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Causation events of stud laceration injuries in rugby union

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Abstract

Laceration injuries in rugby union account for approximately 6% of all injuries sustained during match play. Commentators often cite the design of studded footwear as a causal factor in laceration injuries. In order to assess the laceration injury risk of different stud designs, there is a need to develop a testing protocol that is able to replicate the laceration injury event. This study used a questionnaire to identify the play scenarios that result in laceration injuries. The questionnaire was answered by 191 rugby players, of which 72% had experienced one or more stud injuries during their career which hindered them playing rugby. Half of the laceration injuries described by the respondents came from the ruck, and 27% from a tackle. When analysing free-text responses, a deliberate stamp was described in 35% of the responses and a tackle from behind was described in 14% of responses. These injury scenarios are considered to be the dominant cause of laceration injuries. In future work the identified injury scenarios will be replicated in simulated play and kinetic and kinematic measurements will be recorded. This will inform test parameters for future assessment of laceration injury risk of stud designs.

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1. Introduction

Rugby union is a full-contact sport with a high injury prevalence of up to 91 injuries per 1000 match playing hours at the professional level [1]. Studded footwear is often cited as a cause for laceration injuries occurring in field sports. This was highlighted by Hall & Riou (2004) [2] who cited three case studies of severe laceration injuries and suggested that the design of the stud was the causal factor. To help mitigate the risk of laceration injuries in rugby union, stud design is regulated by the governing body, World Rugby. Currently, the testing protocol for studs, as described in the World Rugby standards [3], are recommended but not mandatory for manufacturers to follow. In the World Rugby protocol, studs are to be tested on skin simulant materials (such as silicone rubber) which are known to be loading rate dependent. The protocol uses a stud mounted on a drop hammer to simulate stamping - a perpendicular movement of the foot onto a player on the ground; and a stud mounted on a pendulum to simulate raking - a similar movement which also includes a horizontal component. The protocol's current test parameters are considered to be unreliable as they lack any supporting evidence to justify their selection. There is a need to improve the test protocol with relevant loading conditions. Kinetic and kinematic data need to be obtained for the dominant injurious scenarios; however, these scenarios are currently unknown.

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A preliminary review of injury surveillance studies in rugby union was conducted to evaluate the laceration injury prevalence in the sport. Inclusion criteria were: (1) conducted after 1995, (2) including a skin or laceration injury category, (3) prospective study design, (4) information on player-exposure hours, (5) written in English or Dutch. Eleven studies [1, 4–14] were selected based on the inclusion criteria. The mean overall match injury prevalence found in these 11 studies was 78 injuries per 1000 exposure hours. The laceration injury prevalence was on average 4.7 injuries per 1000 match exposure hours. Laceration injuries are therefore estimated to make up approximately 6% of the laceration injuries sustained during match play. However, these studies failed to report the injury situation in which these laceration injuries occur. This is because injury scenario classifications commonly used, e.g. 'ruck', 'tackle' or 'open play', lack the detailed information needed to replicate injurious scenarios for measuring kinetic and kinematic parameters of stud-player contacts.

To identify injury scenarios which can be replicated in the lab, detailed information on the injury event is needed. This can be obtained through qualitative research, either by prospectively observing and analysing laceration injuries in the field or by retrospectively asking players about their experiences with this type of injury. Prospectively observing injuries is unfeasible due to the relatively low injury prevalence and excessively long time that would be required; it is more effective to analyse injuries retrospectively, particularly when large samples are required. Therefore, this study used a questionnaire approach to identify the dominant play scenarios that resulted in laceration injuries in rugby union.

2. Methods

Ethical approval for this study was obtained from the Health and Wellbeing ethics committee of Sheffield Hallam University. Respondents had to be over 18 years old and give informed consent for their answers to be used for research purposes.

2.1. Questionnaire development

An online questionnaire was developed to investigate the causation of laceration injuries. The questionnaire contained 16 questions, of which 15 were closed and one was open ended. Closed question answer options were developed through exploratory interviews (N = 4) with experienced players. A pilot version of the questionnaire was completed by 12 respondents. The pilot was used to verify the questionnaire on intelligibility and the range of answer options. The pilot version of the questionnaire also included the option to give feedback to the authors at each question.

