Determination of Objective and Subjective Performance Characteristics of an AFL Football

RESEARCH TEAM

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EXECUTIVE SUMMARY

Introduction

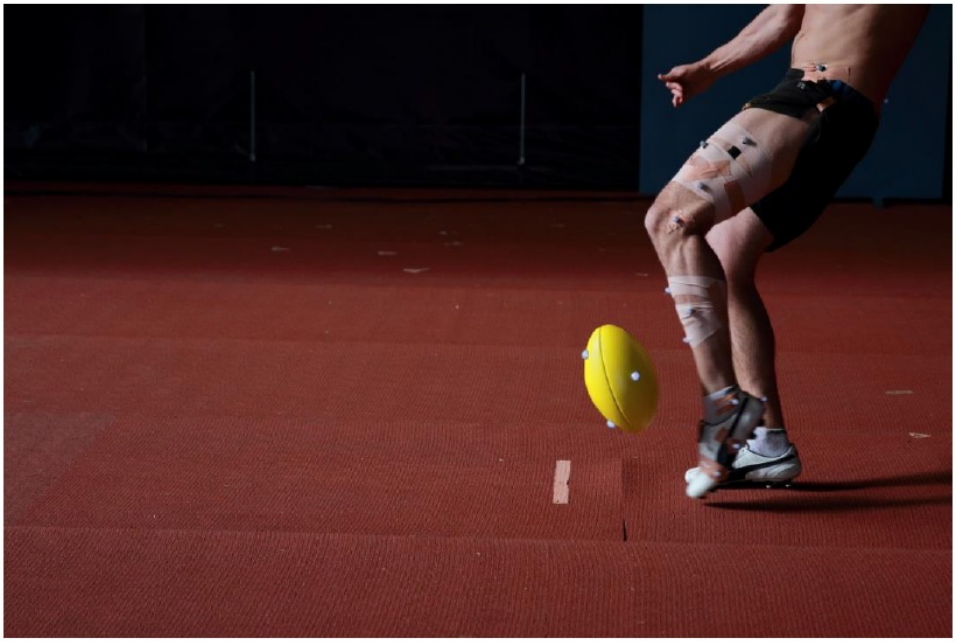
The Australian Football League (AFL) commissioned Victoria University's (VU) Institute of Sport, Exercise and Active Living (ISEAL) to utilise a combination of objective (biomechanical) and subjective (player/umpire perception) measures to determine differences in ball performance between and within three different ball brands (Sherrin, Burley and Ross Faulkner). In addition to comparing the new ball performance of the three brands listed, specific comparisons were also made between two models of Burley, the standard Sherrin ball and Sherrin Smart ball, new and used balls, and red and yellow balls.

Method

Fifteen elite male Australian footballers (either current or recently retired) and eight elite male umpires from the AFL participated. Each player performed eight kicks and two handballs with Sherrin, Burley or Ross Faulkner balls (See Table 1) for a total of 80 kicks and 20 handballs. These included two 20m accuracy kicks, four 30m kicks at goal (2 on the run and 2 from a slow approach), two kicks for maximum distance and two 15m handballs. For each ball, performance was examined using skill specific measures (accuracy and ball speed/distance) as well as mechanical indices of coefficient of restitution and foot to ball speed ratio (to indicate rebound efficiency). Impact characteristics and technical changes were monitored to determine if players changed their technique to accommodate different balls or if differences existed at the most crucial part of the kick - impact. Each umpire completed two "centre bounces" of each ball such that they completed 20 centre bounces with performance being evaluated by COR. Both the players' and umpires' perceptual preferences on various ball qualities were examined in two ways; 1) a paired- comparison and 2) a post-kick/bounce rating. Finally, COR was evaluated mechanically for each ball using a standardised drop test where each ball was dropped from a height of 3 m on five occasions so it bounced in middle (belly) of the ball.

Table 1: Experimental conditions.

