

HIP PADS: EFFECTIVE FRACTURE PREVENTION

Simple intervention can reduce the risk of falls resulting in hip fracture

By George Gross, PT, Tsan-Hui Chen, OTR/L, Carolyn Flaherty

Falls are a serious problem in the elderly. One of the most significant consequences of falls is hip fracture, caused by the sudden transmission of a large, mechanical load, which damages tissues and cells. If this energy load could be dissipated over a larger area, injury could be prevented. This review examines the results of a program that used hip pads in community dwelling, frail elders and found impressive results in hip fracture prevention. There was a hip fracture rate of 0 in the study population compared to a rate of 4.3 $P=0.00089576$ and a highly significant difference.

This study examines the results of a program at the Elder Service Plan of East Boston that used HipSavers for patients with histories of frequent falls to absorb and dissipate the energy transmitted in a fall to prevent hip fractures. HipSavers are underpants with soft thin pads of laminated, shock absorbing elastomers covering each trochanter.

Fall Statistics

Falls are a major health hazard in the elderly. One-third of all elders older than 65 years of age fall at least once a year.^{1 2 3 4} Loss of independence often follows a fall. Falls are a factor in 40 percent of nursing home admissions.⁵ The more frequently falls occur, the greater the likelihood of mortality and morbidity for the older adult.⁶ Fall related injuries are the leading cause of death from injury in people over 65.^{1 7} Only 50 percent of individuals admitted to hospitals as a result of a fall will be alive in one year.^{3 8}

Ten percent of falls in the elderly result in serious injury and 5 percent result in some type of fracture.^{4 8} The rate of hip fracture as a result of falls in the elderly has been calculated between 1 percent and 2.9 percent.^{2 7 8} Hip fractures are one of the most catastrophic, life changing and life threatening consequences of falls and frequently result in decreased mobility and loss of independence in older adults.³ Hip fracture is the most common among all injuries leading to hospital admissions in the United States¹⁰ and is a contributing factor in 40 percent of admissions to nursing homes.^{3 11} One-quarter of these patients die within six months of injury and of those remaining alive, 60 percent have decreased functional mobility and 25 percent remain functionally dependent after a hip fracture.¹²

Rehabilitation after a hip fracture is expensive in emotional and social as well as financial costs. The Center for Disease Control and Prevention statistics for 1994 report 243,000 hip fractures per year. The cost of caring for older patients with hip fractures is \$2 billion annually.¹⁰ Falls pose a particular problem for public health professionals in the development of both surveillance systems and prevention strategies.⁷ Most falls do not result in serious injury and are therefore not reported. The absence of injury probably accounts for the poor reporting of falls and underestimation of the problem.¹⁰ Adler-Traines views injuries as predictable events that have remedial behavioral and environmental antecedents.⁶ Therefore, they can be reduced in number and severity by proper interventions.

Prevention Strategies

Effective fracture prevention strategies can be cost effective and beneficent interventions. Identifying patients at risk permits interventions aimed at reducing both intrinsic and extrinsic risk factors for falls and fractures. Falls are multifactorial. The primary goal is treatment of the problem or the cause to effect clinical change. If change is not expected, the course of action is compensation. For certain patients, the risk of falling remains great despite preventive measures. For these patients, the use of padded undergarments to absorb the impact of a fall and thereby reduce the risk of a hip fracture from a fall has been advocated. Sattin⁷ views injury as a disease with a short latency period. In a fall, a large mechanical energy load is quickly transmitted and damages cells and tissues, potentially resulting in a hip fracture. If the same energy load could be transmitted at a slower velocity or dissipated over a larger area, injury could be prevented.

Study

Subjects. The Elder Service Plan is a full-service health care program for frail elders who meet Massachusetts state requirements for nursing home care but desire to remain at home. The mean age of members is 80 years. Members require some assistance with personal care and activities of daily living (ADLs) and have some combination of acute/chronic medical conditions that requires professional monitoring or supervision. The average number of medical conditions is 9.9/member.

Members who were assessed at high risk for falls because they had two or more falls in the previous four months were evaluated for wearing padded underwear to reduce the risk of hip fracture from a fall. This was a non-random assignment of groups but was undertaken in an attempt to immediately reduce the risk of injury in the high fall risk population. Twenty-nine members wore HipSavers during the study and 438 members did not. The two groups were similar along age and sex dimensions. The mean age of the HipSaver population was 79, one year younger than the control population and there were 6 percent more males in the non HipSaver population. The HipSaver population had much higher percentages on measures of history of falls and history of prior hip fractures.

