



Friction Induced Skin Injuries – Are They Pressure Ulcers? A National Pressure Ulcer Advisory Panel White Paper

November 20, 2012

Authors: Steven Antokal, David Brienza, Nancy Bryan, Laura Herbe, Susan Logan, Jeanine Maguire, Kathy Strang, Maranda Vanbruaene, Jennifer Van Ranst, Amir Siddiqui

Keywords: pressure ulcers, shear, friction, friction blisters, friction injuries, repetitive friction

Introduction

The 2009 International NPUAP-EPUAP Pressure Ulcer Prevention and Treatment Clinical Practice Guideline eliminated reference to friction as a factor in pressure ulcer development. The classification system in the Guideline defines a pressure ulcer as "... a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear." The NPUAP staging system published in 2007 defined a pressure ulcer as a "... localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction." One reason for the deletion of the words "and/or friction" is to reinforce that skin injuries caused by friction are not to be considered pressure ulcers. Despite this, differentiating wounds that have friction as a primary or contributing cause from those caused by pressure and/or shear is sometimes difficult and continues to be a frequently asked question. For example, the following question was posted on the NPUAP website: If a patient develops an ulcer from a shoe rubbing on the side of the foot, is that wound a pressure ulcer?

The literature on the role of friction in pressure ulcer development is not definitive due to inconsistent use of terminology and definitions that have evolved and changed over time. This white paper is intended to raise awareness of the issues concerning the difficulties differentiating pressure and/or shear induced injuries from friction induced injuries, and help to clarify why it was removed from the definition in the classification system.

Background

What is friction? As far as the potential for skin injury is concerned, we are concerned with the types of friction generally classified as dry friction. Friction is the rubbing of one body against another or the force that resists relative motion between two bodies in contact and/or material elements sliding against each other. There are two types of dry friction – static and dynamic (a.k.a. kinetic). Static friction is the force resisting the relative motion between two bodies when there is no sliding. Static friction is the force that prevents a person from sliding down the bed when the head of the bed is raised. The amount of friction that exists at the skin surface depends on the skin's surface properties (e.g. hydration level) and what is in contact with it (e.g. bed linens, clothing, etc.) and the magnitude of pressure (normal force). Moisture is an important factor too, high humidity and liquid moisture tends to increase the friction and cause a person stick to a surface. Dynamic friction is the force resisting relative movement between two bodies in contact as they are moving relative to one another, that is, sliding. Dynamic friction exists when a person is sliding in bed or when their foot rubs against the inside of a shoe and might result in the formation of blisters, skin tags, abrasions, skin tears, and acute skin trauma, and may be misdiagnosed as a pressure ulcer.

Discussion

The origin of considering friction a causative factor for pressure ulcers was a study published by Sidney Dinsdale in 1974. The study was performed on swine and aimed to determine if friction increased the susceptibility to injury when combined with pressure. The results showed significantly less pressure was required to induce full and partial thickness lesions when friction force was also applied. Unfortunately, Dinsdale's description of the methodology makes it difficult to ascertain if the friction applied was static or dynamic. If it were only static friction, and no sliding occurred, then it would be safe to assume that the friction caused significant shear strain in the tissue. If there was sliding, the shear strain would likely be less in magnitude and accompanied by other factors such as heating of the tissue and possibly abrasions. The study also included an experiment to test the theory that friction forces reduced blood flow in the skin more than pressure alone. The result showed that blood flow was not significantly different in the epidermis when friction and pressure were applied together compared to pressure alone. This led the investigator to conclude that the increased susceptibility of lesions with friction was not due to ischemia (reduced blood flow) in the epidermis.

Thirty-five years later, the commonly accepted etiological factors of pressure ulcer development are ischemic injury, reperfusion injury, and excessive deformation of muscle cells (Stekelenburg, 2007). Reexamining Dinsdale's results in light of more recent information, we hypothesize that, since susceptibility to ulcers increased and blood flow was not reduced in the superficial layers of the skin when friction was added, the friction used in Dinsdale's experiment was creating shear strain (deformation) in the deeper layers of tissue. An alternative, yet still consistent, hypothesis as to how friction increases susceptibility to pressure injury is that friction may cause mechanically damaging shear strain of superficial tissue cells. That is, tissue damage results directly from excessive deformation and is not related to ischemia.

So friction appears to be an important factor because it may lead to harmful shear stress and strain. Hence in the current definition of a pressure ulcer, shear remains listed as a primary causative factor and friction is eliminated. To include friction would be redundant because friction appears to be a factor only because it causes shear. Eliminating reference to friction may discourage the mislabeling of with other types of injuries to the skin such as serum filled blisters, etc. that are caused by friction force on the skin.

To answer the question raised regarding an ulcer caused as a result of a shoe rubbing on the side of the foot, this is not a classic pressure ulcer that occurred in a bed- or chair-bound patient. Nonetheless, ulcers of this type can be reduced in ambulatory patients by providing proper fitting footwear.

A question related to the discussion of friction as a risk factor for pressure ulcer development concerns the use of strategies, such as skin lubricants, low friction covering materials and dressings to control friction between load bearing surfaces to help prevent pressure ulcers. These would appear to be valid strategies since reducing of friction on the skin could reduce internal shear in deeper tissues.

Summary

Does friction alone cause a pressure ulcer? No. Friction can cause minor to substantial skin impairment, however, friction alone is not a direct cause of a 'pressure ulcer', but rather is a risk factor that may contribute to or exacerbate pressure ulcer development due to the shear it creates. That is, friction causes the shear strain in the tissue, which can increase the risk of tissue breakdown and lead to pressure ulcers.

Should all friction injuries be labeled as 'pressure ulcers'? No. In distinguishing wound types that have friction as a factor, all factors should be considered. If the cause is solely a friction force, which lends to visible skin impairment, such as a skin tear or laceration, it would NOT be categorized as a pressure ulcer. If however the

lesion presented as a blood filled blister with surrounding purple or maroon discoloration then a pressure ulcer may be suspected. Superficial friction wounds can occur in the same location as pressure ulcers due to the surface effects combined with the deeper effects of shear and pressure. In these circumstances, interventions may need to account for reductions in both pressure and friction.

Disclaimer

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