

HIP PROTECTIVE UNDERGARMENTS

CROSS-REFERENCE TO RELATED CASES

[001] Priority under 35 U.S.C. § 119(e) is hereby claimed to commonly-owned and co-pending U.S. Provisional Application No. 61/802,598, which was filed on March 16, 2013, and which is incorporated herein by reference.

TECHNICAL FIELD

[002] The disclosure relates to undergarments comprising integrated hip protectors, methods of making and methods of using.

BACKGROUND

[003] Elbows, knees, shoulders, ankles, hips and other joints can be especially susceptible to impact damage and yet are challenging to protect without restricting the range of motion and movement of the individual. Hip fractures are serious fall injuries that often result in long-term functional impairment, nursing home admission and increased mortality. Some reported statistics show that the leading cause of hip fractures in the elderly, are falls, with the majority of hip fractures occurring in those over 65 years of age. Some report that as much as 20% of those who suffer a hip fracture die within 12 months of the hip fracture. For survivors, loss of function and independence is profound, with as much as 40% being unable to walk, or requiring assistance a year later.

[004] The CDC reports that in 2007, there were 281,000 hospital admissions for hip fractures among people age 65 and older, and that over 90% of hip fractures were caused by falling, most often by falling sideways onto the hip. However, women sustain three-quarters of all hip fractures. In 1991, Medicare costs for hip fractures were estimated to be \$2.9 billion.

[005] In both men and women, hip fracture rates increase exponentially with age. People 85 and older are 10 to 15 times more likely to sustain hip fractures than are those at age 60 to 65. Osteoporosis, a disease that makes bones porous, increases a person's risk of sustaining a hip fracture. The National Osteoporosis Foundation

estimates that more than 10 million people over age 50 in the U.S. have osteoporosis and another 34 million are at risk for the disease.

[006] A large proportion of fall deaths are due to complications following a hip fracture. One out of five hip fracture patients dies within a year of their injury. Treatment typically includes surgery and hospitalization, usually for about one week, and is frequently followed by admission to a nursing home and extensive rehabilitation. Up to one in four adults who lived independently before their hip fracture remain in a nursing home for at least a year after their injury.

[007] As a result, various types of hip protectors have been commercialized, in an attempt to minimize the number, severity and debilitation of hip fracture. However, such impact protection can be heavy, non-breathable or restrictive, or may not accurately target the hip joint, or if it does so, only inconsistently.

[008] One type of hip protector is a padded belt that is worn over the user's clothing, which is bulky and conspicuous. Another type of hip protector is an undergarment with pockets for receiving a removable hip shield. Although this type of hip protector is less conspicuous than the external belts, they still may add unattractive bulk to the hip region. Although each of the foregoing are somewhat effective, compliance is often low, because they are conspicuous and/or uncomfortable. As a result, compliance is low, reducing their effectiveness.

[009] A need exists for improved hip protection.

SUMMARY

[0010] The present disclosure is directed to, in one embodiment, a hip protective garment, comprising a form-fitted body portion and a hip pad disposed on the body portion. The hip pad comprises a center, such that when the garment is disposed on the user, the center of the hip pad is disposed adjacent to the upper trochanter region of the user's hip.

[0011] In one embodiment, the hip pad can comprise an integrated locator device that allows the user to verify the position of the center of the hip pad relative to the upper trochanter region of the user's hip.

[0012] In one embodiment, the hip pad can comprise a removable impact sensor adapted to measure the force of an impact.

[0013] In one embodiment, the hip pad can comprise an energy absorbing foam material, such as an energy absorbing polyurethane foam.

[0014] In one embodiment, the hip pad can comprise a central region of uniform thickness extending radially from the center of the hip pad. The central region of uniform thickness can extend radially from the center of the hip pad by about 1 cm to about 10 cm. The central region can comprise a thickness ranging from about 1 mm to about 30 mm.

[0015] In some embodiments, the hip pad can have an impact-resistance of up to about 10,000 newtons.

[0016] Another embodiment is directed to a hip protective garment, comprising a hip pad disposed on the garment, the hip pad comprising a center, such that when the garment is disposed on the user, the center of the hip pad is disposed adjacent to the upper trochanter region of the user's hip. The hip pad can comprises a polyurethane foam with a density of about 20 pcf, a thickness of about 15 mm, and that is capable of absorbing about 7000 newtons of force.