Not all 29 test subjects wore HipSavers for the entire 26-month study period. Some developed an increased risk for falls later in the test period and were prescribed HipSavers and their subsequent falls were included in the study group data. Members and/or their family/guardian consented to the use of HipSavers as an injury risk reduction intervention.

Method. Falls were recorded on incident report forms. Falls were defined as events resulting in a person inadvertently coming to rest on the ground. Not all falls that occur at home are reported but underreporting skews the data toward serious falls since falls with subsequent consequences are more likely to be reported than falls without injury. Members with a history of falls or high risk factors were evaluated for HipSavers. Incidence of hip fracture in the member population and the HipSaver population were calculated and compared using Fisher's exact test.

Results. The total falls reported were 568 in the 467 members studied over the 26-month period. The 29 members who wore HipSavers accounted for 199 falls or 3.17 falls/member/year. The 438 members who did not wear HipSavers had 369 falls or 0.3888 falls/member/year indicating that the HipSaver group was at nearly eight times higher risk for falls.

Sixteen of the 369 falls among the members not wearing HipSavers resulted in a hip fracture. None of the 199 falls among the members wearing HipSavers resulted in hip fracture. Fisher's exact test analysis comparing falls between the HipSaver and non-HipSaver populations yields a probability of 0.00089576 that this distribution is random. This is less than 0.05 and therefore a highly significant difference.

Discussion. Hip fractures in the elderly are devastating, costly, traumatic, life altering and life threatening events. Most hip fractures occur as a result of falls. This has logically led to strategies of risk reduction through fall prevention. "Falls don't just happen. They are predictable occurrences, the outcome of a multitude of host related and environmental factors that are potentially amenable to intervention and thereby reduction or prevention."¹¹

Despite fall prevention efforts, some patients still experience falls and therefore remain at risk for hip fracture. For some of these patients, HipSavers are an effective injury prevention intervention. This study indicates that shock absorbing hip pads effectively reduced the risk of hip fracture in this Elder Service Plan population. Comparing the cohort of clients wearing HipSavers to those not wearing HipSavers indicates that the experimental group clients are less likely to incur a hip fracture as a result of a fall.

The sample size is small but the results were significant for the Elder Service Plan in implementing a simple, cost effective intervention to reduce hip fractures. The subjects were not randomly assigned but were selected from the same population and prescribed hip pads because of their history and risk of falls. They fell nearly eight times more frequently than the members of the control population. This would seem to make them more likely to sustain a hip fracture but in fact, no hip fractures were sustained by this group, a very promising finding. This study did not include measures of osteoporosis, bone density, nutrition or endocrine factors, which may cause potential differences between the groups likelihood for fracture and this is an area for further study.

Conclusion

Much research has been done on the costs and consequences of hip fractures and the causes of falls. Fall prevention programs are a necessity for any geriatric program. Despite all fall prevention efforts, some elders continue to fall. Compensatory strategies aimed at reducing the risk of injury from falls is the logical course of action. HipSavers are an effective means of reducing the risk of hip fracture from falls in this population. Despite their effectiveness, HipSavers are not for everyone. Some clients dislike their bulky appearance and choose not to wear them. Some clients, especially those who struggle with ADL's, find that the additional padding makes dressing and toileting more difficult and time consuming. Adaptive clothing might remedy that situation. Patient and/or caregiver acceptance and support is a critical factor since consistent compliance is needed to maximize effectiveness.

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² Knox, R. (1998, Jan. 19). Falls don't have to happen. *Boston Globe*.

³ MacRae, P.G., Lacourse, M., & Moldavon, J. (1992). Physical performance measures that predict faller status in community dwelling older adults. *Journal of Orthopedic and Sports Physical Therapy*, 16(3), 123-128.

⁴ Koch, M., Schalk, M.G., Baker, D., Palumbo, S., & Tinetti, M. (1994). An impairment and disability assessment and treatment protocol for community living elderly persons. *Physical Therapy*, 74(4), 286-298.

⁵ Adler-Trainee, M. (1995, Sept. 8). Falls in the senior population. *Occupational Therapy Forum*, pp. 8-11.

⁶ Van Swearingen, J.M., Paschal, K.A., Bonino, P., & Yang. (1996). The modified gait abnormality rating scale for recognizing the risk of recurrent falls in community dwelling older adults. *Physical Therapy*, 76(9), 994-1001.

