

Rugby athletes and the prevention of injuries: an analysis on judgement skills and decisions-made

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ABSTRACT

Objective: To analyse rugby athletes' judgement knowledge and decisions-made where there is the potential to minimise error and prevent injury.

Material and methods: A prospective cohort of 300 rugby athletes participated in the Division 2A Senior Rugby All-Ireland Championships in the period of 2010 – 2011. The athletes came from the Dublin University Football Club and opposing Clubs, ten match fixtures videoed, injury data were collated with informed consent obtained.

Results: Time durations for the scrum had a mean throw in – clearance of 3.128s (SD 2.109), the tackle, mean clearance time 4.135s (SD 3.0320) and the lineout, mean throw in – clearance 4.072s (SD 3.2584). On space dimensions the scrum, short-arm binding was preferred, Fisher's exact test: p-value = 0.094 and variations in alignment, p-value = 0.056. Of the injury data a Chi-squared test, confirmed significant differences $p < 0.05$ with the hooker compared to the locks in the scrum 33.156 for cervical and lumbar spinal injuries respectively. In open play, loose forwards sustained cervical injuries, $p < 0.05$ due to the tackle compared to midfield backs 28.917 with lower limb injuries attributed to running and being tackled.

Conclusion: Judgement analysis on the scrum, tackle, and lineout showed consistent delays in recovery and completion from ball clearances respectively. Variations in alignments occurred with inconsistencies at the post-set in the scrum. In contrast applying Judgement knowledge with reference to the Laws of the Game there is the potential to minimise error and prevent injury.

Key Words: Rugby athletes, judgements, decisions, injuries, prevention.

INTRODUCTION

In this paper rugby athletes' judgement skills and decisions-made informed the inter-actions in game actions as potential strategies for injury prevention. In other sports a pioneering injury prevention study found that fixed ski bindings were attributed to lower limb fractures. As a result of these findings changes to the release mechanism led to a reduction in lower limb fractures¹. In American football, the spear-tackle was a cause of cervical spinal trauma and a change to the tackle rules led to a subsequent reduction in head and cervical injuries². In rugby scrum studies high transfers of energy were observed at the set having the potential for cervical spinal injury and premature degeneration. It was advocated that changes of Law 20 on the power set to the scrum be made^{3,4}.

Since 1995 the game of rugby, has been influenced by changes in how the game is played by professional rugby athletes. At the amateur level the game has been coached along the lines of these changes at restarts of play and contests for possession in open play. Rugby as a code of football is governed by its Laws which determine the requirements for playing the game.

Athletes learn, coaches adopt and referees apply the Laws of the Game⁵. Rugby referees also learn and apply the Laws as they are written but there are some applications that have not been fully applied. In those applications notably at inter-active phases of contest at the scrum have been influenced by the coaching of the professional game and refereeing policies particularly at the recovery phase in open play at the tackle. An approach in this paper examined how judgement knowledge can facilitate the application of the Laws, the application of fundamental physics and coaching practices concurrently to minimise error and prevent injury. Two themes are portrayed in this paper one is on judgement as an evaluation process defined by perception, form and self-organisational skills and the other as decisions-made on utility, choices and achievements. It is asserted that if the 'know how' principle informs athletes in game situations their executive performances could be enhanced⁶. Translating the knowledge of the Laws of the Game practised at training for match fixtures enables precision and accuracy to potentially achieve the athletes' social judgement skills^{7,8}. In open play studies there were player positions more prone to tackle injuries^{9,10,11}. In preventing sport-related dental trauma it was reported that rugby (union and league) had the highest claims under the Accident Compensation Corporation¹². Under domestic New Zealand Rugby Laws, players were mandated to wear mouthguards but in that report players may not have been wearing their mouthguards. In conclusion, athletes selectively perceive targets which on analysis refined their judgement skills, decisions-made and potentially minimises error and prevents injury¹³.

MATERIALS and METHODS

Study design and participants

This was a prospective cohort study of fifteen playing rugby athletes in the study team versus fifteen playing rugby athletes in an opposition team for each match fixture on ten matches. 80 scrums, 200 tackles and 40 lineouts were evaluated. A random sampling method was employed in which the cohort of players selected in game events alternated between the study team and opposition team within the same match. Of these selections a validation analysis was performed on 20 scrums, 20 tackles and 10 lineouts in sequence within the ten match fixtures.

Qualitative method and quantitative data

Video filming was the method to obtain image data on ten match fixtures in which 80 minutes of playing time was played in accordance with the Laws and Coaching of the Game¹⁴. In this

paper images were selected to illustrate any variations of performances at the scrum, tackle and lineout.

Statistical methods

Statistical analyses used Minitab 16 and results were presented as count (proportion) and mean (SD). Variable comparisons were performed utilised a Student's t-test for paired samples. The Pearson Chi-squared test was in search for any proportionate relationships between player positions, game events and injuries. Statistical significance was considered each time the p value was less than 0.05. If not an alternative explanation was sought.

