Validation of test protocols for assessing motorcycle protective clothing using real world crash investigation

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• Motorcyclists
  • One per cent of vehicle kilometres travelled
  • 22% serious injury, 16% fatal injury (ATC, 2011)

• Deaths and serious injury increasing with motorcycle usage
  • Deaths increased by 17%, motorcycle usage increased by 82% from 2000-2010 (ACT, 2011)

• Protective clothing
  • Reduces risk and severity of injury, particularly soft tissue and open wound injuries (de Rome, 2011; McIntyre, 2011)
  • Ability of clothing depends on its quality- 30% clothing failed in crash (de Rome, 2011)
EU Clothing Standard - Zones

1. Impact protectors required
2. High abrasion resistance
3. Moderate risk of abrasion
4. Provide ventilation
INTRODUCTION

1. Burst
2. Cut
3. Tear
4. Abrasion
OBJECTIVES

• Presents the method we are developing to investigate the adequacy of the testing protocols in the European standard

• Preliminary results for the first 20 cases

• Two example in-depth cases
METHODS – data collection

- 3 year in-depth motorcycle crash investigation - 100 cases
- 3 hour drive from Sydney
- 14 years and older
- Two Sydney hospitals and one regional hospital
### METHODS - Analysis

<table>
<thead>
<tr>
<th>Method</th>
<th>Data Collection</th>
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| Participant interview         | • Self-reported cause of injury  
                                | • Self-reported clothing damage and injuries type and location                   |
| Medical records               | • Injury type and location                                                     |
| Motorcycle inspection         | • Motorcycle damage type and location                                          |
| Scene inspection              | • Road surface characteristics  
                                | • Evidence of crash                                                             |
| Clothing inspection           | • Clothing damage location and type                                            |
| Clothing testing              | • Clothing tolerance to damage compared to the standards                       |
METHODS - Analysis

Chi-squared test

Meet Standard requirements? Yes/No

Clothing worn in crash

Injury occurred? Yes/No

Required performance level adequate
METHODS - Analysis

- Analysis
- Logistic regression

Time to hole

Confounders (crash severity)

Injury

Required level of performance to prevent injury among motorcyclists
PRELIMINARY RESULTS

- 20 cases
- **Age:** average 33, range 16-69
- **Gender:** 18 male, 2 female
- **License:** Full 13, Learners 5, P1 1, P2 1
- **Speed limit:** 60km/h 75%, 60-100km/h 25%
- **Road type:** major arterial 9, minor arterial 6, local 2, national park 2, freeway 1
- **Coarseness:** coarse 4, medium 10, fine 6
- **Body movement:** 9 slide, 5 roll/tumble, 5 some form of movement, 1 did not slide
PRELIMINARY RESULTS

- Fracture: 10
- Abrasion: 73
- Internal Contusion: 42
- Muscular Injury: 18
- Soft tissue injury: 12
- Haematoma: 7
- Laceration: 10
- Motorcycle jackets: 12
- Motorcycle pants: 7
- Motorcycle gloves: 10
- Motorcycle boots: 7
PRELIMINARY RESULTS

- **Footwear**
- **Pants**
- **Gloves**
- **Jackets**

Bar chart showing:
- **Abrasion**
  - Footwear: 19 (17 abrasion, 2 tear)
  - Pants: 19 (12 motorcycle pants)
  - Gloves: 30 (27 abrasion, 2 burst, 1 cut)
  - Jackets: 41 (35 abrasion, 4 tear, 2 burst)
- **Burst**
  - Footwear: 19 (12 motorcycle jackets)
  - Pants: 19 (12 motorcycle jackets)
  - Gloves: 30 (27 abrasion, 2 burst, 1 cut)
  - Jackets: 41 (35 abrasion, 4 tear, 2 burst)
- **Tear**
  - Footwear: 19 (12 motorcycle jackets)
  - Pants: 19 (12 motorcycle jackets)
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- **Cut**
  - Footwear: 19 (12 motorcycle jackets)
  - Pants: 19 (12 motorcycle jackets)
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PRELIMINARY RESULTS

- Abrasion damage
- Abrasion injury

- Jackets
- Gloves
- Pants
- Footwear
CASE 1

- Motorcycle jacket, pants and gloves
- Non-motorcycle footwear (runners)
- 60 km/h speed limit
CASE 1

- Clavicle fracture
- Avulsed fingernail
- Degloving injury
- Abrasions
- Right
- Left
- 6-8
CASE 1

- Abrasions
- Burst
- Ripped
- Came off

Minor abrasions
CASE 1

Abrasions

Burst

Came off

Minor abrasions

Ripped

Ripped

Right

Left

6-8
CASE 2

- All motorcycle protective clothing
- 60km/h speed limit
CASE 2

Contusion 1
Fracture 3
Concussion 5
Abrasion 2
Contusion 4

Right Left Left Right
CASE 2

Minor abrasion

Abrasion

Burst

Minor abrasion

Minor abrasion

Minor abrasion

Abrasion
CASE 2

- Minor abrasion
- Abrasion
- Minor abrasion
- Minor abrasion
- Burst

Right
Left
Left
Right
FUTURE WORK - Testing
FUTURE WORK

• Finish collecting cases

• Police reports (minimise limitations of self-report)

• Petrol tank design/pelvic impact protection

• Friction tests for lining materials

• Compare COF of materials on the road surface to COF of abrasion test
LIMITATIONS

• Self-reported retrospective data – Police reports

• Not all clothing collected as it is often thrown or sent to insurance companies – Buy replicas, gain access to clothing from insurance companies
CONCLUSIONS

- Preliminary results demonstrate feasibility of study

- Riders wear protective jackets, but not as likely to wear protective pants or footwear

- Few items Standard-compliant

- Performance of clothing has been variable

- Potential improvements to the Standard
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