⁷ Sattin, R.W. (1992). Falls among older persons: A public health perspective. *Annual Review of Public Health*, 13, 489-508.

⁸ Baker, S.P., Ginsburg, M.J., & Giuhua, L. (1992). *The injury fact book*. New York: Oxford University Press.

⁹ Hoard, S. (1997, June). New technology can reduce falls. *Briefings on Assisted Living*, p.4.

¹⁰ Holliday, P.J., Cott, C.A., & Torresin, W.D. (1992). Preventing accidental falls by the elderly. In J. Rothman and R. Levine (Eds.), *Prevention practice: Strategies for physical therapy and occupational therapy* (pp. 234-257). Philadelphia: W.B. Saunders.

¹¹ Tinetti, M.G., speechley, M., Ginter, S.F. (1988). Risk factors for falls among elderly persons living in the community. *New England Journal of Medicine*, 319, 1701-1707.

¹² Tideiksaar, R. (1998). *Falls in older persons*. Baltimore: Health Professions Press.

Additional Resource

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Wolter, L.L. (1996). A clinical synthesis of falls intervention trials. *Topics in Geriatric Rehabilitation*, 11(3), 9-19.

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This study was not solicited by the manufacturer. The article was produced here with the cooperation of the manufacturer.

September 2003

HipSaver Hip Protectors achieve 93% compliance.

New Study Reports High Compliance Rate for Soft Hip Protectors in a Nursing Home Population, Confirming Their Effectiveness in Preventing Hip Fractures for At-Risk Elders.

New Study Reports High Compliance Rate for Soft Hip Protectors in a Nursing Home Population, Confirming Their Effectiveness in Preventing Hip Fractures for At-Risk Elders
CANTON, MA -- (MARKET WIRE) -- 09/10/2003 -- The Journal of the American Medical Directors Association reported today on the results of a one-year study on soft hip protectors in a nursing home. In the study, residents who were at risk of hip fractures and asked to wear HipSaver[®] hip protectors did so 93% of the time. This contrasts markedly with a recent Journal of the American Medical Association study reporting only 37% compliance for a hard plastic shell hip protector. Because of the low compliance in that study, the hard-shelled hip protector studied was judged ineffective in protecting against hip fractures.

"This result is good news, both for the elderly at risk for hip fractures and for taxpayers, who foot the one billion dollar annual bill for the 60,000 hip fractures occurring in U.S. nursing homes each year. Hip protectors can significantly reduce suffering and save precious Medicare dollars," states Ed Goodwin, President of HipSaver. "Previously, independent university biomechanical studies and a clinical study have proven the effectiveness of soft HipSavers in reducing hip fractures. Now, this compliance study closes the loop by showing that nursing home residents at risk of a hip fracture will indeed wear HipSavers regularly."

This study was conducted at the Masonic Home in Charlton, MA under the direction of Medical Director Dr. Jeffrey Burl. In this one-year study, 38 nursing home residents, selected for being at risk of hip fracture, wore the HipSaver hip protectors 93% of the time. Indicators for the HipSaver wearing group included osteoporosis, a previous fracture and having experienced a fall in the previous year. The average age of participants was 89.5 and they each fell an average of 3.9 times during the year of the study. While wearing the HipSavers, these residents fell 126 times during the study year, yet none sustained a hip fracture. The study revealed the importance of interdisciplinary involvement of nursing, rehabilitation, and housekeeping in starting and sustaining a successful hip protector program. The study also revealed that hip protectors can be incorporated into the care plan in an actual nursing home with little extra effort.

HipSavers, which have been on the market for 8 years, feature a patented encapsulated soft memory foam pad. Upon impact, the thin pad bloats like a miniature air bag and thereby reduces the force of the fall to the hip bone. After the impact, the pad returns to its relaxed state. HipSavers are produced in a dedicated manufacturing plant in Norwood, Massachusetts. HipSaver now has a strong market presence in the U.S., Canada, Ireland, Australia, New Zealand, the UK and most recently, Israel.

More information can be obtained by calling toll-free in Canada 1-888-771- 0977 or visiting www.hipsaver.ca

Our thanks to Dr. Chiasson for permitting us to share the following section of a recent column.

Q: Dear Doc, I recently met a friend who told me she is wearing hip protectors and I should start wearing them? Do they work, and where can I find some?

