

## **PREVENTION OF FALL-INDUCED HIP FRACTURES: USABILITY EVALUATION OF HIP PROTECTORS**

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Hip fractures are a common consequence of falls among the older population, with the incidence set to rise as our aging society increases. It has been suggested that the use of hip protectors are instrumental in substantially reducing the occurrence of hip fractures and so reducing the associated risks of disability and death. A serious limitation to their efficacy however, is that of non-use, particularly in the community setting. This paper presents a qualitative interpretation of the usability issues arising from the use of hip protectors and reasons for non-compliance. Two types of hip protectors (soft and hard) were examined to deduce if one was superior to the other on these accounts. The main reasons for non-compliance were: poor comfort; poor self-perceived appearance of the user; and high levels of self perceived safety. The soft hip protectors were found to be superior in terms of usability and compliance, and reported to be significantly more comfortable than the hard hip protectors ( $p = 0.009$ ).

### **Introduction**

It has been well documented over the years that a third of individuals over 65, and nearly half of those over 80, fall each year. Current trends show evidence of an ageing population and an associated rise in the number of falls sustained (Easterbrook, 2001). This is a major health concern, especially when considering fall-induced injuries and deaths. Some of the most devastating of these injuries are hip fractures. Deterioration in quality of life results after a hip fracture; inability to manage activities of daily living independently and the subsequent reliance on others after a hip fracture are likely causes of this decline. Repression in social activities is likely to prevail and thus further reduce quality of life. Hip fractures are thus a severe threat to the health and well being of the older population. A time trade off study dramatically illustrates this point: the study found that 80% of the elderly population would prefer a shorter life span instead of a bad hip fracture and the consequences that it would bring (Salkeld et al., 2000). Additionally, hip fractures cost the UK's National Health Service between £12,000 and £20,000 per incident (Easterbrook, 2001). These personal and economic dimensions are imminent issues to note and give weight to the importance of assessing hip fracture prevention techniques and to providing improvements to their efficacy.

It has been suggested that the use of hip protectors may be instrumental in substantially reducing the occurrence of fractures and so eliminating the associated risks of disability and death. Hip protectors are garments worn by older people who are at risk of falling and are thus at an increased risk of experiencing a hip fracture. The standard design of hip protectors includes two pads, one sewn into each leg of a pair of briefs. The materials used in the undergarment and hip protector pads differ between makes, and the size and method of protection offered by the pads also vary. Hip protectors have been developed through substantial biomechanical testing and have been found to be technically able to prevent hip fractures (Parkkiari *et al.*, 1995) by protecting the bones, notably the greater trochanter and proximal femur, during a fall episode.

However, recent studies have shown contrasting views on hip protector efficacy: the serious limitation to efficacy is user non-compliance. Compliance is critical to the effectiveness of hip protectors. If the hip protectors are not worn at the time of a fall, they cannot prevent a hip fracture. A study by Lauritzen *et al.* (1993) reported that less than ¼ of people issued with hip protectors wore them regularly. Previous studies, which have generally been conducted with institutionalised older people, have helped to identify causal reasons for non-compliance: hip protectors have been reported as being uncomfortable, of a poor fit and too tight (Villar *et al.*, 1998; Hubacher *et al.*, 2001). This may give explanation for complaints of bowel irritation and swollen legs (Kannus *et al.*, 2000). Another important issue of concern was reported by Hubacher *et al.* (2001) who found that 38.9% of dropouts versus 12.7% of wearers reported that their appearance was unattractive when wearing the hip protectors, which may be another reason for non-compliance. A further factor acknowledged by a number of studies to limit compliance is the case of skin irritation which can occur (Cameron *et al.*, 2001).

This paper presents a qualitative interpretation of the usability issues arising from the use of hip protectors by community dwelling older people and their reasons for non-compliance. Two types of hip protectors were examined to deduce if one was superior to the other on these accounts, and issues for usability and design improvements have been summarised.

## Method

Nineteen community-dwelling, fall-susceptible, older people (aged between 65-96 years, mean 80), who had not used hip protectors previously, were recruited from the community setting and involved in a cross over study design to test two types of hip protectors. The Safehip (hard) hip protector is anatomically designed to fit over the greater trochanter and proximal femur. It is made from two hard shell-shaped polypropylene plastic shields that are incorporated into briefs. The shields are fixed into the briefs and positioned so that one covers each hip. The briefs are made from a combination of cotton and Lycra®, and hold the shields in place. The hip protectors work by diverting the impact produced from a lateral fall, away from the hip joint and into surrounding tissues. The Hipsaver (soft) hip protector is an all-soft one piece brief. Sewn into the undergarment are two thin viscoelastic foam pads which are situated over the greater trochanter, one on each hip. The pads are encased in a waterproof and airtight pouch, made from nylon and during a fall the impact on the hip is significantly reduced through both energy attenuation and energy absorbing mechanisms.

A multi-methodological approach was taken and included the use of focus groups (n=2) and interviews (n=19) after a period of wear (at least 7 days per garment type).

Repeated measures questionnaires centred on usability issues and compliance, and were used to verify and quantify the qualitative data gathering. Additional questionnaires were also used to determine whether wearing hip protectors had an influence on quality of life and fear of falling. The SF36 (Short Form 36) (a questionnaire that has been developed to identify the health status of individuals) and FES (Falls Efficacy Scale) (developed to measure the fear of falling within individuals, Tinetti 1988) were used to determine these respectively.

