DIFFERENCES IN FOREFOOT LOADING DURING THREE ATHLETIC TASKS ON FIELDTURF.

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INTRODUCTION
Previous research has indicated that in competitive soccer there is a performance limiting injury every 0.8 to 2 matches (Giza, et al., 2003). Over the past few years the playing surfaces used during practice and competition have shifted from being natural grass to being different synthetic turfs, one of which is FieldTurf®. One previous study examined the differences in injuries sustained on FieldTurf® versus natural grass and determined that the incidence of injuries was higher on FieldTurf® (Meyers and Barnhill, 2004). While the incidence was higher on FieldTurf®, the severity of the injuries was decreased with the increase in injuries on FieldTurf® being mostly muscle strains and spasms versus ligamentous injuries on natural grass (Meyers and Barnhill, 2004). The purpose of this study was to determine plantar loading pattern differences while performing three different athletic tasks on FieldTurf®.

METHODS
A total of 36 subjects were recruited and tested during this study. Subjects all signed an informed consent form, which was approved by the institutional review board prior to testing. Each subject had their height and weight recorded and were fit with the proper size shoe and insole. The testing shoe was a Nike Vitoria Hard Ground Boot, with 25 molded cleats. Subjects run an agility course 5 times in each shoe while plantar pressure data were collected on both feet at 100 Hz using the Pedar in-shoe pressure measurement system (Novel Electronics, Inc, St. Paul, MN). The left plant (cross-over cut) around the final flag, the right plant (side-cut) around the second flag, and the acceleration phase at the beginning of the agility course were used for comparison. During the three movements the peak pressure, loading rate, and contact area differences under the entire foot as well as in eight masked regions of the foot were determined. The foot was divided into eight regions for analysis, with following regions being the regions of interest: medial forefoot, middle forefoot, lateral forefoot, hallux, and the lesser toes. Each variable was analyzed using a 1X3 repeated measures ANOVA, followed by Tukey’s post hoc testing when necessary (α=0.05).

RESULTS AND DISCUSSION
Significant differences in peak pressure, contact area, and contact time beneath the entire foot existed between the three movement tasks. In addition, significant differences in peak pressure, contact area, and loading rate existed in the forefoot region between the three movements. The loading rate was highest in the medial forefoot and Hallux during the side-cut task, while the middle and lateral forefoot regions had the highest loading rate during the cross-over cutting task. The peak pressure was highest in the medial forefoot and Hallux during the side-cut task, while the
peak pressure was highest in the middle forefoot during the acceleration task, and highest in the lateral forefoot during the cross-over cutting task (Figure 1).

Figure 1: Peak Pressure comparison between three movement tasks based on foot region. (* = significant difference between side cut and cross-over cut, + = significant difference between side-cut and acceleration, # = significant difference between cross-over cut and acceleration.) (MFF= Medial Forefoot, MIDFF=Middle Forefoot, LFF=Lateral Forefoot, LT=Lesser Toes)

The results of this study are partially supported by previous work by Elis et al, which examined plantar pressure patterns in different athletic tasks. The only comparable task between the two studies is the side-cut task. In both studies, the peak pressure was the highest in the medial forefoot during this task (Eils et al, 2004). The peak pressure values were, however, different between these two studies, with the peak pressure being higher in the study by Elis, et al (Elis et al, 2004). The differences in peak pressure between the two studies could be the result of differences between the testing surfaces used in the two studies.

SUMMARY/CONCLUSIONS

The results of this study indicate that different cutting tasks could potentially lead to different types of injuries. In both the cross-over cut task as well as the side-cut task, the peak pressure was approximately 500kPa. With repetitive loading of this magnitude it is possible that repeated cross-over cutting could result in stress fractures of the fifth metatarsal. Future studies need to be conducted in order to gain a better understanding of potential gender differences in these loading patterns. In addition, future studies examining different cleats plate configurations could help in the prevention of stress related injuries by optimizing cleat type and cleat placement without compromising performance.

REFERENCES


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