Qualitative data

From the video data a judgement analysis described rugby athletes' play in defence and on attack when decisions were made. Other analyses described the attributes of the scrum, tackle and lineout. Results were categorised into the attacking team in which the player who controlled the ball was the decision-maker and the defending team whose judgement skills included evaluations of the behaviours of the attacking team. The injury data described as qualitative and quantitative in the context of a defender who gets injured and an attacking player, the ball controller who may get injured. Codes for the defending player at the tackle were designated as approaches; A1 = side-on, A2 = front-on; A3 = pursuant-on; at levels of contact; H1 = below the waist, H2 = at the waist; H3a = above waist below shoulder, H3b = above shoulder. From the clearances by the defending player; C1 = release ball carrier, C2 = moves away, C3 = gets to feet. In the lineout, the code Pp = Participating player. Within the lineout the attacking team determines the location of the three pods; front pod, middle pod and rear pod where the hooker decides to which pod the ball is thrown to, (see video images on the lineout).

Quantitative data

Time measurements (seconds) were performed in sequences on the 80 scrums, 40 lineouts and 200 tackles. The frequencies from the qualitative data perceived at the scrum, tackle and lineout were reported as quantitative data.

RESULTS

One scrum was chosen to illustrate the attributes of a scrum sequence, one tackle for the tackle sequence and two lineouts chosen because of quantitative data on these game events. The post-script after a player position were abbreviations for the designated team, (st) = Dublin University Football Club, (dsp) = De La Salle Palmerston Rugby Club, (clo) = Clontarf Rugby Club, (cam) = Cambridge University Rugby Club, (gre) = Greystone Rugby Club.

Video Images of the Scrum

Figure 1 at the set the tight-head prop (gre), no3 has a short-arm bind and his opponent the loose-head prop (st), no1 has a long-arm bind. There is equilibrium and the scrum has square alignment.



FIGURE 1

Set, binding props, equilibrium.

Figure 2 at the post-set, both front rows are pushing upwards towards each other, resulting in the 'buckle effect'. The scrum is square in formation, and both teams remain bound.

Figure 3 the ball has not yet been thrown in by the scrum half (gre), no9 on the far side. The attacking team on the left is preventing the defending team advancing towards its goal line. Scrum has become unstable.

In this scrum, the attacking team's stability was potentially affected by the short-arm bind by the tight-head prop (gre) and the alignment of both front rows. The defending team has square alignment and was pushing into the opponent's front row. The attacking team could not maintain its binding at the set resulting in the 'buckle effect'.



FIGURE 2
Front rows 'buckle effect'.



FIGURE 3
Unstable scrum in chaos.

Video Images of the Tackle

Figure 4 the tackler a defender is positioned at the side, (A1) as he wraps his right arm at waist level (H2). The ball carrier has both hands on the ball as another defender no 14 (clo) is in readiness to make a challenge.



FIGURE 4
Contact-held phase of the tackle

Figure 5 the completion phase of the tackle takes place. The tackler (clo) has grounded the tackled player (st) in an (A3) pursuant position at (H1) around the legs. No 14 (clo) goes for the ball. The tackler still holds the tackled player, no12 (st). A supporting player (st) approaches in white.



FIGURE 5
Grounded players' phase

Figure 6 the tackled player remains on the ground he has positioned himself towards his own goal. The tackler has released the tackled player and he is getting to his feet, a ruck has formed Law 16. 15 C3 tackler getting to his feet.



FIGURE 6
Recovery phase no 8, at C3

Figure 7 the tackled player still remains on the ground controlling the ball throughout the recovery phase of the tackle. A non-tackler is rolling away from the tackled player. The attacking team has four supporting team mates on side.

The tackle is a contest between the attacking ball carrier, the decision-maker and the defending team by one or more defenders whose judgements determined the execution of the tackle. The significant findings illustrated in this tackle is the delay in clearance of the ball initiated by the tackled player, the ball carrier then by the scrum half of the attacking team who eventually secures the ball for clearance.

FIGURE 7
Recovery phase delayed



Video Images of the Lineout

In Figure 8 illustrates the inter-active phase of the lineout, Pp (cam) at the mid pod secures the ball. The other two participating players as defenders are going for the ball. They are supported by their team mates.

Fig 9 at the inter-active phase the Pp (dsp) receives the ball at the front pod secures the ball in both hands above his head. Is supported by two team mates as he turns and sees his scrum half, no9 (dsp) to the left to whom he will throw the ball.

Figure 10 at the lineout the Pp (dsp) is brought to ground with the ball with his two supporters but is immediately tackled by no.4 (st) a flanker. The lineout has not yet ended.