Hip in Sydney

A: Dear Hip, what a great friend you have. They must certainly care about you, because breaking a hip can be a common and serious problem in the elderly. As we get older our bones get more frail and brittle. Simple bumps or falls that before would cause no harm can fracture (break) a bone. Hip fractures can be devastating to an elderly person. Up to 30% of patients with a hip fracture will die in the first year after the fracture. 40% will lose their independence after a hip fracture. Obviously the key is in preventing such fractures.

Elderly people should ensure they have a good intake of calcium and Vitamin D. Calcium can be found in milk, yoghurt, and cheese. Often elderly people just do not get enough calcium in their

diet, and a supplement can be helpful. A pharmacist can help show you a combination supplement that has both the recommended daily intake of calcium (1200 mg) and Vitamin D (800 IU) together in one pill. Other very easy and practical measures that can be taken is a quick home assessment. Look out for loose rugs. These should be attached with a no-slip backing or removed completely. Stairs should have rails and bathrooms should be equipped with protective grab bars. These simple measures can go a long way to protect against falls.

Even with all of these efforts falls still occur. There is a new product now, hip protectors, which can be worn over undergarments. Hip protectors provide padding over the hip joint and cushion the impact in case of a fall. Newer hip protectors are not bulky, and are very comfortable. Studies have shown hip protectors can reduce hip fractures by 80%. There are many different brands. One company I know of can deliver them directly. They make the HipSaverR and can be contacted at 1-888-771-0977. The garments cost around \$60, and I recommend ordering 2 pair so one can be washed while you are wearing the other.

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A soft answer to a hard problem

HIP fractures among the aged community cost over \$300 million a year. By 2026 reliable estimates put this annual cost at a staggering \$620 million or 34,000 hip fractures.

Responsible aged care facilities have recognised this problem for some time and have implemented fall safety programs in an effort to reduce the toll of debilitating injury. Such programs typically include fitting residents at risk with hip protection devices, which are usually made of a rigid hard plastic shell, and some form of padding.

The devices have been proved in clinical trials to reduce the impact from a fall to below the accepted fracture threshold (average 3100 Newtons). However, compliance of these types of hard protectors is often unsatisfactory, with residents and patients finding them uncomfortable, bulky and inconvenient.

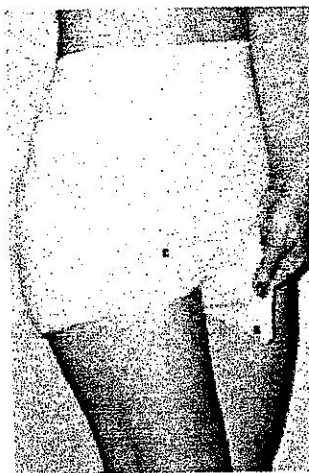
The low compliance rates and slow adoption of hip protectors in general led to the foundation of The HipSaver Company Inc in the USA in 1994, which believed new space-age materials could be used to design an all-soft hip protector that would offer

comfortable, effective hip protection, yet be as easy to put on, to wear, and to launder as regular underwear.

After more than a decade of development and refinement HipSaver is now available in Australia, offering all-soft hip protection that has, according to the manufacturer, been proven to be superior to hard shell technology in both independent biomechanical testing and clinical study.

HipSaver has a patent pending dual-mechanism shunting/absorbing HipSaver airPad – a system shown to deliver significant impact reduction in independent testing (down to just 1790 Newtons). In the event of a fall, the HipSaver airPad absorbs the impact and momentarily inflates the pouch, which shunts the force away from the vulnerable hip bone to the soft tissue of the buttocks.

HipSaver is available in the traditional 'High Compliance' design (soft pads, permanently sewn into the underwear) and also in the new 'Convenience' design (soft pads, removable from the garment) which are supplied as a starter kit of three pairs of pants and one set of pads.



There are several models of HipSaver available, including male and female versions. The 'Slimfit' version is suitable for active seniors in the community, the 'Nursing Home' model is designed with a roomy fit for easy dressing and incontinence care of nursing home residents, and the 'QuickChange' version offers all of the features of the nursing home model with a 'snap-down' front crotch panel that allows incontinence pad changes without having to pull the brief down.

More than 100 care facilities across Australia are specifying the all soft HipSaver.

**Further Information phone
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The company was established by Paul Hoffman in April last year after realising a need for a specialist firm to keep up to date with the continuous changes in the health and aged care sectors.

