

Knee Joint Angles Variations in Multi-directional Single-leg Hop

Kanapot Pengked^{1,2}, Pichitpol Kerdsonnuek¹, Bavornrat Vanadurongwan¹, Harit Apidech³, Weerawat Limroongreungrat³

¹Department of Orthopaedic Surgery, Faculty of Medicine, Siriraj Hospital, Mahidol University, Bangkok, Thailand

²Department of Orthopaedic, School of Medicine, Walailak University Hospital, Nakhon Si Thammarat, Thailand

³College of Sports Science and Technology, Mahidol University, Nakhon Pathom, Thailand

Email: weerawat.lim@mahidol.edu

Summary

This study investigated differences in knee joint angles during multidirectional single-leg hop landings among youth volleyball players, addressing the need for more sport-specific movement assessments beyond traditional single-plane functional tests. The results demonstrate that landing direction significantly influences knee joint kinematics, particularly during the early landing phase. Thus, multidirectional landing assessments may provide a more comprehensive evaluation of movement patterns specific to volleyball performance than a sagittal-plane functional test.

Introduction

Previous studies reported differences in knee kinematics in basketball and volleyball players when performing multidirectional SL landing from a 30-cm platform [1]. Functional tests (i.e. SL hop test and triple hop test) are commonly used for lower extremity injury screening and return to play. However, these tests primarily occur in the sagittal plane. Conducting a multidirectional SL hop test provides dynamic stability assessment and more sport-specific movement. Therefore, this study aimed to examine differences in knee joint angles in youth volleyball players while performing multidirectional landings. Using SPM, we hypothesized that there would be differences in knee joint angles as compared among four directions [forward (0°), 30° diagonal, 60° diagonal, and lateral (90°)].

Methods

Sixty-two female youth volleyball players (\bar{x}_{age} 17.8 \pm 3.3 years, \bar{x}_{height} 1.77 \pm 0.11 m, and \bar{x}_{weight} 69.5 \pm 12.9 Kg) participated in the study. 3D motion analysis cameras synchronized with a force plate were used to capture SL landing. Twenty-one reflective markers were placed on the anatomical landmarks. Three successful trials were collected and used for analysis. The directions of jumps are shown in Fig 1.

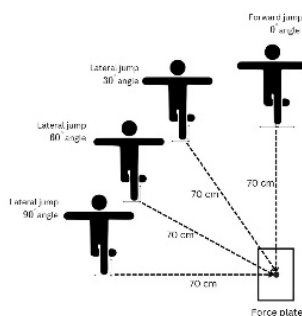


Figure 1: Single-leg landing in the four directions

Results and Discussion

SPM ANOVA comparison of landing from different angles revealed significant differences in knee joint angles in sagittal and frontal planes but no significant differences in the transverse plane were observed (Fig 2).

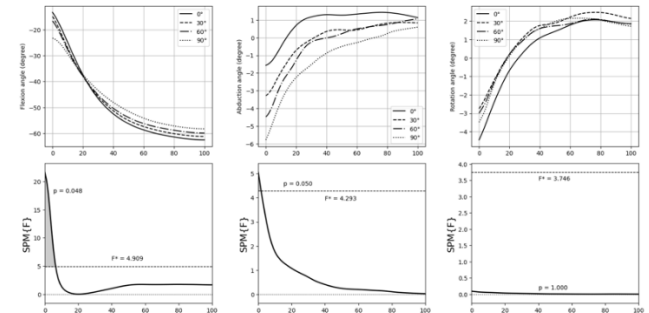


Figure 2: Results of knee joint angles (top row) and SPM ANOVA comparison of knee joint angles (bottom row) during four single-leg landing directions. *Grey shaded areas: highlighting statistically significant differences between the four directions, F* = critical threshold.

Post-hoc analysis reveals significant differences in knee flexion in a forward direction compared to the other three directions during the first 20% of the landing phase. For the frontal plane, the differences in knee angles in the forward direction compared to other directions were found in the first 40% of the landing phase. These findings demonstrate that landing direction significantly influences knee joint kinematics in youth volleyball players, particularly during the early landing phase. This suggests that multidirectional landing assessments may provide a more comprehensive evaluation of movement patterns specific to volleyball performance than traditional single-plane functional tests.

Conclusions

Differences in knee joint angles exhibited when performing multidirectional single-leg landing. Performing diagonal and lateral landings could provide a more comprehensive and sport-specific evaluation of movement patterns.

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References

[1] Sinsurin et al. (2013). *AJSM*, **4(3)**: 195–200.