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# Tackling the Mechanics of Concussion

Xanthe Harrison\*

**Abstract:** Tackle Mechanics, a Newcastle research based start-up investigating whether modifying tackle techniques in rugby union and rugby league can reduce the risk of concussion injury to players. Using gold standard three-dimensional motion capture technology, tackle techniques have been accurately measured and players have successfully modified their technique after coaching.

**Keywords:** Tackle Mechanics, Three-dimensional motion capture, Concussion

## 1. The success story

Across both rugby union and rugby league, the tackle is the most common impact event and accounts for the greatest number of injuries. Of particular concern, is the high incidence of concussion associated with tackling. This presented the key challenge of reliably identifying which tackle techniques increase the risk of injury and seeing whether a player can actually change their technique if instructed, maintain this changed technique across multiple sessions and then implement it in a game situation to mitigate injury risk. The Tackle Mechanics group used gold standard three-dimensional (3D) motion capture technology to accurately measure tackling techniques and found that players can make modifications after coaching. There's evidence now that tackle specific training could be implemented to reduce the risk of injury. This is the start of an evidence-based solution for the community to decrease concussion risk, rather than just quantify the impact of a concussion. Being an early stage start-up, Tackle Mechanics has recently been part of a research translation and commercialisation program to further their research.

## 2. How did we start?

Timana Tahu, former NRL and rugby union player, was motivated to change his tackling technique to reduce injury risk after sustaining a severe head knock which left him unconscious using traditional methods. In his move into coaching at the end of his professional career, he aimed to share his modified tackle techniques. Timana was met with questioning as he ran

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**Xanthe Harrison:** Gordon Eye Surgery, 2/741 Pacific Hwy, Gordon NSW 2072, Australia, Email: [xanthe.harrison@students.mq.edu.au](mailto:xanthe.harrison@students.mq.edu.au)

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coaching clinics in college programs in the USA, asked repeatedly to provide the evidence for his methods, particularly as he challenged long standing coaching methods. In the search to validate his modifications, Timana collaborated with Biomechanist Dr Suzi Edwards and Neuropsychologist Associate Professor Andrew Gardner on Tackle Mechanics to accurately measure the body's movement during different tackle techniques. Dr Edwards was motivated by her "passion to make sport safer for everyone in the community" and Associate Professor Gardner is the co-director of the Hunter New England Health Sport Concussion Clinic. It was thought if a player was given instructions on the tackling technique that should be used, their posture during the tackle would change to mitigate the risk of injury.

### 3. Our technology



*Figure 1. Photograph of Timana Tahu, Tackle Mechanics founder, showcasing the Three-Dimensional Motion Capture Technology, preparing for recording*

### 4. The journey so far

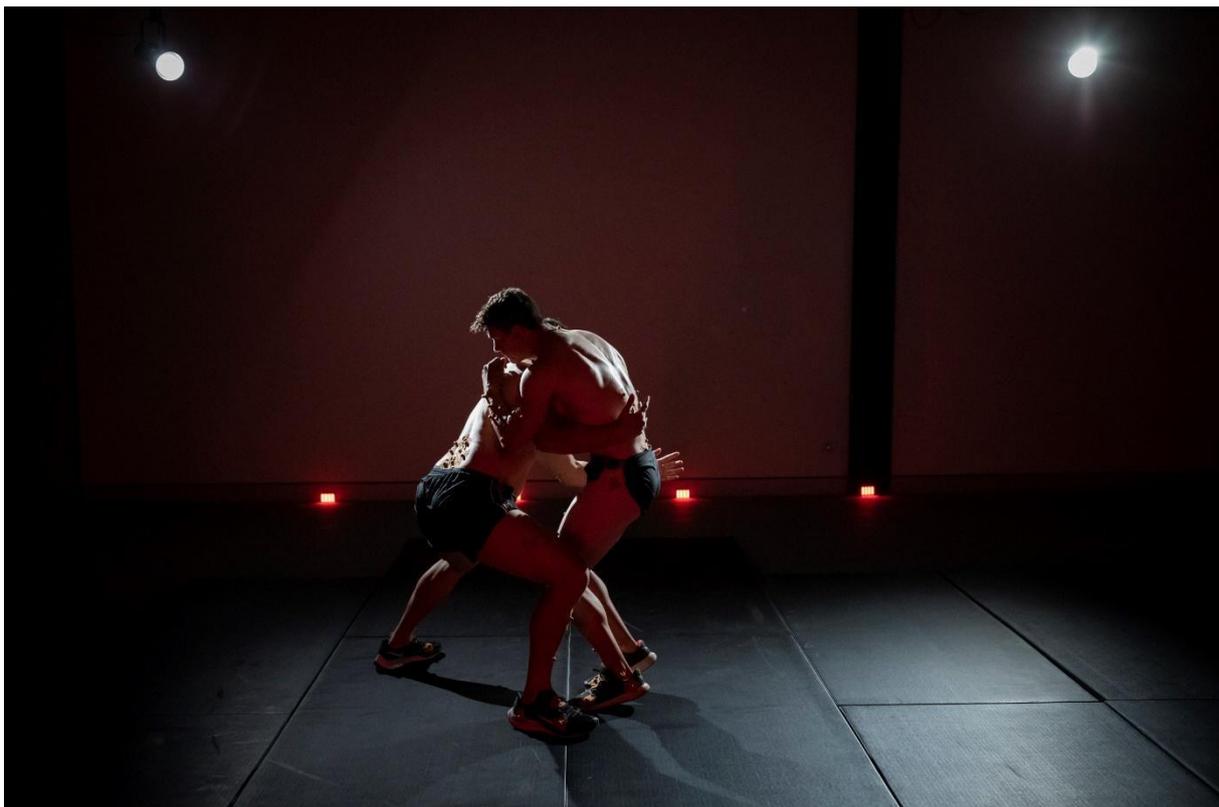
While Timana had been using his variation on the traditional tackle technique for ten years, it wasn't until 2017 that he approached Dr Edwards and Associate Professor Gardener to conduct formal research. Associate Professor Gardner and Timana then approached the NRL Research Committee who saw the vision of the research and funded the pilot study.

