Protective Clothing and Impact Protection for Motorcyclists

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Abstract

Impact protectors are worn by motorcyclists to reduce the risk and severity of injuries in crashes, but previous research reports no benefit in terms of preventing fractures. This study examined the performance of impact protectors worn in serious injury crashes and their energy attenuation performance when tested under the European Standard (EN1621-1). Eighty-three percent of impact protectors tested met Standard requirements. While only 4 impact injuries (defined as fractures, dislocations, avulsions) occurred in protected regions, no association between energy attenuation and these injuries was found. Characteristics other than energy attenuation may be important for protection, but further research is needed.

Background

Impact protectors (IP) reduce overall injury risk in motorcycle crashes (de Rome et al., 2011). Nygren (1987) and Otte et al. (2002) have shown IP can attenuate sufficient energy to reduce fracture severities in the laboratory. There is little evidence that the use of IP commonly used in protective equipment for motorcyclists are effective in reducing the risk of fractures. These IP usually comply with the European Standard EN1621-1, which sets minimum energy attenuation requirements. Two studies were conducted to examine (i) the effectiveness of IP worn by Australian riders in crashes, and (ii) the energy attenuation performance of IP, and how this relates to real world injury outcome.

Method

Motorcycle riders (n=90) were recruited as part of a previously reported in-depth study (Brown et al., 2015). Impact injuries, (i.e. fractures, dislocations, avulsions) due to impact to shoulders, elbows, hips and/or knees were identified from medical records. Details of IP worn were collected from interview, and clothing was inspected where possible. Clothing damage and/or presence of impact injury were used to identify body regions impacted. Study 1 examined associations between IP use and impact injury using multi-level regression to control for confounders. (See Figure 1)

In Study 2, IP from clothing (n=76) was categorised by CE certification and IPs were tested to energy attenuation requirements of EN1621-1, based on average and maximum transmitted force. (See Figure 1) Associations between energy attenuation and injury were examined using logistic regression accounting for repeated measures.

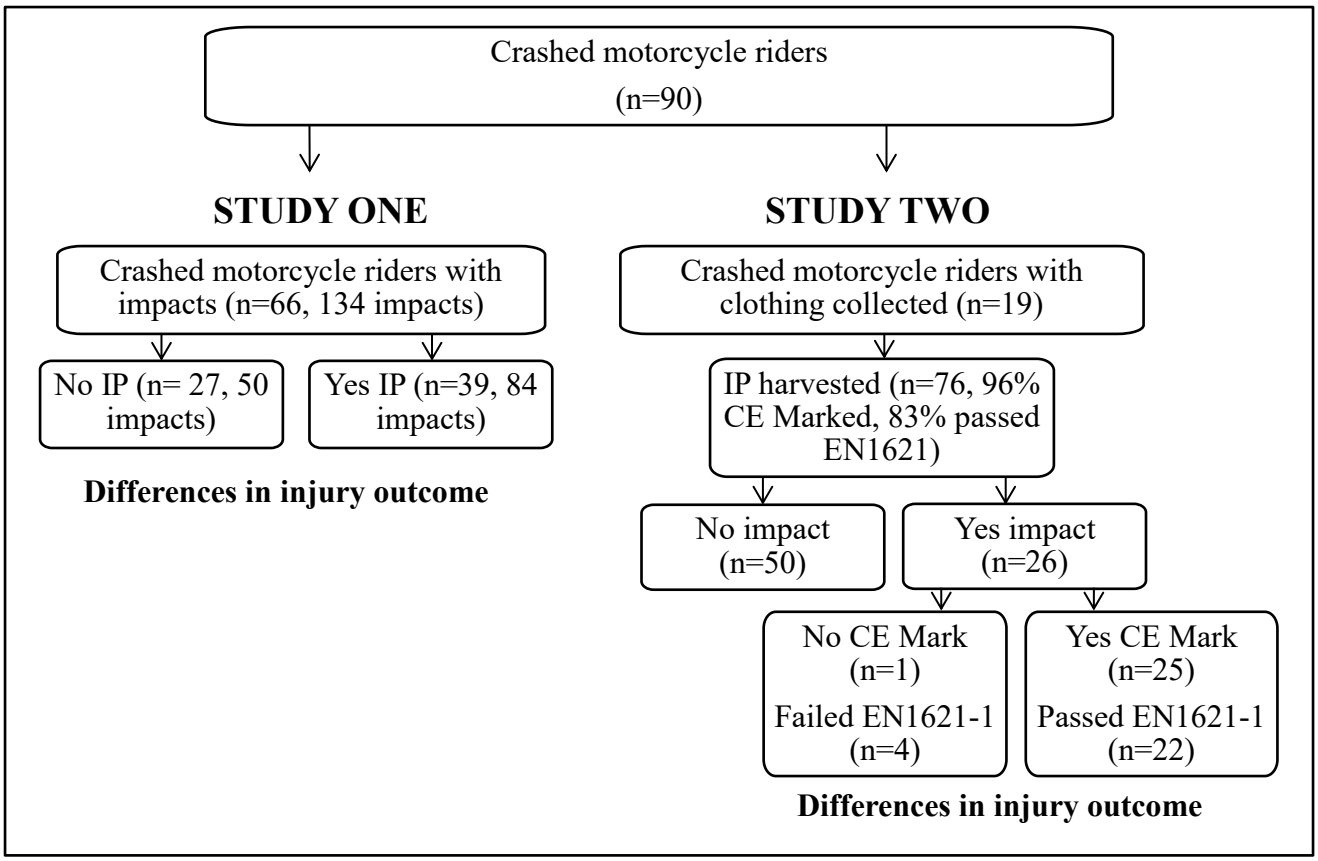

Figure 1: Flowchart of study design

Results

Study 1 identified 134 impacts (66 riders) across IP locations, with 84 impacts (39 riders) identified in regions where IP was present. There was no significant difference between number of impact injuries (OR = 1.28, 95% CI: 0.47-3.53) or injury severity (OR = 0.81, 95% CI: 0.17-3.82) in IP protected and unprotected regions.

Among the 76 IPs harvested from 19 riders in Study 2, four impact injuries occurred out of 26 identified impact locations. Ninety-six percent of harvested IPs were CE marked, and 83% of IPs harvested passed the energy attenuation requirements of EN1621-1. No significant difference was found between impact injury and meeting EN1621-1 requirements (p = 0.5, Fisher's Exact test). Additionally, there was no association between average force transmitted in the EN1621-1 test and presence of impact injury (OR = 1.1, 95% CI: 0.91-1.24); however, as maximum force transmitted increased, impact injury was more likely (OR = 1.1, 95% CI: 1.01-1.2).

Conclusions

The results confirm findings of de Rome et al (2011). Although most IPs met EN1621-1 requirements for energy attenuation, meeting this requirement was not associated with a reduced likelihood of the injuries studied. Study limitations including the small hospital-recruited sample suggest further study is warranted. Furthermore, the small number of riders with impact injuries in regions covered by IP suggests there may be some benefit, apart from the ability of the impact protector to attenuate energy when tested to EN6121-1.

Table 1: Occurrence of impact injury in riders with impact protection, CE certified impact protection and impact protection which passed EN1621-1 energy attenuation requirements.

		Impact Protection Worn (n=134)		**CE Certified (n=26)**		**Passed EN1621-1 Requirements (n=26)**	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
Impact Injury	**Yes**	42 (50%)	29 (58%)	3 (12%)	1 (100%)	3 (14%)	1 (25%)
	No	42 (50%)	21(42%)	22 (88%)	0 (0%)	19 (86%)	3 (75%)

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