[0017] Another aspect of the disclosure is a hip pad comprising a center, such that when the garment is disposed on the user, the center of the hip pad is disposed adjacent to the upper trochanter region of the user's hip. The hip pad can comprises a polyurethane foam with a density of about 20 pcf, a thickness of about 15 mm, and that is capable of absorbing about 7000 newtons of force. The foregoing hip pad can be placed in a pocket at the hip to provide hip impact resistance.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The foregoing and other features and advantages will be apparent from the following more particular description of exemplary embodiments of the disclosure, as illustrated in the accompanying drawings, in which like reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the disclosure.

[0019] FIG. 1 shows a partial view of a user wearing an exemplary padded undergarment according to the present disclosure, in a standing position;

[0020] FIG. 2 is a front view of the user in FIG. 1, showing the pad spaced apart from the undergarment, and the disposition of the pad on the undergarment, relative to the user's hip joint, specifically, the upper trochanter;

[0021] FIG. 3 is a front view of the user in FIG. 1, showing the pad disposed on the undergarment in a protective position relative to the user's hip joint, specifically, the upper trochanter;

[0022] FIG. 4 shows the user of FIG. 1, in a seated position, showing the relative orientation of the pad relative to the greater trochanter during movement;

[0023] FIG. 5 is a top view of a portion of the padded undergarment shown in FIG. 1;

[0024] FIG. 6 is a schematic side view of a portion of the hip pad and body portion shown in FIG. 5, through line 4-4;

[0025] FIG. 7 is a schematic side view of the hip pad shown in FIG. 5, without the body portion;

[0026] FIG. 8 is a schematic side view of another embodiment of the hip pad and body portion shown in FIG. 6; and

[0027] FIG. 9 is a schematic side view of the hip protector pad shown in FIG. 6, without the body portion.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0028] The present disclosure is directed to garments, particularly undergarments, which comprise improved, self-orienting and conformable hip protection pads. The garments are lightweight, soft, flexible and breathable, resulting in improved compliance by users. The integrated pads are designed to provide sufficient impact-resistance to prevent a hip fractures. In some embodiments, the pads can withstand forces in the range of about 7000 newtons ("N"). As such, the present garments provide sufficient impact-resistance to reduce hip fractures both because they are designed to

withstand the force of a fall that would otherwise result in a hip fracture and due to increased compliance.

[0029] FIG. 1 shows a partial view of a user wearing a hip protective undergarment **10** according to the present disclosure. Undergarment **10** comprises a body portion **20** and a padded hip protector portion **30** (hereinafter “pad **30**”) attached to the body portion **20** at the hip region, adjacent to the greater trochanter of the femur bone.

[0030] Undergarment **10** is selected to be form-fitted, rather than loose. The term “form-fitted” or “form-fitting,” as used herein, means that the garment tightly follows the contours of the part of the body being covered, or that is held to the skin by elastic tension. Thus, undergarment **10** is selected to closely conform to the user’s body and to minimize the amount of lateral movement, longitudinal movement and twisting of the undergarment relative to the user’s body, when in use. Suitable materials for the body portion include knits, woven and nonwoven fabrics, leather, vinyl or any other suitable material. A variety of natural and/or synthetic materials can be used for the body portion including, but are not limited to, knits, woven and nonwoven fabrics, leather, vinyl or any other suitable materials that include elastane or an equivalent thereof. Such materials provide a smooth line as well strength when pulled tightly. Other suitable materials include functional materials with repellent and/or absorbent characteristics, such as the type disclosed in U.S. Publication No. 2010/0249736, the disclosure of which is incorporated herein by reference in its entirety. The garments can also be made from a wicking fabric that is designed to move moisture away from the skin layer.

