SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The objective of this study was to test the impact absorption of flooring and underlay materials for the purposes of reducing hip fractures in older people.

Can Flooring and Underlay Materials Reduce Hip Fractures in Older People?

Minns, J.
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Key Concepts/Context

Falls resulting in fracture of the hip in older people are a major health problem worldwide. Flooring that is slippery and unsuitable footwear are other major factors contributing to the onset of fractures in the home. Building design should incorporate measures to minimize the risk of falls.

Methods

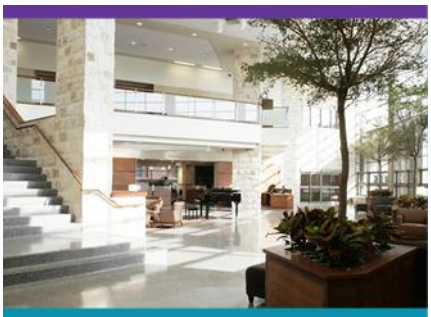
A mechanical rig was constructed to test the impact properties of flooring materials (carpet, vinyl, and underlays) attached to the flat underneath surface of the weight carrier, which was dropped onto a hip model fixed to the floor.

Findings

Impact testing on current conventional underlays under carpets, regardless of the composition and construction of the carpet, suggest they offer poor energy absorption when older people fall, and thin and thick vinyl floors are even poorer at reducing the energy that may fracture a hip in an older person. This study found that Sorbothane and PVC foam offer the best reduction, although they have to be at least 12mm thick to reduce the values to below those likely to fracture the hip from a fall. Underlays more than 15mm thick may present other problems such as limiting the traction of wheeled devices including wheelchairs or hoists. Polyurethane foams were also considered, but these were shown to not withstand repeated loading and had undesirable absorbent properties.

Limitations

New materials and innovations are consistently introducing new materials into the market that were not included in this study, which limits the generalizability.



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Design Implications

The underlay, and its role in reducing the energy and peak forces transmitted to the hip from a lateral fall onto the greater trochanter, provides a more permanent solution and because it is hidden from view; aspects of texture and color are not considerations for purchasers of floor coverings. Fabrication of the PVC foam into a flexible workable form may be difficult, as it is a rigid form that does not stretch or bend easily during laying and positioning. A quicker immediate solution to provide protection with existing materials could be to use two or even three layers of the rubber crumb underlay, as the reduction of peak force under the carpet may be below the level that may be expected to fracture the hip. The ideal underlay/floor covering should have the following features:

- Sufficient firmness to reduce the energy level experienced at the hip to fracture the hip (<20J); 20J is considered the maximum that would fracture most hips in osteoporotic older people (i.e., at least a 50-per cent reduction in impact energy). Most foam rubber underlays only provide 10-30 percent reduction in energy.
- Reduction in peak force to below 2kN, which is the minimum threshold at which most osteoporotic patients are unlikely to fracture their hips
- Sufficient thickness and softness to prevent possible rucking or tripping on the carpet/vinyl that will be lying over the underlay; maximum thickness of the floor covering materials, including the underlay, should be 20mm.
- Good compression set properties, that is, return to its original thickness after both short-term (less than one second) and long-term loading (greater than five weeks)
- Anti-static characteristics to reduce attraction of dirt and minimize static buildup on the carpet/vinyl overlay due to relative movement between the two
- Moisture-resistance on both the upper and lower surfaces
- Suitably flexible for ease of laying down and fixing. Some of the firm PU and PVC foams are difficult to roll and lay flat during cutting and shaping.
- Minimum aging effects: must not shrink or distort with time and temperature Easy to cut by knife/scissors and lay for the carpet fitters
- Comparable costs to the current conventional underlays (£7 to £8 per square meter)
- Compliance with the fire and building regulations (such as noise reduction) pertinent to flooring covers