates (Kistler)
- Inverse dynamics: Qualisys Track Manager and Visual3D
- MATLAB to extract time-series data

Outcome

- Analysis focused on joint angle and joint moment at Loading Response (LR) and Terminal Stance (TSt)
 - At the hip, peak flexion and flexor moments were measured at LR and initial contact, respectively, while peak extension and extensor moments were identified at TSt.
 - For the knee, peak flexion and flexor moments were extracted at LR, with minimum flexion and peak extensor moments recorded at TSt.
 - Ankle analysis included peak plantarflexion and dorsiflexor moments at LR, and peak dorsiflexion and plantarflexor moments at TSt.

Statistical analysis

- Mann-Whitney U tests with statistical significance set at $p < 0.05$ were used for group comparison.

Result

- Kinematic data: no between group differences
- Kinetic data:
 - The affected side of LAS (Fig. 1.)
 - Smaller peak knee flexor moment at LR, a shift to an ankle plantarflexor moment at LR
 - A shift to a knee extensor moment at TSt, greater peak ankle plantarflexor moment at TSt
 - The unaffected side of LAS group (Fig. 2.)
 - A shift to an ankle plantarflexor moment at LR
 - Greater peak ankle plantarflexor moment at TSt

Conclusion

- Despite preserved sagittal-plane kinematics, patients with chronic ankle pain after LAS demonstrated altered gait kinetics in both limbs. These preliminary findings suggest possible bilateral compensatory kinetic adaptations during gait.
- Moreover, a unilateral injury results in increasing the mechanical demand on the contralateral, unaffected limb to protect the injured side and potentially triggers a bilateral reorganization of the lower extremity kinetic chain.
- Rehabilitation after LAS may need to address bilateral kinetic compensation rather than focusing solely on the injured ankle.

Table 1. Participants baseline details

Characteristic	Subject		
	S1	S2	S3
Gender	Female	Female	Female
Age(years)	30	40	54
Height(cm)	163	164	168
Weight(kg)	55	57	45
Affected side	Left	Right	Left
Previous sprain(months)	5	3	3
Ankle sprain grade	2	1	2

Figure 1. Sagittal angle and moment trajectories of affected limb of ankle pain group and control

Bold lines: mean value of each group, Shaded area: standard deviation
Blue line affected limb of ankle pain group; Orange line control group.

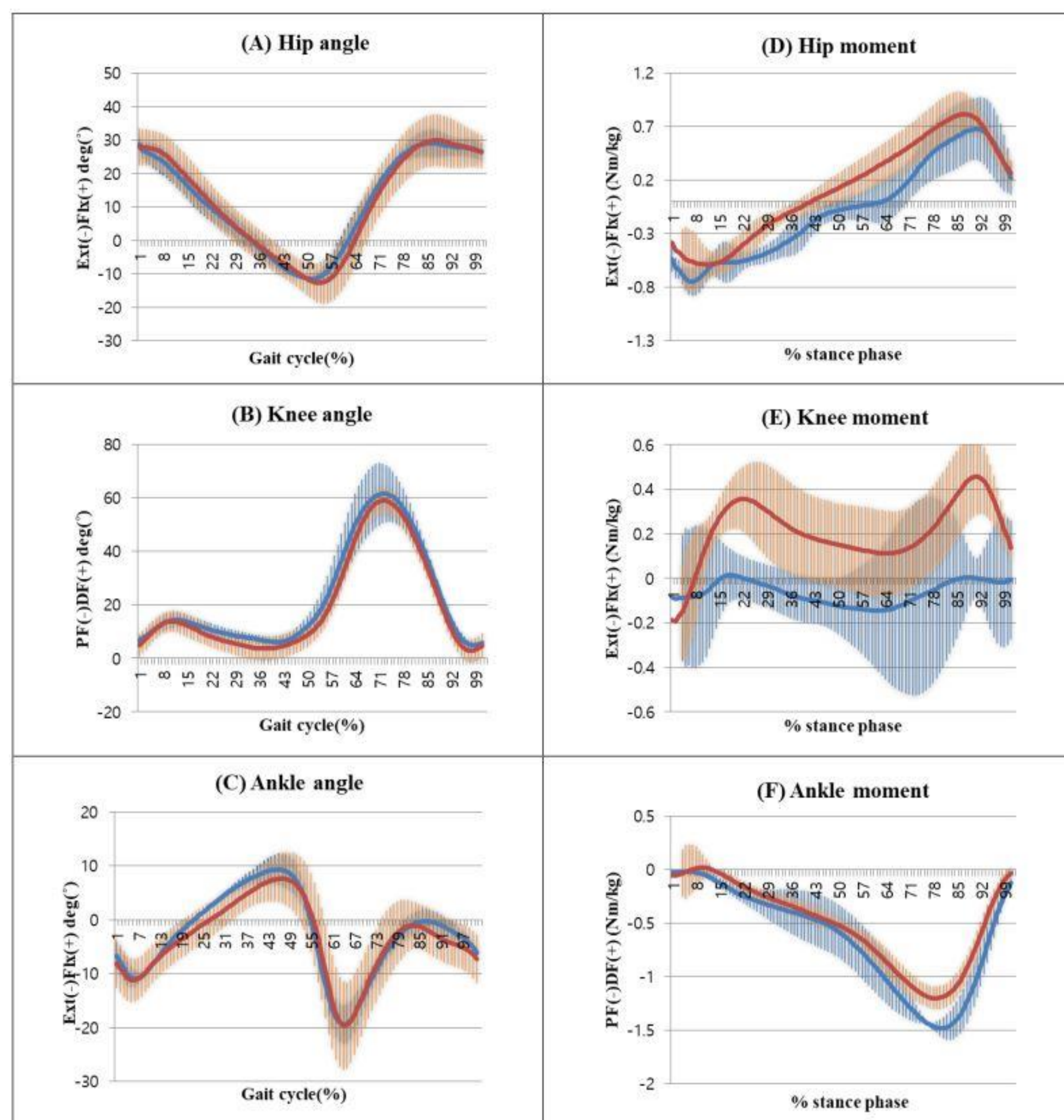


Figure 2. Sagittal angle and moment trajectories of unaffected limb of ankle pain group and control

Bold lines: mean value of each group, Shaded area: standard deviation
Blue line unaffected limb of ankle pain group; Orange line control group.