[0031] FIGS. 5-9 show exemplary hip pad **30** according to the present disclosure in greater detail. Pad **30** has a shape, size and configuration adapted to the contours of the outer hip section, including a central oval shape, and “wings” extending from the left and right sides of the oval. It should be understood that the pad can comprise any shape, size, thickness or configuration as is practical or desired to prevent or minimize hip fractures. The hip pad includes cushioning regions of various shapes, sizes, configurations and thicknesses. For ease of discussion, the terms “cushioning region” and “medallion” will be used interchangeably throughout the description. Various

materials can be used for the medallions, as will be described below. The medallions are spaced apart by channels of various depths and configurations, which define the perimeter of the medallions. The upper surface of the medallions may include grooves of various depths and configurations, which define, in part, the contours of the medallions. In some instances, a perimeter flange is provided, spaced apart from the perimeter of the pad.

[0032] As shown in cross-section in FIGS. 6 and 7, pad **30** comprises a cushioning layer **15** disposed between optional outer and inner layers **16,17**, which together define a front surface **10**, a back surface **12** and a perimeter **14**. Suitable materials for the cushioning layer **15**, and optional outer and inner layers **16,17** are disclosed in co-pending and commonly owned U.S. Publication No. 2012/0084896 and U.S. Publication No. 2013/0061377, both of which are incorporated herein by reference in their entirety.

[0033] Pad **30** comprises one or more channels **38**, which define spaced apart medallions regions **50, 60a,b** and wing medallions **70a,b**. As shown, channels **38** have a width "**W₁**" defined by the spacing between the perimeter of adjacent medallions, a depth "**D₁**" defined by the spacing between the upper surface of the medallions and the upper surface of the pad **30**, and a thickness "**T₁**" defined by the combined thicknesses of the inner and outer layers **16,17** and the cushioning material **15** disposed between the layers. For ease of discussion, the "channels" will be referred to hereinafter as hinges throughout the description, without intending to limit the fact that the grooves also function as hinging elements.

[0034] The width **W₁** of the hinges can be varied as desired or needed, and can range from as narrow as about 1 mil to about 1000 mils, or more. The hinges **38** may be linear or curved, and the depth of the hinges between the medallions may be the same or different, and may vary along the hinge. Both curved and linear hinges may be used in combination in the pads, as in the present embodiment, and may include a combination of curved and linear hinged areas. In the present embodiment, the hinges function as locators ensuring that the pad is lined up properly with the intersection of

the **X** and **Y** axes of the user's hip joint and/or with the user's greater trochanter, as shown in FIGS. 2 and 3.

[0035] An optional perimeter flange **40** (hereinafter "flange") may be defined in the upper surface **10** to maintain the medallions in spaced apart relation from the perimeter of the pad. In the present embodiment, the optional perimeter flange **40** has a width "**W₂**" defined by the spacing between the perimeter of the outermost medallions and the perimeter **14** of the pad **30**. The width **W₂** of the perimeter flange **40** may vary, as desired. As will be described in greater detail below, the perimeter flange **40** is thinner than the medallions, allowing the pad to be attached to items such as clothing along the flange area using a variety of techniques, such as by sewing, gluing, bonding, and the like. When integrated with the body portion, the pad can be sewn, glued or otherwise attached to the outside of the sleeve fabric, or it can be sewn or attached to the interior surface of the sleeve, and exposed through a corresponding opening in the sleeve.

[0036] In some embodiments, center medallion **50** can comprise a central region "**R**" extending radially from center point **P**, with a substantially uniform thickness, and the thickness of the remaining medallions can decrease radially from **R** toward the perimeter of the pad **30**. Alternatively, the upper surface of a medallion may comprise a surface that is defined by a thickness that generally decreases radially toward the perimeter of the medallion, or toward the perimeter of the pad.

[0037] Optionally, one or more grooves **42** may be formed in the upper surface of the medallions. Like the hinges **38**, the grooves **42** increase the flexibility of the pad, and as the thickness of the cushioning layer **15** in the grooves **42** is decreased, the flexibility of the grooves **42**, and pad **100**, increases. The width, depth, orientation and position of the grooves **42** in the upper surfaces of the medallions may be varied, depending on a number of factors including, but not limited to, the desired direction and amount of flexibility, and the like.

[0038] Like hinges **38**, the grooves **42** may be curved grooves, or linear grooves that are disposed along parallel and/or intersecting axes. Both curved and linear grooves

may be used in combination, and the grooves may include both curved and linear regions.