A final version of the questionnaire was developed in response to the pilot work. Respondents were first asked how often they had experienced stud injuries, including the option to select that they had never received one. Stud injuries were further defined as being 'minor stud injuries' - meaning that it did not hinder the respondent from continuing to play rugby - and 'substantial stud injuries', where a player had to refrain from fully participating in training or matches. If respondents had never received a substantial stud injury, they were still asked to continue with the questionnaire, answering generic questions on their boot type and stud checks. Respondents that had experienced at least one substantial stud laceration injury were invited to answer questions on the cause of their most severe stud injury. First, they were asked to categorise the event into the categories *'being tackled'*, *'tackling someone'*, *'on the ground in a ruck'*, *'stepping over a ruck'*, *'collapsed maul'*, *'I don't remember'* or *'other'*. The respondents were asked to describe the injury event in their own words (open question). Generic questions were answered by all respondents. The generic questions collated information on the use of different stud types through asking players what type of boots they used. Multiple answers were possible since players can have more than one pair of boots for varying pitch conditions or playing positions. The respondents were also asked how often they would check their own studs and if they had ever found their studs sharpened due to wear.

2.2. Questionnaire deployment

Amateur rugby players of any gender were targeted during the distribution of the questionnaire. The final version of the questionnaire was open to receiving respondents from the 9th March 2015 until 14th April 2015. The questionnaire was publicised through various internet platforms such as Facebook and Twitter, blog posts and on rugby discussion forums. The questionnaire was also publicised through contact with university sports teams and by asking rugby clubs to forward the link to their members.

2.3. Questionnaire analysis

Closed question responses were converted to percentages of total responses for the particular question. The open question analysis was an iterative process, based on the thematic analysis approach of Braun and Clarke (2006) [15]. First, the researchers familiarised themselves with the data. Second, the data was loaded into a computer assisted qualitative data analysis software program called NVivo (version 10, QSR International Pty Ltd., Australia). Since analysis of qualitative data in its raw form is likely to be too unmanageable to produce systematic and significant outcomes, data must initially be sorted and categorized [16]. Subsequently, initial themes in the form of 'nodes' were generated and these themes were expanded and refined based on the

data. This process was triangulated with peer researchers. Figure 1 provides a hierarchy of all the identified themes. The free-text responses were categorised on injury event, injury severity and person responsible for injury. After all the responses were appropriately coded, the emerging key concepts were analysed [16]. This research predominantly looked at the frequency of different 'causation event' nodes in the response data set and used word frequency counts to identify situational data on the laceration injury events. The results of the qualitative analysis of laceration injury events in rugby were further triangulated to the closed question on the same subject.

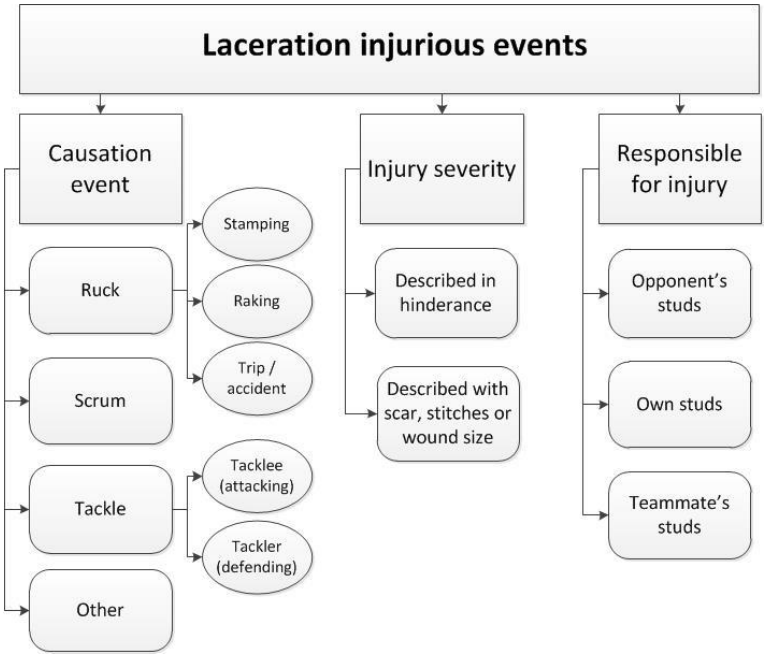

Fig. 1. Flowchart of the open question response themes.

