KNEE JOINT MOMENTS DURING SPORTS ACTIVITIES ON ARTIFICIAL TURF

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INTRODUCTION

In team sports, the knee joint is especially susceptible to non-contact injury. With the increased use of artificial turf in sports, there is little evidence regarding the effect of these surfaces on knee joint loading. The aim of this study was to quantify the three-dimensional knee joints moments during different sports movements performed on artificial turf.

METHODS

Ten subjects (ages: 28.2±9.7 years) took part in the study. All subjects played professionally or at a high level of competition and had no history of significant lower extremity injury. Each subject performed three movements on two types of artificial turf. One surface was a short pile, sand-infilled turf and the other was a third generation, long pile, sand/rubber infill turf (3G). The three movements consisted of a straight-line sprint (RUN), a one-stride stopping action during a sprint (STOP) and a 45°-cutting turn to the right (45R). The laboratory was laid out with each turf to provide an area large enough to perform the movements fully. The subjects performed each movement three times on each surface. The players wore their own preferred footwear and were instructed to perform each running movement as fast as possible.

Three dimensional motion analysis was performed using an 8-camer, 120Hz Vicon Motion System. Markers were attached to the body to allow the identification of bony landmarks. Ground reaction forces were measured using a Kistler force plate which was synchronized with the Vicon data. Knee moments were calculated using inverse dynamics and normalized to body weight.

During the stance phase, Peak moments were measured during a weight acceptance (WA) period (0-20% of stance phase) and during a propulsion (PP) period (21-100% of stance phase) for the RUN and 45R. A propulsion period was not defined for the STOP movement, except for moments in the sagittal plane. Moments in this paper are reported as moments that must be generated by the internal musculature.

RESULTS AND DISCUSSION

The magnitudes of the knee joint moments are comparable with published data [1,2]. Internal knee flexor moments of approximately 1-1.5N/kg were applied to the knee during the WA phase of all three movements. These were slightly lower on the 3G turf. Large extensor moments were measured during the propulsion phase, especially in the 45R movements.

Frontal and transverse moments were more variable between subjects, especially during the STOP. During WA, there was an abductor knee moment during the RUN, whereas a larger adductor moment was applied during the 45R. During PP, the RUN produced higher abductor moments than the 45R, with values slightly reduced on the 3G turf. In the WA phase, internal/external moments during the 45R and STOP were much higher than the RUN.

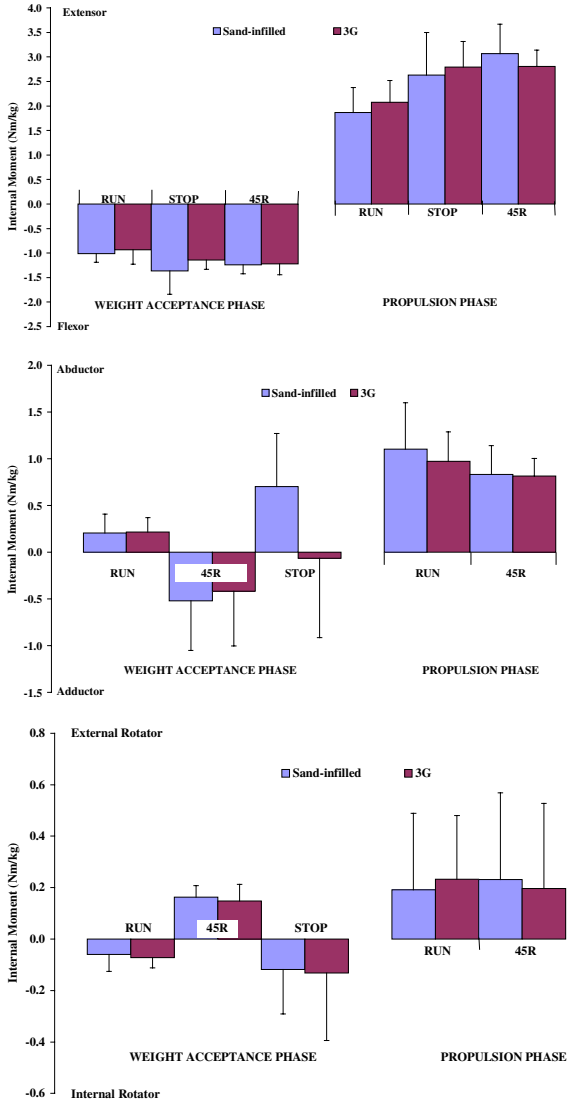

Figure 1 Knee joint moments in transverse, frontal and transverse planes

CONCLUSIONS

Movements that involve rapid deceleration and/or a change in direction produce large knee moments The high moments observed have the potential to significantly load the knee ligaments, increasing the risk of injury.

It is indicated that the sagittal plane loading of the knee during initial impact is generally reduced on third generation turf.

REFERENCES

1. Besier T.F.et al. *Med Sci.Sports Exerc.,* 33. 1168-1175, 2001.
2. Pollard C. *et al.*, *Proceedings of ISB XIX*, Dunedin, New Zealand, 2003.