DEVELOPING A TEST METHOD FOR ASSESSING SKIN INJURY RISK ON RUGBY TURF

M. MacFarlane[1,2], C. Dyson[2], M. Douglas[3] and P Theobald[1]
[1] Cardiff University, Queens Building, CF24 3AA, United Kingdom
[2] Sports Labs Ltd., Livingston, EH54 9DE, United Kingdom
[3] World Rugby, Dublin, Ireland

Introduction

Rugby Turf is a World Rugby-approved synthetic grass system which is increasingly being adopted across elite clubs and international competitions. Installation of Rugby Turf pitches now tallies 963 globally and has enabled the sport to continue growing, by providing longer playing time and reduced maintenance costs, relative to natural turf. Despite the multiple benefits, players perceive these surfaces to have an increased risk of frictional skin injuries, known as 'Turf Burns'. Although turf burns are regarded as minor injuries that do not typically prevent players participating, they are believed to be an inconvenient injury. Negative media reports on turf burns limit widespread acceptance of Rugby Turf which could subconsciously influence in-game decisions, potentially hindering player performance or increasing injury risk.

World Rugby already has Rugby Turf performance specifications, benchmarked against natural grass, to protect player welfare. The Securisport is the current test device used to calculate friction and predict skin injury; however, the prevalence of turf burns means the validity of this device is doubted. Key limitations [1] are the inability to represent a player in motion by not accurately simulating an authentic impact at realistic speeds - two parameters that are known to inform frictional severity. In addition, the repetitive circular sweeping action quickly influences surface condition which means the results are not representative of the specified turf system. In combination, these deficiencies highlight the potential for low quality Rugby Turfs to erroneously gain accreditation and possibly cause preventable skin injuries.

This study aims to develop, manufacture and have accepted by peers, a new rig that will enable better understanding of skin injury risk. Ultimately, this device will be used for assessing new turf products and given the potential incoming ban on rubber-based products, novel infill materials [2].

Methods

A survey was designed and ethically approved, to capture the opinions of amateur and elite rugby players towards artificial surfaces [3]. This highlighted that most players experienced two distinct skin injuries, burns and abrasions, with their knees being the most vulnerable anatomical location. The new test device should, therefore, recreate a realistic knee-turf contact whilst monitoring temperature rises and the abrasive nature of turf.

Elite rugby players are able to achieve sprint velocities of 9.1 m/s [4]. In reality, it is unrealistic that skin would interact with the turf at this speed, therefore, the maximum horizontal impact velocity has been reasonably reduced to 5 m/s and will

Corresponding author email: macfarlanemj@cardiff.ac.uk

be generated by adopting roller coaster technology. This linear induction motor rapidly accelerates the carriage up to the desired velocity by utilising electromagnets. An added benefit of this technique is the lack physical contact between the motor and carriage which provides the ability to monitor the natural deceleration of the impactor. Vertical impact velocities are generated by allowing the impactor to free fall through a range of release heights to produce a maximum velocity of 3.85 m/s. Varying vertical and horizontal velocities enables investigating a range of 'resultant' contact scenarios. The impactor was 3D printed, using anthropometric knee data, and wrapped in Lorica Soft, a synthetic leather, to provide similar frictional responses as *in vivo* skin [5][6]. Accelerometers capture impact and dynamic frictional coefficients, whilst thermocouples aid in predicting if the injury mechanism is abrasive, thermal or both.

Results & Conclusion

This prototype (Figure 1) has been presented to, scrutinised, and widely accepted by the international Rugby Turf testing community and is recognised as having the potential to revolutionise strategies to mitigate turf burn risk, both in rugby and the wider sporting environment. The realistic impact velocities generated coupled with the development of an impactor possessing good biofidelity demonstrate that this device applies a holistic approach to measuring skin friction on Rugby Turf. Consequently, this device should have improved validity versus the Securisport. Initial testing has produced encouraging results that demonstrate suitable sensitivity of the impact and dynamic frictional coefficients which will be used to provide an insight into the contact scenarios which are most injurious.

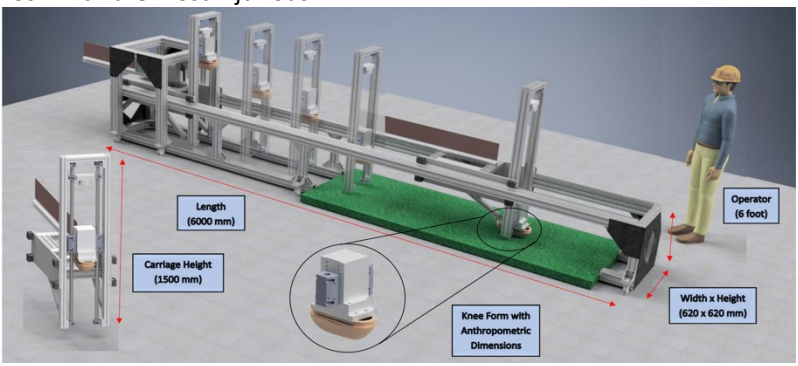

Figure 1: Novel test rig to assess potential for skin injuries on Rugby Turf.

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Corresponding author email: macfarlanemj@cardiff.ac.uk