3. Results

In total, 191 rugby players answered the questionnaire. The 191 respondents represented all playing positions on the rugby pitch. Respondents were 24.7 ± 6.2 years old and had 9.2 ± 7.0 years of experience playing rugby. Most respondents (76%) played rugby 1-3 times a week, which indicates a predominantly amateur population. A minor stud injury was experienced by 97% of the respondents more than once a year, and 71% of the respondents answered they have had at least one substantial skin injury caused by studs. Of these, 80 respondents answered the optional open question on the injury scenario. Table 1 presents the results of the closed question on the injury event causing the most serious stud laceration injury to the respondents.

Table 1. Results of the closed end question on the cause of the most severe stud injury a player had sustained during their career.

Tackle		Ruck		Various		
Being tackled	Tackling	On the floor	Stepping over	Collapsed maul	Do not remember	Other
11%	16%	50%	4%	8%	5%	5%

Open ended question responses yield a similar distribution of injury causation events; 56% of injuries occurred in the ruck and 34% of the injuries occurred during a tackle. During the rucking situation, respondents described deliberate stamping as a cause for their injuries in 35% of all free-text responses. For example, one respondent stated: "*As I was tackled the opposition came over to ruck and purposely stamped and scraped their studs down my shin*". In a tackling situation, the player who was making the tackle received laceration injuries from the opponents boot by a foot flicking up in their face, on the chest or around the waist. A tackle made from behind accounted for 14% of the injuries described in all free-text responses. For example, one respondent stated: "*I tackled the opponent from behind when they were sprinting and I wrapped my arms around her waist and pushed forward. Her stud went into my sternum as her foot came up*". The responsibility for causing a stud laceration injury does not always lie at the opponent's boot (66%) with 20% of the respondents stating they were unclear on who had caused the injury. This is likely to be due to the nature of the ruck. Table 2 presents who was thought to be responsible for the injury; teammate, opponent or the player him/herself.

Table 2. Studs responsible for causing the laceration injuries.

Opponents studs	Team mate studs	Own studs	Unclear
66%	14%	3%	20%

Of the total 191 respondents, 72% wore boots with the traditional aluminium screw-in studs. Respondents can have more than one pair of boots, and 12% of the respondents (also) used moulded boots with rounded studs. Bladed style boots were worn by 17% of the respondents in this survey. Other stud types, including triangular shaped studs and a combination of moulded studs and screw-ins called 'hybrids', were used by less than 10% of the respondents in the survey. Of the traditional aluminium stud wearers, 42% of the respondents state they regularly check their studs on sharpness. Overall, 38% of respondents who check their studs have found them to be sharpened due to wear on at least one occasion.

4. Discussion

The two most common laceration injury scenarios caused by studded footwear in rugby union were stamping on a player on the floor in a ruck and a tackle from behind, in which the tackling player experiences the laceration injury. Rugby is a sport with a high injury occurrence; it was found that the mean injury prevalence in 11 epidemiological studies cited in the literature was 78 injuries per 1000 match exposure hours. On average 4.7 laceration injuries per 1000 match hours were sustained by players, therefore an estimated 6% of the injuries in rugby union were cited as skin lacerations. In comparison, a systematic review paper by van der Eijnde *et al.* (2014) [17] on skin injuries in football found that 0.1 to 6.2 laceration injuries occurred per 1000 exposure hours (n = 10 studies). Similar footwear is worn across both sports and it is therefore not surprising to see laceration injuries happening in both football and rugby, with the high contact nature of the game of rugby leading to a higher injury occurrence.

To investigate the injury causation in a predominantly amateur rugby cohort, a survey research was conducted with 191 rugby union players. Just over half (54%) of the laceration injuries sustained by the rugby players who filled out the questionnaire were caused in a rucking situation, which makes the ruck a clear risk factor for this type of injury. The free-text answers about the injury causation varied in detail, but overall reconfirmed that most of the laceration injuries had happened in the ruck. Respondents described a deliberate stamp in the ruck by an opponent player in 35% of the cases. According to Brooks *et al.* (2005) [1] the majority of all injuries sustained by forwards in professional rugby union matches come from in a rucking situation. The results of the current study suggests that laceration injuries are likely to make up a significant part of rucking injuries. The next stage of the research will be to obtain the kinematic and kinetic parameters of the stamping and tackling injury scenarios that is identified in this research. It is hoped that the results from this planned research will inform improved stud testing protocols.

