IMPLEMENTING AN ISO STANDARD FOR SNOWBOARDING WRIST PROTECTORS

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Wrist injuries are common among snowboarders [1]. Beginner snowboarders are particularly prone to wrist injuries, as they often outstretch their hands when attempting to cushion a fall [1]. Experienced snowboarders are more prone to injuries affecting regions, such as the trunk, and knees [2]. While wrist protectors can prevent injuries, most snowboarders do not wear them, and it is unclear which designs are best [1]. In 2011, the International Society for Snowsport Safety formed a group to develop a standard for snowboarding wrist protectors, which led to the recent publication of ISO 20320:2020 [3]. This recent development provides an incentive for manufacturers to market products that comply with ISO 20320:2020, which would then help consumers to make informed choices about wrist protection.

ISO 20320:2020 contains two main performance tests, termed i) limitation of wrist extension and ii) impact performance (Fig 1). The purpose of the limitation of wrist extension test is to check that the protector can stiffen the wrist joint and prevent wrist hyperextension, a key contributor to wrist injuries [1]. The protector is fitted to a wrist surrogate, as developed by Adams et al. [4], and a torque (value dependent on surrogate / protector size) is applied to the joint to extend the wrist. To pass the test, when an initial torque is applied wrist extension must be between 50° and 75°, and then between 55° and 80° when the torque is increased. The impact performance test only applies if the manufacturer claims the product protects the palm against impact, which is not ideal as it could make it harder for consumers to make informed purchasing choices. The protector is secured to a rigid hemisphere (100 mm radius), and a 2.5 kg mass is dropped (height dependent on protector size) onto the palm. For the protector to pass, the impact force must be under 3 kN.

As ISO 20320:2020 was only published in 2020, no products have yet been certified. However, the development of the standard has helped to focus and progress

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research in this field and further work is underway to improve the biofidelity of the specified surrogate design [5], determine the product's impact performance whilst mounted to a wrist surrogate [6], and develop finite element models to explore wrist protector design [7].

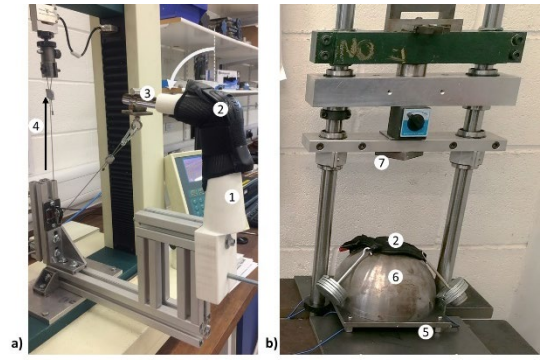

Fig. 1: ISO 20320:2020 performance test setups (a) limitation of wrist extension test (b) impact performance test. 1- Polyamide hand and wrist surrogate, 2 -wrist protector, 3 - steel rods to apply the load, 4 - displacement to generate torque in surrogate wrist, 5 - load cells, 6 - hemispherical dome, 7 - guided falling mass

ISO 20320:2020 marks an important step towards improving wrist protectors and reducing snowboarding injuries. More work is needed, to i) ensure wrist protectors comply with ISO 20320:2020, ii) raise awareness of the standard among snowboarders and iii) monitor if having certified wrist protectors reduces snowboarding injury rates. Research can focus on critiquing ISO 20320:2020 to ensure it is fit for purpose, to underpin periodic updates that may be required. Such research could include investigating test parameters and pass thresholds and implementing a wrist surrogate into the impact performance test.

1. Michel, F.I. *et al.* (2013). White Paper: functionality and efficacy of wrist protectors in snowboarding—towards a harmonized international standard. *Sports Eng*, *16*(4): 197-210.
2. Ogawa H, et al. (2010). Skill Level-Specific Differences in Snowboarding-Related Injuries. *Am J Sports Med.* 38:532–7.
3. ISO 20320:2020. Protective clothing for use in snowboarding — Wrist protectors — Requirements and test methods.
4. Adams, C. *et al.* (2018). Effect of surrogate design on the measured stiffness of snowboarding wrist protectors. *Sports Eng*. 21: 217–225.
5. Leslie, G. *et al.* (2020) Effect of Surrogate Surface Compliance on the Measured Stiffness of Snowboarding Wrist Protectors. In *MDPI Proceedings.* 49(1):84
6. Adams, C. et al. (2021). Impact Testing of Snowboarding Wrist Protectors'. *Proc Inst Mech Eng P J Sport Eng Technol.*
7. Newton-Mann C, et al. (2018) Finite Element Model of an Impact on a Palmar Pad from a Snowboard Wrist Protector. In *MDPI Proceedings.* 2(6):314.

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