IMPACT SHOCK DURING CONTROLLED LANDINGS ON NATURAL AND ARTIFICIAL TURF.

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INTRODUCTION

Many artificial turf surfaces are installed with a foam underlay to simulate the compliance of natural turf. The intended purpose of the cushioning layer is to reduce the impact loads experienced by athletes. Mechanical impact tests clearly distinguish differences in shock attenuation among surfaces. However, in previous studies of different surfaces the peak force[1, 2] or peak shock[2] experienced by human subjects during controlled landings was not affected by surface characteristics. The purpose of this study was to determine whether shock to the lower extremity during drop landings on natural and artificial turf surfaces was similarly uninfluenced by surface characteristics.

METHODS

Fifteen athletic male volunteers (mass: 99.6 ± 16.5 kg, stature: 1.84 ± 0.07 m) performed drop landings from a height of 1.0 m onto a natural turf surface and an artificial turf surface installed at a professional football practice facility. In mechanical tests of shock attenuation, the natural turf surface scored significantly better than the artificial one. The axial acceleration of the lower leg was recorded using an Entran EGA100 accelerometer (±100 g range) strapped tightly to the distal the medial aspect of the tibia. The amplified accelerometer signals were sampled at 512 Hz using a 12-bit ADC. Surfaces were presented randomly. Four trials from each subject were recorded on each surface. The power spectra of the acceleration signals were determined using previously described methods[3].

RESULTS

Typically, tibial acceleration signals were dominated by a single deceleration peak, 15 to 40 g in magnitude and of less than 100 ms duration (Figure 1). Peak acceleration averaged -25.7 g (± 6.6 sd) on the natural turf compared with –30.1 g (± 8.5 sd) on the artificial turf surface. The difference between the two surfaces was statistically significant (Multi-Factor ANOVA with repeated measures, $p < 0.01$). In addition, compared with the artificial turf surface, the natural turf significantly attenuated the mean acceleration power spectra during landings (Figure 2).

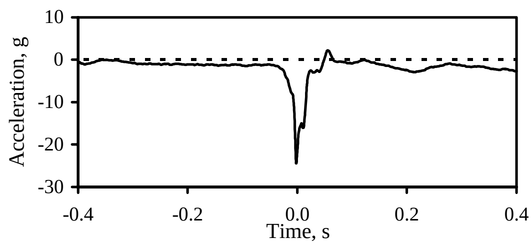

Figure 1: Example tibial acceleration signal.

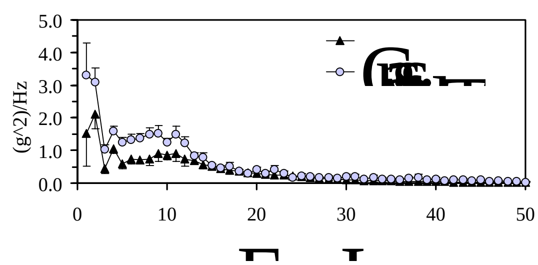

Figure 2: Average power spectra (Mean ± SEM).

DISCUSSION

The different surfaces produced significantly different tibial accelerations during controlled landings. The observation of reduced impact shock on the natural turf surface was consistent with mechanical test results and with subjective reports of perceived impact severity, but in contrast to some previous reports. In a study of landings on gymnastic mats[1], for example, peak impact force did not differ significantly among surfaces. It has been hypothesised that adaptive strategies during controlled landings counteract and minimise surface effects. The results of this experiment suggest that such strategies are not universally effective in reducing shock to the lower extremity. However, our observations would be consistent with an adaptive response if it is assumed that the goal of adaptation is to control shock to the head or torso rather than to the lower extremity.

REFERENCES

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