Figure 11 the recovery phase of the tackle, the ball is made available and is secured by the scrum half (dsp). The tackled player remains on the ground. The lineout has not ended as the tackle has not been cleared from the line of touch. The tackle has ended as the ball is secured by the scrum half (dsp).¹⁶

The lineouts show challenges by two defenders (st) in Figure 8 and a tackle, Figure 10 by a defender (st) whose judgement skills were put into effect. The tackled player made the ball immediately available to his scrum half but remained on the ground. A chaos occurred as attending players become involved in the tackle.



FIGURE 8
Pp (cam) ball held at mid pod



FIGURE 9
Pp (dsp) front pod receives ball.



FIGURE 10
Pp (dsp) tackled, by no4 (st).



FIGURE 11
Lineout (dsp) and chaos.

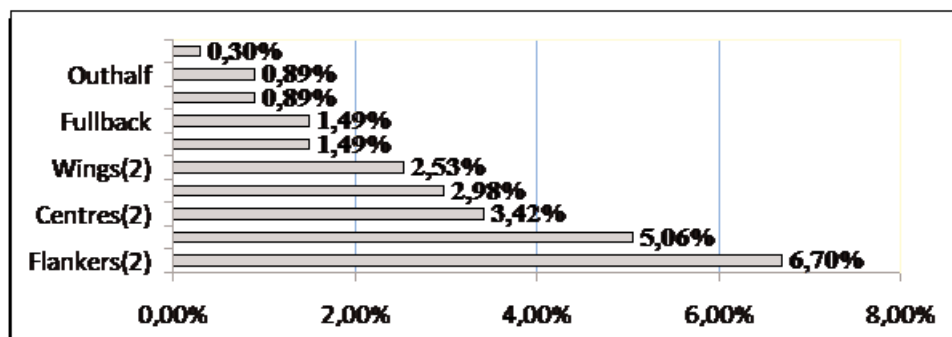


FIGURE 12. The proportion of tackle injuries by player position.

Prospective actual injuries

The actual injuries study was only on the study team, the Dublin University Football Club Senior Team. The cumulative number of case injuries reported and analysed was 336.

This included 38 insidious injuries attributed to uncertainty, for instance, with lumbar injuries affecting the locks, it was found that the locks reported more injuries as forwards not only due to the scrum but also the lineout. The incidence rate of total injuries was 53.90 injuries per 1000 training and player-match hours. The tackle was the highest 144 (42.86%) of all injuries, running 62 (18.45%), ruck 32 (9.52%), scrum 21 (6.25%) and lineout 11 (3.27%). Bruises amounted to 56 cases (16.67%), strains 254 cases (75.59%) and 25 non bruises nor strains (7.44%) of all injuries.

Tackle injuries by player position were related to the defender's (player position) and the attacking player, the ball carrier. The loose forwards, the flankers and the no.8, as defenders were the players more involved in inter-active contests in open play and the centres as midfield backs were less involved. The locks were the least affected by a tackle injury.

In Table 1 the Pearson Chi-squared test confirmed the hypothesis supporting a significant relationship between different player positions and diagnostic site of injury. The hooker was compared to the locks, the out half compared with the centres and the flankers compared to the centres. There was no significance between the out half and the centres injuries but there were significances between the hooker and the locks and between the flankers and the centres.

TABLE 1. Chi-squared distribution on player position, game event and injury

Player Positions	X ² -test	Game events	injury	DF	α	p value	Significance
F & C	28.917	Tackle,	Tackle	3	7.815	< 0.05	Yes
H & L	33.156	Scrum,	Lineout	4	9.488	< 0.05	Yes
OH & C	4.659	Kicking,	Running	4	5.991	0.097	No

Legend: F=flankers, C=centres, H=hooker, L=locks, OH=out half (fly half).

Results on scrum formations, n = 80

From the space data on the scrum, short-arm binding was preferred, Fisher's exact test: p-value = 0.094 and variations in alignment, p-value = 0.056. There were no significant differences in binding patterns between the study team (st) and the opposition team (op). That being the case, the behaviours of the tight-head props, no3 of either team represented a variation of Law 20 on bindings of the props in which all props are required to bind long-arm. A t-test two samples, assuming unequal variances was performed at the post-set for alignment (squareness) versus non-alignment (variations) and showed no significance, n = 80. 95% CI, z = -1.91, p-value = 0.056. Suggesting that non-alignment had the potential for the 'buckle effect' to occur thus a chaotic moment becomes possible. The shorter time phase durations were at the throw in at the scrum, mean 1.716s, SD 1.0912 pooled data. The delayed time phase durations were at the clearance at the scrum, mean 3.128s, SD 2.1098 pooled data. This could be explained by the alignment of the ball at the throw in and whether the ball was hooked or due to the mass effect during the inter-actions between both teams for possession.