Ball Type	New or Used
Sherrin	New
Sherrin	Used
Sherrin Yellow	New
Sherrin Smart	New
Burley	New
Burley	Used
Burley Yellow	New
Burley2	New
Burley2	Used
Ross Faulkner	New



SUMMARY OF RESULTS

RESEARCH OBJECTIVE 1: Identify performance differences between three different brands (4 ball types) of a new red football (Sherrin, Burley, Burley2, Ross Faulkner)

Burley New v Sherrin New

Differences existed in the rebound characteristics of Sherrin and Burley balls. Sherrin were more energy efficient in kicking indicated by higher Coefficient of Restitution (COR) and foot to ball speed ratios. This might have contributed to the perception that players found the Burley to be heavier. The only other difference between balls, a higher initial ball flight trajectory evident in the Burley balls, might also align with a 'heavier' ball. However on a group basis, there were no ball flight, impact or technique differences when kicking either ball suggesting if players did act on their perceptions, the changes were very subtle or different for different kickers. Examining individual kickers, technique did change subtly for the different balls but these changes were not consistent between players. Further, the differences in foot to ball speed ratio represented an approximate difference of only 0.5 - 1.0 m when kicking maximally so the practical significance of this finding would seem to be low.

When the look and feel of the new balls were considered prior to their actual use a number of key perceptions

were evident. The Burley New ball was perceived by both players and umpires to be smaller than the Sherrin New ball with the umpires overwhelmingly suggesting the Burley to be more rounded. While the players then felt the Burley was also heavier, the umpires considered the Burley lighter. The players perceived a more inconsistent stitching for the Burley, while the umpires felt the Burley New was more used.

A contributing factor to this comparison (and all others) was the variation in balls within-brand, evidenced for example by mass variations. These were as high as 8% for Sherrin and Burley Red (approximately 40 g) with the lowest variation evident in the Burley 2 Red ball (4.6%). Subtle differences in shape and stitching were noted by some participants in this study and players at club level from personal correspondence with the researchers. This in combination with the individual variation in technique changes between balls, are important aspects of performance to explore in future.

Burley2 New v Sherrin New

A larger number of differences were evident between Sherrin and Burley2 balls but as for the Burley comparison, there were many more similarities. Burley2 balls exhibited a larger COR and hand to ball speed ratio for handballs (but not kicks overall) indicating they performed more efficiently at lower speeds. Differences also existed for kick impact characteristics with more force being applied to the Burley2 ball and a shorter contact time evident indicating the balls do function slightly differently. The greater force application might have been in response to the perception of the ball being heavier, although this finding was inconsistent with that for the Burley ball so this point is not clear. As for the Burley ball, there were no technique differences evident nor were there any ball flight differences between balls but individual differences existed.

The Burley2 ball was perceived to be overwhelmingly more rounded by both players and umpires and in turn heavier. Interestingly again players and umpires differed in relation to size with the players rating the Burley2 larger whereas the umpires rated it smaller than the Sherrin. In terms of performance the players felt the Burley2 bounced lower than the Sherrin. The umpires perceived the Burley2 as more used but with more consistent stitching than the Sherrin.

Ross Faulkner v Sherrin New

Little difference was evident between the Sherrin and Ross Faulkner ball with only contact time being significant. There were no differences in COR or foot/hand speed for any comparison, no impact changes and no technique alterations. Given players considered this ball to be very different it was interesting that these perceptions did not seem to influence performance. In particular, the more pointed ball might be expected to influence the angle that the ball is positioned on the boot during the kick but this was not the case.

The Ross Faulkner was collectively seen by players and umpires as smaller, slipperier, lighter and harder. In fact, the Ross Faulkner ball was perceived to be lighter than all other balls tested. This was supported by mass measurements but interestingly there were few technical and impact differences between Sherrin and Ross Faulkner balls with some players reporting liking the slightly smaller and lighter ball. Consistent with these perceptions, the players also considered it pointier whereas in contrast the umpires felt it was more rounded. In terms of subjective performance the players found that bouncing was harder to control (this was also found relative to the Burley2 ball) and it was perceived to produce a lower bounce height than the Sherrin New ball. The umpires from a look and feel perspective felt the Ross Faulkner was more used but with more consistent stitching than the Sherrin New ball.