[0039] As shown in FIG. 1, the hip pad **30** comprises a center point **P** disposed at the intersection of horizontal and vertical axes **X** and **Y**. Similarly, the greater trochanter of the user corresponds to **P'** at the intersection of the horizontal and vertical axes **X'** and **Y'** on the user. As shown, the pad **30** is attached to the body portion **20**, such that in use, the position **P** of the center medallion **50** corresponds to the user's greater trochanter, corresponding to **P'**. As a result, the center of the hip pad **30** is maintained in the same position relative to the greater trochanter during movement, such as when the user is in a seated position, as shown in FIG. 4.

[0040] As shown, pad **30** is attached to the body portion **20** by stitching the perimeter flange **40** to the body portion **20**, such that the center of the hip pad corresponds to the greater trochanter of the femur. In use, the combination of the flexible hinges **38** and grooves **42** allow the pad **30** to conform to the user's body, particularly the hip region, thereby maintaining the pad **30** in close proximity to the user's body and maximizing the impact-absorption capability of the pad **30** when the user falls.

[0041] FIGS. 7 and 8 illustrates another embodiment of an exemplary cushioning pad **30'** according to the present disclosure. Pad **30'** has a similar structure to pad **30**, other than that the thickness of the cushioning layer **15** disposed between the upper and lower layers **16,17** in hinges **38,50** is maximized during the manufacturing process, to provide greater impact resistance.

[0042] The size, shape, configuration, and dimensions of the pad, medallions, medallion contours, hinges, grooves and flange; and the thickness, density and type of material; may be varied as desired in order to achieve the desired functional characteristics for the hip pad, that is, to prevent or minimize hip fractures by maximizing the impact resistance to the force that a user would cause a hip fracture from a fall, which has been estimated to be in the 7000 newton range. All of the foregoing features, alone or in combination, are designed to facilitate the flexibility of

the pad either inwardly or outwardly to conform to a user's body during movement. However, it should be understood that in each of the foregoing embodiments, and in any pad according to the present disclosure, all of the foregoing measurements can vary depending on the desired characteristics and design of the pad. For example, the pads are designed to provide a variety of characteristics such as, but not limited to, cushioning, vibration dampening and/or impact absorption, and the like. The characteristics of the pad may be varied by changing the thickness and/or material type of cushioning layer **15** in the medallions, changing the spacing between the medallions (i.e., the width of the hinges), and/or changing the contours of the medallions, and the like. For example, using a gel for cushioning layer **15** provides a pad with cushioning and vibration dampening characteristics; using a foam decreases the weight of the pad; using a rate dependent or impact absorbing foam increases the impact absorption of the pad; etc. In general, increasing the thickness of the cushioning layer **15** in the medallions generally increases the foregoing characteristics; and using a combination of materials for cushioning layer **15** may provide a combination of characteristics.

[0043] The cushioning material **15** may comprise a foam material, such as a low-density foam material. Examples of suitable low-density foams include polyester and polyether polyurethane foams. Various types of impact absorbing materials have been found suitable for the cushioning material, particularly energy absorbing materials, which are those that are soft to the touch, and temporarily harden on impact as they absorb the energy of the impact (rather than transmitting the energy, in this instance, to the body), after which they revert to their initial state. One suitable rate dependent foam is available from Rogers Corporation under the brand names PORON® and PORON XRD®, which is a microcellular polyurethane foam. Desirable densities for such foams can range from about 5 to about 35 pounds per cubic foot (pcf), more particularly from about 10 to about 30 pcf, and more particularly still from about 15 to about 25 pcf. Desirable thicknesses for such foams can range from about 3 mm to about 20 mm, more particularly about 6 mm to about 17 mm, more particularly still about 10-15 mm.

[0044] It should be noted that the terms "first," "second," and the like herein do not denote any order or importance, but rather are used to distinguish one element from

another, and the terms "a" and "an" herein do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced items. Similarly, it is noted that the terms "bottom" and "top" are used herein, unless otherwise noted, merely for convenience of description, and are not limited to any one position or spatial orientation. In addition, the modifier "about" used in connection with a quantity is inclusive of the stated value and has the meaning dictated by the context (e.g., includes the degree of error associated with measurement of the particular quantity). Unless defined otherwise, technical and scientific terms used herein have the same meaning as is commonly understood by one of skill in the art to which this disclosure belongs.

