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Letter to the Editor

The European Standard testing method for motorcyclists' protective clothing (EN 1621-1) is unsuitable for hip protectors

Dear Editor,

The recent study of Holzer et al. described the results of mechanical testing of different hip protectors according to the The European Standard testing method for motorcyclists' protective clothing (EN 1621-1).[1] They concluded that soft hip protectors of the "energy-absorbing" type (especially their own AHIP protector and Astrosorb protector) were superior to hard hip protectors of the "energy-shunting" type in reducing impact force. However, the testing system employed by Holzer et al. is unsuitable for measuring and comparing the force reduction provided by various types of hip protectors, and therefore the conclusions of Holzer et al. are biased and misleading.

As described by Holzer et al. themselves, the EN 1621-1 protocol only serves as a method to study and compare the material properties of different hip protectors, and not the ability of the device as a whole to reduce the force applied to the proximal femur—which is the primary protective mechanism and design criteria for hip protectors. This is because as a simple two-part apparatus (a steel "impacter" and steel "anvil"), the EN 1621-1 protocol does not take into account the energy-shunting properties of the hard protectors at all. The 50 mm hemispherical anvil on which the hip protector is placed has a much smaller radius and surface area than the human hip region. This prevents the outer edges of the hip protector from contacting the anvil surface. Accordingly, the system cannot capture a primary protective mechanism of hard shell protectors—shunting the energy of the fall away from the bone. A second major problem with the use of EN 1621-1 in testing hip protectors concerns the fact that the system does not simulate the soft tissues overlying and surrounding the proximal femur—which are known to strongly influence the performance of hip protectors.[5] Given these severe limitations, it is not surprising that Holzer et al. found that soft hip protectors perform better than hard protectors. However, this conclusion is likely to be erroneous given their inappropriate tests methods, and only serves to cloud the literature on the biomechanical performance of hip protectors.

The approach selected by Holzer et al. was made even more confusing when the authors state further in their text that "the EN 1621-1 is not used to test hip protectors in a simulated physiological falling condition", which, of course, should be the purpose and final target of reliable biomechanical testing and comparison of different hip protectors.[2,10,11] This has been made especially clear in the coming international consensus statement on biomechanical testing of hip protectors.[10] Accordingly, we strongly disagree with the authors' statement that their "testing method could serve as an international standard."

Most hip fractures are caused by a sideways fall with impact to the greater trochanter of the proximal femur.[9] In such a fall, the relative small and sharp tip of the greater trochanter (as the most lateral part of the pelvic region) contacts the surface first thus receiving a high portion of the total impact force. For this reason, hard hip protectors of the "crash-helmet" type were designed to carefully cover (i.e., form a bridge over) the greater trochanter and to both partly absorb the impact energy and to shunt the impact energy away from the greater trochanter and direct it to less vulnerable parts of the pelvic region; that is, iliac crest, femoral shaft, and soft tissue lying anterior and posterior to the proximal femur.[2,7,8,11] And, in good accordance with these fall-simulating biomechanical tests, the clinical ability of hard-shield hip protectors to prevent hip fractures was verified in randomized controlled trials of adequate user compliance.[3,4,6]

Thus, we see that the study of Holzer et al. fails in its primary purpose and conclusions, and therefore these misleading observations should be used neither in science nor for marketing purposes. A second point needing attention is that in this paper the average fracture threshold of the proximal femur is suggested to be 35 kN.[1] According to a comprehensive literature review, this threshold is approximately 10 times lower.[10]

Conflict of interest statement

P. Kannus and J. Parkkari have received grant funding, lecturing fees, or consulting fees from Aventis, MSD, Novartis, Pfizer, Respecta, and Roche.

S.N. Robinovitch is a paid consultant to Tytex A/S, manufacturer of the Safehip line of wearable hip protectors.

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Author's reply

Author's reply to a letter to the editor

With regret we had to read the comment on our recent mechanical study of hip protectors.[1]

We were deeply disappointed at the personal defamation and especially deeply struck by mentioning that the AHIP Protector and Astrosorb are our own hip protectors. Here we clearly state that we have no relationship whatsoever with the company producing both of these. On the other hand there may be a need to mention the inventors of the KPH protector: K—Kannus, P—Parkkari, H—Heikkila. Therefore we wonder why two of the co-inventors of the KPH protector (Kannus, Parkkari) dare to use the word "bias" in this respect. Since the commercial launch of this hip protector Kannus and co-authors continuously produced data to support their product. The readers may have their own opinion on bias of their studies and criticism.

The aim of our study and the motivation using EN 1621-1 is discussed *in extensio* in the publication. There is nothing to add.

Basically hip protectors are a groundbreaking method for fracture prevention. But it is known that it is a precarious intervention as patients tend not to wear them. It is even more confusing that critics arise about a positively intended study. The focus always has to be on patients and their needs. Therefore we must progress in a fair and scientific way and manner to improve the current state. Only this was the aim of our study. Currently data supporting the use of hip protectors is quite controversial however for the individual patient hip protectors definitely pose an important element of fracture prevention.

Conflict of interest

None.

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Letter to the Editor

Dear Sir,

We read your editorial on 'Early diagnosis of compartment syndrome: Continuous pressure measurement or not?'[1] with interest and not a little trepidation for the management of future patients in the NHS. Your message is that ICP monitoring is unnecessary. However we feel that we should point out that there is evidence that the traditional clinical signs of compartment syndrome are at best often difficult to interpret. Ulmer, in his analysis of the usefulness of these signs, showed that the classical clinical signs had a sensitivity of 13–19% and a positive predictive value of only 11–15%.[2] The editorial mentions that Ulmer stated that if three clinical signs were present the probability of a compartment syndrome was 93%. However it did not state that one of the clinical signs was paralysis which, if allowed to develop, precludes full recovery! If one relies on clinical signs one must be very careful about underdiagnosing compartment syndrome.

You have highlighted the paper by Al-Dadah et al. in which the authors undertook a retrospective study comparing ICP monitoring and clinical monitoring. This is an interesting paper but we doubt that it represents standard practice in the NHS. In the clinical monitoring group the patients were monitored hourly using an appropriate chart of clinical signs and a visual analogue pain scale. They were also monitored with a single ICP pressure assessment at the Consultant's discretion which is not routinely done in the NHS. This system appeared to give the same results as ICP monitoring.

One of the undoubted advantages of ICP monitoring is that it raises an awareness of compartment syndrome amongst nurses and inexperienced junior surgeons and this is also true of the system of clinical monitoring adopted by Al-Dadah et al. You have correctly said that their paper used a clinical monitoring protocol but we believe it inevitable that your editorial will be interpreted as showing that ICP monitoring is equivalent to standard clinical observations undertaken by an increasingly inexperienced group of junior doctors at night. This of course is simply not the case.