## **Discussion of Results**

The hip protectors generally seemed to be well accepted, although many participants were concerned about their appearance in the garments and what others thought. This seemed to negatively affect compliance, especially with regard to the hard hip protector. The majority felt that the hard hip protector was more uncomfortable compared to the soft, and this seemed to influence both preference and compliance. This view was similar for comfort at night, with the soft type again being preferred. Toileting was made difficult with the use of the garments and in some instances made participants have to rush to the toilet due to the extra time required to remove additional clothing. Furthermore, many individuals regarded the garment as unnecessary, which also had an adverse effect on compliance. The percentage of participants who reported wearing the soft hip protector for 'most days' or more during the study period was 67% compared to 53% of participants wearing the hard design. The main reasons for non-compliance were: poor comfort and fit; poor self-perceived appearance of the user; and high levels of self-perceived safety. The soft hip protectors were found to be superior in terms of usability and compliance, and reported to be significantly more comfortable than the hard hip protectors ( $p = 0.009$ ).

It emerged that many of the participants who found the hip protector to be uncomfortable went on to report that they failed to continue wearing the garment. The responses support the natural conclusion that if the garment is uncomfortable, then the likelihood of it being worn is reduced. Comfort was especially noted to influence compliance at night, as one of the reasons presented for non-use at night included the concern that the garment would be uncomfortable to wear at this time and that it may disturb their sleep.

It is important to recognise that the older population for whom the protective devices are essentially being developed is likely to present with physical difficulties. Those individuals with such attributes have been found to have difficulties in getting the hip protectors on and off (van Schoor et al., 2003), as was an issue reported by some of the participants in this study. It has been noted that this difficulty may increase the risk of falling and thus place the wearer at a greater risk of a hip fracture (Oster & Specht-Leible, 1999). Additionally, this usability issue was also of concern to some individuals in an aesthetic sense as the clothing fitted tightly over the protectors, making them more conspicuous to others. For other users, this issue was not of any concern as they felt that safety takes priority and they were more concerned with protecting their hips during a fall than worrying about their appearance. Fear of falling is often a concern among the older population and this lack of confidence can cause further falls or cause a self-imposed restriction on activities. It was suggested by a number of participants that they felt safer when wearing the hip protectors and a feeling of safety was associated with their wear, influencing compliance positively. However, for some, the use of the protectors made

them feel more at risk because it raised awareness of their fall risk. It was revealed in the study that individuals who felt more confident in their walking ability were less inclined to comply, the reasons given were that they felt no need to wear the device because they had not had a fall, or hadn't had one for a while, or that through other interventions (such as physiotherapy) they felt as if their mobility was improving and were therefore at less risk of falling (and had less need for protection). As a linear relationship exists between the number of fall risk factors and likelihood of falling, it is not surprising that individuals with a greater risk of falling have a higher compliance rate (Hubacher *et al.*, 2001). Additionally, it is important to understand the psychological effects that the use of hip protectors can have on users. For some, the inability to dress or toilet independently with their use, to feel undignified, or to feel at increased risk of falling, may affect individuals' quality of life.

Interestingly, although the protectors resulted in a lot of negative comments from the participants, very few stated that their design could be optimised, although this may have been due to concerns that changes could reduce their efficacy in fracture prevention. From comments made during the study, it appeared that users may benefit from cooler fabric, less bulky (less visible) and softer material in the design of the protectors, and an easier way to don and doff such garments. The design could be changed although it is likely that a number of participants will not be willing to wear them as they feel they are accepting old age:

*"I just thought - they are the last straw. You think, why should it happen to me... and it has happened to me, and I don't like it, do I, but who am I to be that proud at 85 - I felt very degraded [wearing the hip protectors]. I just can't visualise having to wear those things every day and perhaps at night... I just feel as though that's the end."*

It may be necessary to employ other additional support to increase the acceptance and subsequent compliance of hip protectors. Literature has suggested that a possible intervention to help improve compliance involves educating the nursing staff caring for the patients about the use of hip protectors and the risks associated with hip fractures. Therefore, the type of information that the staff can give to their patients can be more tailored to suit an individual. Meyer *et al.* (2003) reported successful adherence with this methodology and a 40% reduction in hip fractures being achieved as a result. A study by Parkkari *et al.* (1998) supports this as an effective method of achieving good compliance and reported an adherence rate of 91%, with a one hour introduction lesson on the incidence, causes, consequences and prevention of hip fractures, given to the nursing staff.

## **Conclusions**

The aim of the study was to develop a greater understanding of the usability issues surrounding hip protector use among community dwelling older people, and to identify reasons for non-use. The study aimed to compare two different types of hip protectors, a hard hip protector (Safehip) and soft hip protector (Hipsaver), on issues of usability. The study concluded that the soft hip protector is superior in terms of usability and general compliance.

It can be suggested that there is a requirement to involve the user in the design process in order to improve acceptance and compliance. It can further be concluded that the nature of the information given to the user on allocation of hip protectors impacts on compliance and needs to be tailored to an individual's perception of their own limitations.

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