Data from the NRL between 2017 and 2019 found the majority of concussions in rugby league are sustained by the tackler. Research has also found that tackle height is the main factor

indicating tackle injury risk. This created the foundation for the research to focus on one-on-one tackling situations and how tackle height can be manipulated to reduce injury risk.

The research group have published three peer-reviewed papers in 2021. So far the trio have proposed a research framework for future 3D motion capture studies, identified different movement strategies a ball carrier may take based on the position of the tackler, and found tacklers can change their tackling posture after instruction by an expert coach, providing preliminary evidence that tackle specific training may be an injury reduction strategy. The goal now is to expand the study into in-game situations, investigate long-term effects of coaching, and disseminate this knowledge into the community.

There has been strong media interest already, with the University of Newcastle publishing an article in the uni's media outlet Hippocampus, with a reach of over 136 million views in three months with coverage in Australia, the USA, UK, United Arab Emirates and New Zealand. Subsequently, there are now billboards of Timana all over the Hunter Valley and Central Coast. Tackle Mechanics have recently also been part of a research translation and commercialisation program to further their work.



*Figure 2. Photograph of Timana Tahu and Exercise and Sport Science student Scott engaging in a tackle for motion capture recordings.*

## 5. Look to the future

With plans to continue research and studies well underway, there is much to come from Tackle Mechanics. Reflecting on their research journey so far, Dr Edwards notes *“we have overcome the limitation of the lack of existing gold-standard technology to measure 3D tackle techniques in real-time, in a game by exploring 3D tackle motion in the laboratory. Within the process, we are developing technology that can be later used in games to more accurately identify concussion risk. We are actively working to develop new evidence-based coaching methods to implement from under 8s to elite level across the rugby codes to make sports safer. Currently, we are implementing innovative research ideas in rugby league in NSW Australia, with the aim that in the future, we will expand into the US market of American Football as they base their tackling technique on the rugby codes, making our product highly suitable to upscale to the US market, and ultimately the NFL.”*

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### The company

Tackle Mechanics  
University of Newcastle  
University Drive  
Callaghan NSW 2308  
Australia

## Investment Rounds (collected in 09.08.2021)

| Seed | 2017 | NRL Research Committee | \$8000 |

## Main facts (collected in 09.08.2021)

The research collaboration started in 2017.

The first product is currently under development.

The company currently employs 3 people, Timana Tahu, Associate Professor Andrew Gardner and Dr Suzi Edwards.

The next milestone is to publish an evidence-based coaching manual to provide coaching strategies to mitigate injury risk and to upskill current coaches.

**Xanthe Harrison** is an Orthoptist at Gordon Eye Surgery and Lane Cove Eye Surgery, multidisciplinary eye care practices which service the northern suburbs of Sydney, and an Academic Tutor in the Macquarie University Department of Psychology.

Xanthe delivers quality patient care utilising state-of-the-art technology in the screening and assessment of adult and paediatric patients with eye pathology and eye movement conditions.

Xanthe has expertise in the fields of human movement, cognitive and brain sciences, and orthoptics. She has completed a Bachelor of Human Sciences from Macquarie University, and a Masters of Orthoptics from the University of Technology Sydney.

Previously Xanthe has been part of a research group at the Macquarie University Department of Cognitive Science investigating brain health with portable EEG technology. She has recently been awarded the Orthoptics Australia Prize and the Lance/Jolly Prize for clinical placement and academic achievements in her Orthoptics degree.

