28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Analysis of the biomechanical response to unanticipated impacts in professional rugby union

Kneblewski, A., Valdes-Tamay, L., Bourgain, M., Rouch, P.

ENSAM ParisTech

INTRODUCTION:
The concussion study is of growing interest in professional rugby union, in particular due to the increase of its incidence in last decades. Concussion prevention requires a better understanding of the biomechanical parameters involved in risky play phase. Tackle is identified as the main cause of concussion and certain factors are likely to increase this risk. During unanticipated tackle, the players attention is focused on ball possession or teammates movement, and therefore, the player is more vulnerable to collision. The aim of this study is to analyze the biomechanical response of professional rugby players to unanticipated impacts.
METHODS:
17 professional rugby players participated in this study. They were categorized into two position groups: forwards and backs. An impact simulation device has been developed to reproduce unanticipated tackles under safe and reproducible conditions. Each participant experienced a total of 12 impacts, on the right and left lateral faces, during a motor dual task situation. To evaluated the kinematics response to the impact, players were equipped with 4 inertial units (Vicon, 1200 Hz), positioned on the head, the C7 cervical vertebra, the sternum and the sacroiliac line. The influence of position on player kinematic response was identified using a one-way analysis of variance.
RESULTS:
The maximum values of linear and angular accelerations were calculated for each segment. The variance analysis revealed a significant influence of the position on the linear and angular head accelerations: the acceleration peaks are higher for the backs than for the forwards ($p<0.001$). Two head injury criteria were included in this study: the Severity Index and the GAMBIT. For these two parameters, the mean values are higher for the backs than for the forwards ($p<0.001$).
CONCLUSION:
We propose an original experimental device for studying unanticipated impacts in a controlled environment. Results showed that the backs experienced higher head acceleration peaks and higher injury criteria than the forwards. These results indicate that when faced with the same impact, backs are characterized by a wider head kinematic response, exposing them to a greater concussion risk. These findings can be explained by the morphological characteristics, weaker for backs than for forward. Indeed, analysis revealed the existence of a negative correlation between the morphological characteristics and the head kinematic parameters associated with concussion risk. Another explanatory factor concerns the higher level of cervical strength in the forwards than in the backs, due to their greater involvement in combat actions. It is possible that these adaptations also participate in limiting the concussion risk by reducing the magnitude of the head kinematics after the impact. This study improves our understanding of the biomechanical mechanisms involved in unanticipated tackle and provides intervention perspectives for sports staff to implement concussion risk prevention strategies.

Topic: Biomechanics

Presentation Oral

European Database of Sport Science (EDSS)

Supported by SporTools GmbH

31994