

ASSESSING THE ABILITY OF PADDED CLOTHING TO PREVENT STUD INDUCED INJURIES IN RUGBY UNION

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Padded clothing (shoulder padding) is worn in rugby union to give players an opportunity to protect themselves. A performance specification for padded clothing has been set out by World Rugby™, with the intention that padding only protects against cuts and abrasions [1]. Within this performance specification is a drop tower style impact test, with the padding placed over a cylindrical steel anvil and impacted by a flat steel striker. Cuts and abrasions are commonly caused in rugby by the stud of another player [2]. There is no published research which assesses padded clothing's ability to protect against cuts and abrasions. Oudshoorn [3] highlights two distinct phases of stud impacts, an initial direct impact and a raking phase. This study aims to assess the ability of padded clothing to prevent stud induced injury, implementing a silicone and chamois leather-based shoulder surrogate in an impact testing set up (Fig. 1a).

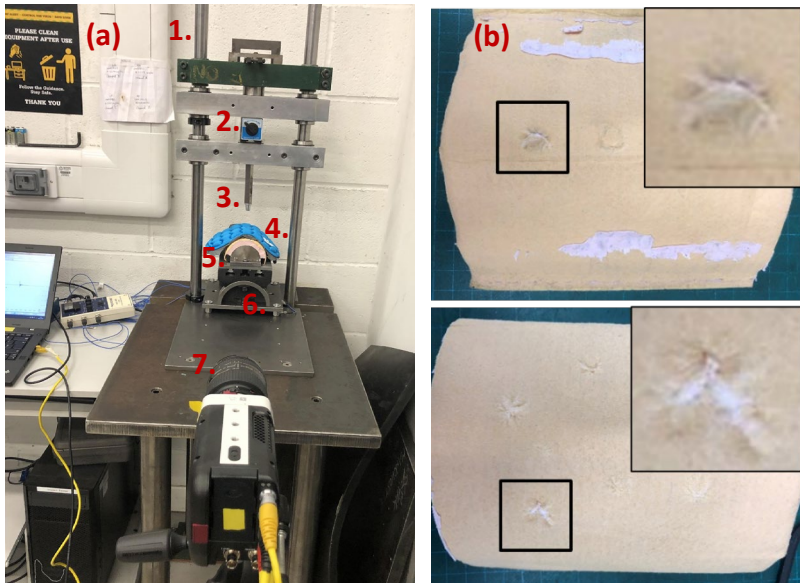


Figure 1: (a) Experimental test set up for the replication of direct stud impacts using a shoulder surrogate (1. Rail Guides, 2. Magnetic Switch, 3. Stud Striker, 4. Padding Sample,

5. Shoulder Surrogate, 6. Load Cells, 7. High Speed Camera), (b) Images of tearing caused by stud impacts (top) No padding, (bottom) Covered with Plastazote foam.

An incremental process (+ 1 cm increase in drop height) was used to find the impact energy (J) and force (N) required to tear the surrogate (replicating a cut) in three scenarios, i) without padding, ii) with control foam (Aortha White, Plastazote®, -LD-60, Algeos) and iii) with two World Rugby approved commercial padded clothing samples (MS 1 & 2). A tear was defined when the silicone could be seen through an opening in the chamois layer (Fig. 1b). The stud (World Rugby™ approved) tipped striker (mass = 3.65 kg) was set to the desired drop height, held with a magnet and then released to drop and impact on the shoulder surrogate/padding. A photograph of the surrogate was taken after each impact. A tear in the chamois leather was seen at an impact energy of 2.5 J with no padding; an increase of 1.1 J was needed to cause a tear with MS 2 covering the surrogate, and an increase of 2.5 J with Plastazote and MS 1 covering the surrogate (Table 1).

Table 1: Peak impact force and tear (Y/N), with and without padding.

	Energy (j)	1.8	2.1	2.5	2.9	3.2	3.6	3.9	4.3	4.7	5.0
	Drop Height	5	6	7	8	9	10	11	12	13	14
	(cm)										
No	Force (N)	545	731	1091	-	-	-	-	-	-	2432
Padding	Tear (Y/N)	N	N	Y	-	-	-	-	-	-	Y
Plastazote	Force (N)	-	400	549	652	656	700	841	940	1154	1355
	Tear (Y/N)	-	N	N	N	N	N	N	N	N	Y
MS 1	Force (N)	-	-	195	-	214	1085	1180	1585	1623	1724
	Tear (Y/N)	-	-	N	-	N	N	N	N	N	Y
MS 2	Force (N)	-	502	658	668	845	1070	1191	1259	-	-
	Tear (Y/N)	-	N	N	N	N	Y	Y	Y	-	-

A mean increase in impact energy of 75% was needed to tear the chamois leather (simulating a cut or abrasion) when MS 1 or MS 2 were used as padding. On average, MS 1 and MS 2 attenuated 40% of the impact force. The study shows the use of padded clothing in rugby could lead to a reduction in stud-induced injuries. Future work could use the shoulder surrogate to assess the ability of padded clothing to protect against other superficial injuries, like bruising.

1. World Rugby (2021) Body Padding Performance Specification. <https://www.world.rugby/the-game/player-welfare/equipment/specifications/body-padding>. Accessed 29th July 2021.
2. Oudshoorn, B. Y., Driscoll, H. F., Dunn, M., & James, D. (2016). Causation events of stud laceration injuries in rugby union. *Procedia Eng.* 147: 496-500.
3. Oudshoorn, B., Driscoll, H., Dunn, M., Senior, T., & James, D. (2018). Development of a test method for assessing laceration injury risk of individual cleats during game-relevant loading conditions. *Footwear Sci.* 10:1-10.