[0045] While the disclosure has been described with reference to exemplary embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the disclosure without departing from the essential scope thereof. Therefore, it is intended that the disclosure not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this disclosure, but that the disclosure will include all embodiments falling within the scope of the appended claims.

[0046] What is claimed is:

CLAIMS

1. A hip protective garment, comprising:
 - a form-fitted body portion; and
 - a conformable hip pad disposed on and integral with the body portion of the garment, the hip pad comprising a center, such that when the garment is disposed on the user, the center of the hip pad is disposed adjacent to the upper trochanter region of the user's hip, and during use, the hip pad remains disposed adjacent to the upper trochanter of the user's hip.
2. The hip protective garment of Claim 1, wherein the hip pad comprises an integrated locator device that allows the user to verify the position of the center of the hip pad relative to the upper trochanter region of the user's hip.
3. The hip protective garment of Claim 1, wherein the hip pad comprises a removable impact sensor adapted to measure the force of an impact.
4. The hip protective garment of Claim 1, wherein at least a portion of the body portion comprises an absorbent material.
5. The hip protective garment of Claim 1, wherein the hip pad comprises an energy absorbing foam material.
6. The hip protective garment of Claim 5, wherein the energy absorbing foam material is a polyurethane foam.
7. The hip protective garment of Claim 6, wherein the polyurethane foam has a density of about 10 pcf to about 30 pcf.
8. The hip protective garment of Claim 7, wherein the polyurethane foam has a density of about 15 pcf to about 25 pcf.

- 9.. The hip protective garment of Claim 1, wherein the hip pad has a central region of uniform thickness extending radially from the center of the hip pad.
10. The hip protective garment of Claim 1, wherein the hip pad has a central region of uniform thickness extending radially from the center of the hip pad by about 1 cm to about 10 cm.
11. The hip protective garment of Claim 1, wherein the hip pad has a central region of uniform thickness extending radially from the center of the hip pad by about 3 cm to about 8 cm.
12. The hip protective garment of Claim 1, wherein the hip pad has a central region of uniform thickness extending radially from the center of the hip pad by about 5 cm.
13. The hip protective garment of any one of Claims 9 to 12, wherein the central region of uniform thickness has a thickness ranging from about 1 mm to about 30 mm.
14. The hip protective garment of Claim 13, wherein the central region of uniform thickness has a thickness ranging from about 5 mm to about 25 mm.
15. The hip protective garment of Claim 14, wherein the central region of uniform thickness has a thickness ranging from about 10 mm to about 20 mm.
16. The hip protective garment of Claim 15, wherein the central region of uniform thickness has a thickness of about 15 mm.
17. The hip protective garment of Claim 1, wherein the hip pad comprises an impact-resistance of up to about 10,000 newtons.

18. The hip protective garment of Claim 1, wherein the hip pad comprises an impact-resistance of up to about 7000 newtons.

19.. The hip protective garment of Claim 1, wherein the hip pad comprises an impact-resistance of up to about 5000 newtons.

20. The hip protective garment of Claim 1, wherein the hip pad comprises an impact-resistance of up to about 3000 newtons.

21. A hip protective garment, comprising:

a form-fitted body portion; and

a conformable hip pad disposed on and integrated with the body portion of the garment, the hip pad comprising a center, such that when the garment is disposed on the user, the center of the hip pad is disposed adjacent to the upper trochanter region of the user's hip, and during use, the hip pad remains disposed adjacent to the upper trochanter of the user's hip;

wherein the hip pad comprises a polyurethane foam with a density of about 20 pcf, a thickness of about 15 mm, and that is capable of absorbing about 7000 newtons of force.

22. The hip protective garment of Claim 1, wherein the center of the hip pad is aligned with the upper trochanter region of the user's hip.

23. The hip protective garment of Claim 22, wherein during use, the center of the hip pad remains aligned with the upper trochanter region of the user's hip.

24. The hip protective garment of Claim 21, wherein the center of the hip pad is aligned with the upper trochanter region of the user's hip.

25. The hip protective garment of Claim 24, wherein during use, the center of the hip pad remains aligned with the upper trochanter region of the user's hip.