Respondents of the questionnaire stated in 66% of the cases that the opponent's boot was responsible for the injury, and in 20% the responsible player remained unknown. Most respondents (72%) wear aluminium screw-in studs themselves, and 42% of the aluminium stud wearing respondents check their studs regularly. Of all the respondents who check their studs, 38% has found them sharpened due to wear at least once. This information reiterates the need for stud checks prior to a match. With over one-third of aluminium stud wearers having found their studs sharpened, future test methods should investigate the effect of different materials and wear on laceration injury risk.

The final version of the questionnaire was only available online, which might have excluded people with no access to the internet. We do not believe this has biased the results. The certainty of the outcome of this research could be optimised by

increasing the sample population. Furthermore, it would be interesting to include elite players in the research, to see if a difference in causation event is found at different playing abilities.

5. Conclusion

In a predominantly amateur cohort of 191 rugby union players, 54% of the stud laceration injuries happened in the ruck, with stamping by opponents causing this type of injury in 35% of the cases. Tackling was accounted for 27% of the laceration injuries, and the tackle from behind where the boot of the ball carrier hit the tackling player was described by respondents to cause their injuries in 14% of the cases. It is therefore evident that these two injury scenarios are the dominant cause of laceration injuries.

6. References

[1] Brooks JHM, Fuller CW, Kemp SPT, Reddin DB. Epidemiology of injuries in English professional rugby union: part 1 match injuries. Br J Sports Med 2005;39:757–66.

[2] Hall MJ, Riou P. Football blades: a cause for concern. Br J Sports Med 2004;38:642.

[3] World Rugby. Regulation 12. Provisions relating to players' dress. Dublin: 2015.

[4] Best JP, McIntosh AS, Savage TN. Rugby World Cup 2003 injury surveillance project. Br J Sports Med 2005;39:812–7.

[5] Bird YN, Waller AE, Marshall SW, Alsop JC, Chalmers DJ, Gerrard DF. The New Zealand Rugby Injury and Performance Project: V. Epidemiology of a season of rugby injury. Br J Sports Med 1998;32:319–25.

[6] Brooks JHM, Fuller CW, Kemp SPT, Reddin DB. A prospective study of injuries and training amongst the England 2003 Rugby World Cup squad. Br J Sports Med 2005;39:288–93.

[7] Fuller CW, Molloy MG. Epidemiological study of injuries in men's international under-20 rugby union tournaments. Clin J Sport Med 2011;21:356–8.

[8] Fuller CW, Laborde F, Leather RJ, Molloy MG. International Rugby Board Rugby World Cup 2007 injury surveillance study. Br J Sports Med 2008;42:452–9.

[9] Fuller CW, Raftery M, Readhead C, Targett SGR, Molloy MG. Impact of the International Rugby Board's experimental law variations on the incidence and nature of match injuries in southern hemisphere professional rugby union. South African Med J 2009;99:232–7.

[10] Fuller CW, Sheerin K, Targett S. Rugby World Cup 2011: International Rugby Board injury surveillance study. Br J Sports Med 2013;47:1184–91.

[11] Garraway WM, Lee AJ, Hutton SJ, Russell EBAW, Macleod DAD. Impact of professionalism on injuries in rugby union. Br J Sports Med 2000;34:348–51.

[12] Jakoet I, Noakes TD. A high rate of injury during the 1995 Rugby World Cup. South African Med J 1997;87:45–7.

[13] Kerr HA, Curtis C, Micheli LJ, Kocher MS, Zurakowski D, Kemp SPT, *et al*. Collegiate rugby union injury patterns in New England: a prospective cohort study. Br J Sports Med 2008;42:595–603.

[14] Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol 2006;3:77–101.

[15] Denscombe M. The Good Research Guide: For Small-Scale Social Research Projects. 2014.

[16] Van den Eijnde WA.J, Peppelman M, Lamers EAD, van de Kerkhof PCM, van Erp PEJ. Understanding the Acute Skin Injury Mechanism Caused by Player-Surface Contact During Soccer: A Survey and Systematic Review. Orthop J Sport Med 2014;2:1–8.