

Does the Toe Out Angle Change the Mechanical Loads at the Knee?

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Introduction

The toe out angle is a factor affecting the knee kinetics and kinematics. From our study, the ACL patients landed out-toeing during side-step cuttings. However the effect of toe out angle during sports specific movement that involved rapid change in direction is unknown. The purpose of this study was to investigate the effect of changing the toe out angle in knee kinetics and kinematics during side-step cuttings.

Material and Methods

Fourteen college athletes participated in the study. A three camera system, a force plate and 6 retro-reflective markers were used to obtain 3-D limb kinetics and kinematics, at a frequency of 120 Hz. Each subjects performed three different side-step cuttings with different toe out angles: natural, intentionally in-toeing (in-toeing), and intentionally out-toeing (out-toeing). Differences among the three groups were tested by ANOVA at a significance level of $\alpha = 0.05$.

Result

The average toe out angle for each different side-step cuttings was 34.2 degrees for out-toeing, 3.0 degrees for natural and -18.5 degrees for in-toeing. At the middle stance the knee flexion angles were significantly larger in natural than in in-toeing and out-toeing. The knee posterior forces in the mid-stance were significantly smaller in out-toeing than in in-toeing and natural. There was no difference in the knee vertical force among three groups. Side-cut with out-toeing had a significantly reduced peak quadriceps moment and that with in-toeing had a significantly increased peak quadriceps moment than natural.

Conclusion

The quadriceps moment and knee posterior force in out-toeing were significantly smaller than in natural and in-toeing. Landing out-toeing during side-step cutting observed in ACLD patients should be the adaptive motion to reduce the mechanical loads at the knee. The quadriceps moment in in-toeing was significantly larger than in out-toeing and natural. Landing in-toeing should be one factor to improve the performance in sports activity such as side-step cutting. Thus the toe-out angle changed the knee kinetics and kinematics dramatically.

Key word: Side-step ,Toe out angle,Motion analysis

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