Repetitive Subconcussive Head Impacts – Brain Alterations and Clinical Consequences, (RepImpact)

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Concussion occurs from an impact to the head that results in rotation and acceleration forces that stretch the brain tissue. It is a very common injury that affects millions of people every year worldwide. The harmful long-term effects that range from chronic cognitive symptoms to progressive neurodegenerative diseases are now acknowledged. However, even more common than concussions are subconcussive blows to the head, which usually don't result in acute symptoms. Subconcussive blows to the head are observed in millions of people who participate in sports, who are in the military service, or who experience medical conditions such as head banging in children with autism. Because there is often no evidence of immediate clinical symptoms, subconcussive blows to the head are generally considered to be harmless among athletes, parents, coaches, and even physicians. Until recently, technical limitations have made it nearly impossible to detect subtle brain alterations following repetitive subconcussive brain trauma. Using highly sensitive neuroimaging techniques, we have now demonstrated for the first time alterations in the brain's microstructure in soccer players who are at high exposure to repetitive subconcussive impacts. This finding is not only very alarming given the more than 250 million soccer players worldwide, but, and most importantly, it suggests that even repetitive subconcussive blows to the head may lead to long-term alterations of the brain's structure and function. The overarching aim of this project is to detect and to characterize alterations in the brain's structure, function and connectivity due to exposure to repetitive subconcussive brain trauma and to identify the role of risk factors. We propose a multidisciplinary (e.g., neuroradiologists, computer scientists, neuroscientists, physicists), longitudinal study, which follows young professional youth soccer players over time, and uses cutting-edge neuroimaging and biochemical techniques. By focusing on soccer as an example of a sport where subconcussive blows are commonly observed, we can begin to understand the risks of repetitive subconcussive blows to the head, and, most importantly, we can begin to understand which factors determine recovery versus those factors that lead to persistent symptoms, cognitive impairments, and brain alterations. The results of this project will dramatically change our understanding of the effects of subconcussive brain trauma and it will lead to a new understanding of underlying causes and risk factors. This knowledge will, in turn, lead to new horizons of research for the early diagnosis, treatment, and prevention of long-term consequences of brain injury, and thus change the landscape of global health.