Hoffman believes in developing a "sound knowledge within fewer markets to be in a better position to have a full appreciation of the industry for which we recruit".

Drawing on contemporary practices in the commercial sector, Ardent has grown rapidly. The company's consultants are not on revenue-based targets. Ardent establishes key performance indicators for all consultants, which include relationship development with clients and candidates, and response times to internal and external communications ranging from phone calls and emails to resumes.

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FOR IMMEDIATE RELEASE

NEW STUDY REPORTS HIGH COMPLIANCE RATE FOR SOFT HIP PROTECTORS IN A NURSING HOME POPULATION, CONFIRMING THEIR EFFECTIVENESS IN PREVENTING HIP FRACTURES FOR AT-RISK ELDERLY

September 10, 2003, Canton, MA - The *Journal of the American Medical Directors Association* reported today on the results of a one-year study on soft hip protectors in a nursing home. In the study, residents who were at risk of hip fractures and asked to wear HipSaver® hip protectors did so 93% of the time. This contrasts markedly with a recent *Journal of the American Medical Association* study reporting only 37% compliance for a hard plastic shell hip protector. Because of the low compliance in that study, the hard-shelled hip protector studied was judged ineffective in protecting against hip fractures.

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More information can be obtained by calling 07 3392 0588 or visiting
<http://independentliving.com.au/hipsavers.htm>

The published study can also be viewed at www.jamda.com

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Interpretation of Biomechanical Testing of HipSaver® Dual-mechanism Shunting/Absorbing AirPad

August 2000

Background: HipSaver pads were tested at the Harvard affiliated laboratory in 1996 and found to offer 10% better impact attenuation than SafeHip® (SafeHip is the product resulting from the initial research efforts as reported in *The Lancet* 1993 341:11-18). Since then HipSaver has researched a variety of materials with various attributes for potential incorporation into the HipSaver product. In August 2000, the selected construction (HSPE4 12.7mm) was sent to the Tampere University of Technology Applied Mechanics Laboratory for impact testing on a mechanical hip system. The research group affiliated with this laboratory is currently most active in the development and biomechanical testing of hip protectors and has several published reports on the subject.

HipSaver Pad Construction: HipSaver encloses a 1/2" (12.7mm) thick damping foam material in a waterproof/air tight pouch. The pads taper down to 1mm at the edge. The pouch is either RF or heat sealed around the perimeter. Pad diameters are 6.5 to 7.5 inches. These pads are sewn into polycotton underwear so as to overlie the trochanters.

Test Results: The test system and protocol are identical to that reported in *Bone* 1999 Aug. 25(2):229-35 (abstract enclosed). The pad being tested is affixed to a surrogate hip bone and then impacted by a swinging pendulum. Load cells capture the amount of force on the system. The test report on HipSaver shows the HipSaver pad (HSPE4 12.7mm) lowered a typical falling force of 7200N to below the fracture threshold of 3100N +/- 1200N. The following table compares the results from the HipSaver test to other pads tested in the *Bone* report (using the identical system and protocol):

Pad Id.	Description	7200N Fall Force Reduced to
KPH2	35mm height, polyethylene shell	760N
SafeHip	25mm height, polypropylene shell	2240N
Safty pants	20mm thick, low density polyethylene (soft)	2270N
HipSaver HSPE4	12.7mm thick, urethane foam in pouch (soft)	1790N

Conclusion: Only KPH2 and HipSaver reduced the applied force clearly below the fracture threshold of 3100N (+/- 1200N). A lower value on this test indicates better protective capacity since the values represent force REDUCTION. The above shows HipSaver to offer 20% more attenuation than SafeHip.

The Damping Foam Absorbs the Shock and the Displaced Air Redistributes the Forces in the AirPad:

Although the HipSaver pad has the lowest profile (thinness) and is the softest, it performed remarkably well when compared to the stiffer and thicker pads. This result stems from the fact that the airtight pouch renders an "energy shunting" or diverting effect on the applied force: the initial impact is absorbed by the urethane foam and the displaced air from the foam inflates or distends the surrounding pouch. Hence, much similar to automotive air bag, the force is redistributed over a larger and softer area. This inflation effect can be demonstrated by pushing a HipSaver pad with the heel of the hand and observing the distention of the pouch. The HipSaver pad is thus a dual mechanism "shunting/absorbing" air pad.