Moisture and Temperature

Excessive moisture and temperature at the support surface - body interface has been presented as a complicating, and possibly a causative factor in the development of pressure ulcers (PresShear™ sore). Reviewing the literature and suggested product utilization reveals a dichotomy in actual practice with proven basic science facts.

Starting with the body-support surface interface temperature, one must consider the source of the temperature. The body creates internal temperature due to metabolism and mechanical activity, mainly muscular contraction. The core temperature of the body (98.6) is created by metabolic activity particularly by the liver. This accounts for the core temperature to be the highest at the torso, followed by the head, and finally the extremities. Long-term temperature regulation is by the hypothalamus - pituitary - thyroid axis. The body responds to hypothermia by increasing core temperature through the activity of the hypothalamus. The “quick fix” method is by peripheral vascular constriction and rapid muscular contracting (shivering). The control of an excessive temperature is accomplished by peripheral vascular dilation, rapid respiration, and sweating. Thus the temperature - sweating relationship occurs.

Sweat is composed of water, minerals, and some urea. It is secreted mainly by the eccrine gland and less by the apocrine glands. These are also controlled by the hypothalamus. The amount of sweat produced can range from 600 ml per day to 4 L per hour. The distribution of sweating is greatest at the palm and sole region, followed by the torso, head and extremities. The physiological reason for sweating is two-fold. The primary reason is temperature regulation of the body by evaporation and secondary as a surface friction reduction mechanism.

This brings us to the review of basic temperature regulating mechanisms of nature. The temperature of the body is regulated through radiation, conduction and convection. The temperature transfer from one source to another is always from the greatest temperature (source) to the least temperature (sink). The greater the temperature gradiency, the quicker the transfer of heat. The human body transfers heat by these three means of which convection is the most efficient. This is merely moving active molecules from a higher temperature environment into a lower temperature environment. The evaporation of sweat on the body’s surface greatly enhances this mechanism. Convection can occur passively (natural) or by force. The action of both is the same, but the passive way is slower. This relationship of convection to body temperature is well illustrated by the wind chill and heat index weather reports.

Taking into consideration the diminished temperature regulatory mechanism of the geriatric patient and the debilitated patient, the use of low air loss surfaces must be questioned at best. If evaporation, convection and temperature controls are the basis for this product selection, then extreme precaution must be taken to prevent the potential detrimental drying of the skin (friction risk); dehydration (evaporation risk) and core temperature decrease (temperature risk). If any one, or worse yet all of these risks materialized, the body's response could be peripheral vascular constriction, vascular bed stasis due to dehydration, and increase surface shear forces (friction). Here we see the aforementioned dichotomy between physiological facts and product promotion.

The greatest concern in utilizing the low air loss technology is in the treatment of increased moisture buildup secondary to incontinence and excessive sweating. If one only recognizes that urine is water, urea and minerals, and sweat is water, salts and minerals and the effect of forced convection therapy (low air loss) is to increase evaporation, then common sense tells us we are concentrating the true irritative components of sweat, urine and fecal material by leaving them in contact with the skin. These higher concentrations then increase the likelihood of skin irritation and breakdown. Now if these substances are infected or an open draining wound exists, then the contamination of the surrounding environment must also be addressed.

The mechanism of contamination can be divided into four (4) categories. These categories are (1) contact, (2) airborne, (3) droplet and (4) vector. The first three must be addressed in any health care facility. Thus the use of support surfaces must comply with the guidelines for isolation control dictated by the Government. The entire potential for cross contamination must address the blowing of air through a contaminated environment that may originate from respiratory, digestive or soft tissue sources.

Now the other extreme must be addressed. A totally occlusive barrier will create an environment at the body-support surface interface that will not allow normal convection to occur. When this occurs the temperature of the body in the region of the occlusion will not radiate or convex heat from its surface. The R factor of the occlusive surface will dictate the conductive transfer. This phenomenon explains the need to have a non-powered porous support surface that will allow the body to properly transfer or preserve heat in the immediate surrounding environment. If the normal convection, evaporation, conduction, and radiation of temperature occur, then the body will better retain its core temperature and surface moisture.

Vapor permeable but liquid impermeable materials have been promoted to allow the body to utilize its natural temperature control, however the size of the pore in the material must be known so vapor transfer will not contaminate the inner media of the product. The ability to allow normal convection with evaporation, as well as prevention from airborne and droplet contamination must be critically evaluated. This requires constant evaluation of the inside of the container contents concerning moisture buildup, fungi, and bacteria contamination. The concern about enterococcus and TB should also be addressed.