Results on tackler's judgements at the tackle, n = 200

In the study team, defenders' judgements on approach were 46% (A1) side-on and 34% (A1) by the opposition players when defenders. With the (A2) front-on approach, this was the same as, 23% and was fewer in frequency. The study defenders' judgements on approach were 31% (A3) pursuant-on and opposition 43%. The level (height) for the contact-held was 48% (H3a) for the study defenders and 40% (H3a) for the opposition players when defenders.

The mean time durations from contact/held and brought to ground were shorter for the tackle 1.516s, SD 1.254 (st) and 1.550s, SD 1.276 (op).

Results on time durations at the recovery phase of the tackle, n = 200

The mean time duration (from brought to ground to clearance of the ball) were longer at the recovery phase of the tackle, study team 3.35s and opposition team 3.77s, 95% CI -1.07 (-1.194, 0.355), p-value = 0.287. There was no significance between both teams on time durations and an alternative explanation was that the delays were due to conditions based on the knowledge of Law 15 being applied by the tackled player and the response by the scrum half.

Results from contests at the lineout, n = 40

The frequency target favoured the middle pod, mean 0.3375, SD 0.4758 followed by the front pod, mean 0.3375, SD 0.4713 and the rear pod, mean 0.2911, SD 0.4572 the least. There were 25 mauls, 2 tackles, 7 rucks with 3 occasions where the ball was thrown beyond 15 metres. The time durations from the throw in – receiving the ball, mean of 1.131s, SD 0.866 (st) and mean of 1.312s, SD 0.606 (op). For the receiving - clearance duration times were a mean of 3.042s, SD 3.488 (st) and mean of 2.554s, SD 2.926 (op) with maximum times of 15s and 12.19s respectively such times are explained by a maul or tackle.

Results of the researcher's validation analysis compared to two independent assessors

Quantifications of the qualitative data were performed on selections from the scrums, tackles and lineouts in which there is 90% similarity (Assessor A) and 80% similarity (Assessor B) compared with to the researcher's assessment. The differences were in the interpretation of a short arm bind by the loose-head prop and whether the ball was thrown in straight or not.

DISCUSSION

The importance of this paper has shown that in all ten matches there were no significant differences in the team behaviours at the scrums, tackles and lineouts. Simply, because both teams applied their perceived judgement knowledge of the Laws of the Game, despite the chaotic moments in restarts of play and decisions-made by the player controlling the ball when to pass or release. The first judgement strategy highlighted chaotic moments at the scrum, where variations on alignment with short-arm binding by tight-head props and variations with ball entry by the scrum half. The hooker may decide to not directly hook the ball but rather rely on the shove by the second row. As a consequence the scrum invariably resulted in the 'buckle effect' derived from the shove by the second row with variations of alignment and energy transfers. The duration of time was short, from the set to throw in and delayed from the throw in till the ball was cleared from the scrum. The delay was influenced by the mass effect of both scrums over the slow movement of the hooked ball from the front row. The second judgement strategy highlighted chaotic moments at the tackle where attending players contesting for the ball were off their feet as defenders and or attackers. After making the ball available, the tackled players did not move away nor got to their feet immediately. Time durations were relatively short for the tackle but delayed at the recovery phase thus errors occurred.

Chi-squared tests on patterns of injuries significantly found that the hooker was the player most affected at the scrum and as a tackler with cervical and ankle strains. Midfield backs experienced lower limb strains due to running and contusions due to being tackled. With dead ball kicking by the out half and fullback both these positions experienced adductor strains. Less common were lumbar strains potentially affecting the locks due to the shove at the scrum and as participating players' on the descent in the lineout.

The literature supports the findings of the scrum and cervical injuries affecting the hooker, but in addition this paper clarifies how cervical injuries were likely to be attributed to the 'buckle effect' and with the hooker's other roles as tackler where spinal injuries may have been due to the tackle. Lower limb injuries reported in the literature showed similar findings affecting the midfield backs during running with hamstring strains and kicking the ball with adductor strains affecting the out half (fly half) and fullback.

Social judgement knowledge on perception, form and self-organisational skills facilitated the 'know-how' principle which asserted that knowledge informed rugby athletes in the execution of these skills. In the attacking team only one person of the 15 players controls the ball whose decisions-made determines the nature of the game.

CONCLUSIONS

Judgement analysis on the scrum (Law 20), tackle (Law 15) and lineout (Law 19) showed consistent delays in recovery and completion from ball clearances respectively. Although few injuries occurred during the recovery phase of the tackle these could be prevented. Variations in alignments at the front rows occurred with inconsistencies at the scrum potentially resulting in the 'buckle effect.' In contrast applying Judgement knowledge and decisions-made to the Laws of the Game there could be a potential to minimise error, prevent injury and chaos

Competing interests

There were no competing interests and the study was self-funded.

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