

## COMMENTARY

THE SKIN AND ITS RESPONSE TO MOVEMENT<sup>1</sup>

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*Healthy Skin is Designed to Respond to Movement*

The skin is designed so that health of the outer 0.3 mm of its surface is maintained by low amplitude body movements. There are two essential working parts of the skin—the outer and the adipose tissue. The outer 0.3 mm, which includes the epidermis and its blood supply as well as its lymphatic drainage system, works to display, to protect and to provide an immune and endocrine system. Moisturization from within keeps the surface resilient but it is balanced by effective drainage. The rest of the dermis is in support, and deep to the dermis but closely linked to it is the adipose tissue. This contributes to the body's shape, disperses the forces of pressure and acts as an endocrine and thermo-regulatory system. Into this system enters a blood supply, dividing into rich capillary beds in the upper 0.3 mm of the skin and in the adipose tissue. Both drain into the venous system. The outer working part of the skin is drained by a lymphatic system, which is a rich plexus just deep to the capillary bed. It exits through the adipose tissue but provides very little effective drainage of that system.

*Atrophic and Hypertrophic Skin Responds to Movement Less Well*

Different regions of the body show some variation in the thickness and exact function

of the skin. There are regional differences due to damage from the sun, gravity, obesity or exposure to cold. Variability of the upper dermis depends upon a range from atrophy to hypertrophy. Most regions of the skin, in health, show an undulating epidermis with rete ridges, supplied by a rich capillary network with hairpin loops in the papillae. In hypertrophy, these become elongated and tortuous, lying in the papillae surrounded by elongated rete ridges. In atrophy, the epidermis is flat, the hairpin loops disappear altogether and the horizontal sub-papillary lies at some distance away from the epidermis. It is poorly supported and dilated, and it may be visible from the surface as telangiectasia. Factors which encourage changes to atrophy include chronic exposure to the sun, aging and steroids. It is also seen following chronic cold exposure and is one consequence of gravitational effects from the lower leg. More commonly, gravity leads to elongation of the hairpin loops. Often, in the lower leg, one sees great heterogeneity with atrophy and hypertrophy observable in the same area of skin.

The lymphatic system begins just deep to the capillary bed and is surrounded by a network of collagen and elastic fibers, which helps it to be responsive to movement and links it to the overlying epidermis, perhaps providing low resistance pathways for passage of materials from the epidermis. In atrophy and hypertrophy, the system loses its efficacy often due to loss of elastin.

*Ultrasound Studies*

<sup>1</sup>Based on a lecture to practitioners of manual lymphatic drainage, London, May 1998

Contemporary techniques of ultrasound allow us to take pictures of the skin *in vivo*. In particular, it shows that the capillary bed provides an excess of water which can be seen in the upper dermis. It shows diurnal variation and can be reduced by elevation of the tissues to discourage gravitational influences on the capillary venous system. Indentation of the skin as may occur by indenting a fingernail or blunt steel probe or lying on a wrinkled pillow provide indentation marks which, on ultrasound, clearly show indentation into the upper dermis, down to the level of the capillary bed and the lymphatic bed. It emphasizes the superficial level of the structures and the ease with which they can be manipulated on the surface.

#### *Lymphatic Failure*

A feature of lymphatic disease which may be associated with venous disease is gross changes in the proportion of the tissues. If the drainage system of the skin is interfered with, collagen fibers are laid down, there is angiogenesis—there is an accumulation of fat cells and the structure of the thickened tissues is quite different from that in health. It also means that the response of the tissues to movement is compromised. A feature is that the blood vessels, lymphatics and fat cells are all vulnerable to excessive injurious movement leading to excess leakage and inflammation. Further expansion of the tissue is limited by its sclerotic fibrosis.

#### *The Natural Movement of the Skin*

Normal healthy tissues respond to low amplitude movement. By low amplitude, one means 40 blinks of the eyelid or 40 paces when walking per minute. Vigorous exercise tends to damage the vasculature or at least overload the lymphatics. The tissues are helped by elevation because it empties the venous system and reduces the load on the lymphatics. They should always be protected from the sun, and shade is of benefit in lymphedema. Because of an increase in adipose tissue, the outer surface of the skin may become insulated and cool. Cold skin is less easily manipulated, tending to be harder than warm skin. At the same time, the vulnerability of edematous skin may lead to

blistering and shearing off of the surface working area of the outer 0.3 mm of skin.

The ideal is a healthy skin maintained by low amplitude movement. These movements are usually natural movements, the kind of movements of the skin that occur when doing limited exercise of a natural kind, like taking a walk. They should allow a full range of joint movements. Natural movements include the kind of movement that occurs in the early morning when one wakes up, such as blinking, yawning or stretching. They are movements which tend to empty the lymphatics in the chest and abdomen before activating the lymphatics in the peripheries. They are movements which are often initially involving the shoulders and thighs before stretching out to the fingers and toes.

Finally, body movements are designed to make use of the normal structure of the skin, leading to stretches and strains in which the collagen and elastic fibers extend mechanical signals which may be transduced into biochemical signals at the cellular level. The fibrous network of supportive collagen and elastin is distributed optimally to allow a response to movement. In diseased skin, one of the additions that may help the tissues to respond is a supportive sleeve, a stocking or bandage, which allows the movements to be felt by the tissues and in which some compression at the surface may occur when muscles in the deeper tissues contract.

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