RESEARCH OBJECTIVE 2: Identify performance differences between a Sherrin Smart ball and a standard Sherrin football.

There were few differences in technique, impact characteristics and ball performance between the Sherrin standard football and the Sherrin Smart ball. Coefficient of restitution and foot to ball speed ratio was higher in the Smart ball for some kicks but this difference represented an increase in distance of less than 1 m. There were no differences in technique or impact characteristics and while the Smart ball was kicked with a lower spin rate, this rate was similar to that of the Burley2 new ball. Overall there would seem to be little change in either ball or participant performance when using either the Sherrin standard or Sherrin Smart ball.

The Sherrin Smart ball was perceived by both players and umpires to be more used and heavier than the Sherrin New ball. The umpires also perceived the Smart ball to be pointier, possessing harder inflation, more inconsistent stitching and with rougher leather than the Sherrin New ball. After performing with the ball the players rated the Sherrin Smart ball as larger and having a more erratic level of flight control than the Sherrin New ball. Perhaps some of these perceptions were reflective of the manner in which the Smart balls were stitched, although it is of note here that these perceptions would largely be due to differences between Sherrin balls themselves and not due to the addition of the Smartball instrumentation. No other significant differences were noted between the two balls.

RESEARCH OBJECTIVE 3: Identify performance differences between a new football and a used (kicked in) football

Changes in ball performance and impact characteristics were evident in comparisons of New and Used balls. Both Sherrin and Burley Used balls tended to become more 'rebound efficient' evident in higher COR and foot/hand to ball speed ratios. This might be due to the leather 'softening' particularly near the points of the ball, which would align with the perception that the Used balls were rounder. These performance changes are consistent with reports from the first stage of this research project where interviewees noted a better performance for a Used ball. Differences also existed for Sherrin balls at impact with greater force and work being applied to the Used ball, greater foot to ball contact distance evident and differences existing in ankle mechanics. Small differences existed in ball angle at contact, trajectory and knee range of motion but these were not consistent between kicks.

The Sherrin Used ball was perceived by the players to be slightly more rounded and slightly lighter than the Sherrin New ball. The umpires' perceptions generally reflected the players particularly in regard to appearing more used, albeit they felt the Used ball to be slightly smaller. The umpires also noted more inconsistent stitching and slightly rougher leather on the Used rather than the Sherrin New ball. When all balls were considered after performance testing it was clear that the Used balls (irrespective of brand) were perceived to be rounder, older and stickier (more grip) than the new balls. Importantly, numerous players commented on the reduction in pointedness of the ball as an appealing trait as they found pointed balls less forgiving and at times slightly painful to kick - perhaps explaining some of the biomechanical differences found.

RESEARCH OBJECTIVE 4: Identify performance differences between a yellow football and a red football

Overall there were no differences in biomechanical factors for the Sherrins. Burley Yellow balls exhibited a higher foot to ball ratio for kicks, increased work on the ball, a slightly different ball position at impact and different ankle mechanics. Also of note for both brands, Yellow balls tended to show higher COR and foot to ball speed ratios for tasks where the ball was struck nearer the point (kicking and handball) while Red balls tended to have higher values where the ball was struck nearer its middle (umpire bounce, ball drop).

Despite the widespread popularity of a perceptual or performance advantage for Yellow over Red balls, the players reported no perceptual differences between any of the Red and Yellow balls on the qualities examined. However, in contrast to the players, the umpires reported a perceived higher ball bounce height for the Yellow balls (both brands) relative to the Red balls. However, as noted above this is not supported in the biomechanical testing.