According to a report by the CDC (1999), approximately 80,000 Americans experience the onset of disabilities resulting from brain injuries each year. An estimated 5.3 million Americans, a little more than 2 percent of the US population, currently live with disabilities from traumatic brain injuries (TBI). Sports and physical activity provide significant exposures to TBI with some 300,000 sports-related concussions or mild traumatic brain injuries estimated to occur each year in the US. It has been reported that motor functions may recover more slowly than cognitive function or may not be closely related to standard neuropsychological assessments. Also, approximately 1/3 of TBI patients complain of poor balance and poor coordination. The overall goal of this project is to longitudinally quantify deficits in the maintenance of dynamic stability during locomotion and in sensory motor functions of individuals following a concussion and to establish recovery curves of these measurements from the time of injury. A total of 60 (30 concussion subjects and 30 controls) college men and women participating in intercollegiate, intramural and club sport athletic activities at the University of Oregon will be recruited in this study. In this project, a biomechanical motion analysis will be used to assess the whole body dynamic stability during walking with various terrain and attention conditions, and a battery of sensory motor tests will be used to examine the ability of several selected sensory motor functions and their contribution to the deficits during dynamic motor tasks. Concussion subjects will be tested at four times post-injury: 1) within 48 hours, 2) five days, 3) 14 days, and 4) 28 days. The same number of testing times and durations will also be applied to control subjects. The specific aims of this project are to 1) develop a biomechanical measuring system to quantitatively evaluate the dynamic balance control of concussion patients during gait; 2) understand the association between the cognitive function of concussion patients and their abilities to negotiate obstacles and maintain sideways stability; 3) characterize how specific visual, oculomotor and attentional functions contribute to the deficits in dynamic balance control during gait of concussion patients; and 4) establish recovery curves based on measures of dynamic stability, sensory motor control, and neuropsychological function and investigate the functional relations between these measures. The knowledge gained from this proposed research will provide an objective and quantitative measurement of the residual impairment on dynamic motor functions following a concussion, which will enhance the development of TBI assessment and rehabilitation programs.