Airbag vests in equestrian sports – assessing the protective potential

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I. INTRODUCTION

Injuries to the upper body are frequently observed in equestrian sports [1,2] whereas AIS3+ thorax injuries are of particular concern. Particularly in disciplines such as eventing or jumping, injuries are often sustained in falls, but can also result from other incidences (e.g. hoof kicks). To protect athletes, safety vests are available and recommended for use. Traditional vests include material to absorb energy in case of an impact; these products must fulfill requirements as laid out in standard EN13158. More recently, garments including an airbag were brought on to the market. However, to date there is no standard defining minimum requirements for such airbag vests. This study analyses the applicability of the draft standard for motorcycling airbag vests (prEN1621-4) to test airbag vests for equestrian sports.

Fig. 1: Airbag vests A, B, C in their inflated state shown on a dummy measuring pressure on the upper body

II. METHODS

Three samples of commercially available airbag vests for equestrian sports were tested based on EN13158 (impact tests) and using a dummy equipped with pressure sensors on its torso which allowed investigating the load distribution transmitted to the torso (Fig 1). Additionally measures as defined in prEN1621-4 were determined such as the time from deployment until full inflation, the trigger force and the time duration for which the airbag was fully inflated.

III. INITIAL FINDINGS

Conducting tests according to EN13158 plus prEN1621-4 was possible without practical problems. Table 1 summarizes the test results obtained. The additional recordings including the maximum pressure on the upper body induced by the airbag inflation were evaluated.

	Vest A	Vest B	Vest C
Impact absorption Level 1 – 25 J	0.20 kN @ 0.35 bar	0.34 kN @ 0.35 bar	*6.70 kN @ 0.35 bar** 3.17 kN @ 0.5 bar 0.44 kN @ 0.75 bar
Impact absorption Level 2 – 30 J	0.25 kN @ 0.35 bar	*6.45 kN @ 0.35 bar** 0.37 kN @ 0.5 bar	2.18 kN @ 0.5 bar 0.33 kN @ 0.75 bar
Impact absorption Level 3 – 35 J	0.25 kN @ 0.35 bar	3.05 kN @ 0.5 bar 0.44 kN @ 0.75 bar	*9.69 kN @ 0.5 bar** 0.35 kN @ 0.75 bar
Inflation time	0.124 s	0.115 s	0.135 s
Maximum pressure	67 kPa	84 kPa	44 kPa
*does not meet the requirements of EN 13158			

IV. DISCUSSION

The design of airbag vests for equestrian sports and motorcycling differs. Airbag vests in equestrian sports are worn, for example, on top of another garment such that the airbag can basically deploy unrestrained. Nonetheless, the principle of the current draft standard for motorcycling seems applicable to equestrian vests. The test procedures suggested can also be followed using equestrian vests, but some requirements and threshold values need further discussion. Therefore an amendment of the current standard for equestrian sports (EN13158) is suggested that specifically addresses equestrian vests rather than applying prEN1621-4 directly. Inclusion of additional measurements such as the pressure recording should also be discussed.

V. REFERENCES

[1] Hasler et al, J Trauma Mgmt & Outcomes, 2011.
[2] Ball et al, Amer J Surg, 2007.

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