

Six Nations Rugby Union: Were the gloves off?

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As the Six Nations Cup reached its patriotic climax, two University of Sheffield engineers were keeping a closely scientific eye on the ball. Experts in tribology—the science of friction—Drs Roger Lewis and Matt Carré are more interested in grip than glory.

Drs Lewis and Carré in the University's Department of Mechanical Engineering have been measuring the dynamic friction between the material of the ball and the skin on the fingertips and palm, and the mitts that some players choose to wear under different [weather conditions](#). They're looking to answer one question: what's the best way to ensure that players don't fumble the ball?

"Catching and handling a ball with great skill and confidence is practically second nature to players at this level," says Dr Lewis. "But handling errors are still seen in professional rugby games and even more so in amateur rugby, so ball manufacturers are working constantly to provide extra grip to overcome the problems that occur, not all of which are related to player ability. Given that a slip at the wrong time could mean the difference between winning and losing a match, it's important that this potential is explored – and there's still scope for improvement." he said.

Rugby balls are now manufactured with pimples on the surface of their four panels to improve handling, and players may also wear fingerless gloves, known as mitts, which also have a surface texture to afford even greater grip, especially in [wet conditions](#).

In a paper published in the journal *Tribology International*, Drs Lewis and Carré have shown that simply adding pimples to equipment does not necessarily deliver the intended result.

They believe that equipment manufacturers need to consider the implications of the dynamic friction produced by the different loads used in catching, throwing and manipulating the ball using different parts of the hand - and how the characteristics of the pimples interact with skin or mitts under the different conditions on match day.

"When we looked at the rugby balls themselves, used in dry conditions with no mitts, balls that had more closely spaced pimples were better for grip. But in wet or muddy conditions, the density of the pimples allowed a film of moisture to form between them, so in these conditions, a ball with wider pimple spacing is better," he said.

In addition, the researchers found that mitts with coarse texturing can have a detrimental effect on grip. "To truly work as intended, the texture on the mitts needs to interlock with the pattern on the ball. We found that mitts with coarse texturing actually reduced grip in some cases," said Dr Lewis. Of the mitts tested, synthetic leather mitts produced the overall best performance across all conditions, as the imposed texture interlocked best with the pimples on the ball.

Rugby ball manufacturers have introduced different pimple patterns for different types of rugby union, for example the pimple pattern on balls for 'rugby sevens', a form of rugby where the ball is almost constantly handled and rarely kicked, is more widely spaced than the pattern on balls for the conventional 15-player version of the game. "But this has been done without the fundamentals of textured visco-elastic material interactions with skin being fully understood, and in any case, our results show that the pimple pattern on the mitts is an equally important factor," says Dr Lewis.

Rather than being a criticism of current equipment design, Dr Lewis sees his results as an opportunity for sports equipment manufacturers.

"Technology is helping athletes of all skill levels improve performance in so many other sports, why should rugby union be left out? Our work suggests that there's no one optimum design for all weathers, so manufacturers could design different balls targeted at countries with particular climates, for example. And our results could help feed some science into the design process of mitts too, to allow players to match the mitts' pimple design with the type of [ball](#) being used to ensure better interlocking. At the moment, adding texture is simply assumed to improve grip, but this isn't necessarily so."

Provided by University of Sheffield

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