ATHLETIC VENUES AS EXTREME ENVIRONMENTS

M. C. Storrie-Lombardi[1]

Kinohi Institute Technical Report 20071003.2

Abstract: Artificial sports surfaces commonly employed in youth football, soccer, and tennis have long been suspect as causative for increased frequency of injuries to head, back, knees, and ankles, sometimes life-threatening or career-ending. In hot, sunny climates, the temperature characteristics of these surfaces contribute to the onset of heat stress syndrome and, in the most extreme cases, the collapse, seizures, coma and death associated with heat stroke. The inability of players and trainers to compensate for electrolyte and water imbalances increases the likelihood that young players early in a fall season may experience multiple signs of partial central nervous system impairment during normal athletic competition. The symptoms most likely to appear include changes in attention span, confusion, perceptual distortions, variability in reaction time, and diminished hand-eye coordination. The altered mental state can delay self-diagnosis, impair defense responses, and would be expected to produce an increased frequency of mechanical injury including traumatic concussion during contact sports such as football or soccer. The current paper is a brief summary of published literature addressing portions of this issue.

1. Introduction

In our Institute the search for organisms adapting to extreme environments usually takes us to sites far removed from everyday life: high mountain alkaline lakes, acid mines deep in the earth, basalt lavas underneath the ocean, and the deserts of Chile, Africa, Australia, and the Antarctic. At each site life is most often threaten by extremes in one or more of six environmental characteristics: temperature, water deprivation, pressure, sheer forces, electrolyte imbalance, and pH. Interestingly, one of the most extreme environments on planet Earth occurs much closer to home: the artificial playing surfaces increasingly common in football, soccer, and tennis.

Since the first appearance of these surfaces players, trainers, coaches, and team physicians have all commented on the fundamental physics distinguishing artificial playing surfaces from well-watered grass or clay surfaces. The gradual change in surface density as a function of depth characteristic of water distribution in the chaotic structure of natural surfaces acts as a cushion softening the effects of either sudden direct impact or rapid shifts in direction. Artificial surfaces are comprised of a relatively soft upper layer and rigid underpinning. They lack the complexity of multiple soil grain sizes and interlocking root structures comprising natural grass fields. As a result, artificial surfaces have been implicated in career-ending knee, hip, and back injuries, as well as life-threatening head trauma. Now, increasing attention is being given to two other characteristics of artificial turf: excessive surface temperature and the spread of drug-resistant bacteria. In essence, these are alien, dry, barren, hard-packed wastelands exhibiting none of the familiar forest and veldt characteristics that have shaped the evolution of human physiology.

The most severe risks occur when young, student athletes play early in a season on hard, unyielding surfaces in hot afternoon sun and receive inadequate replacement of salt, water, and sugar.

[1] url: www.kinohi.org; e-mail: mike@kinohi.org

