Getting a Handle on the Superficial Fascial

In Consideration of the Cutaneous Nerves

By Stephen Evanko, Ph.D, Certified Advanced Rolfer™

Ah, the superficial fascia. This thin layer of loose fatty connective tissue underlies the skin and binds it to the structures beneath. This layer also contains the cutaneous vessels and nerves, and is also called the hypodermis, subcutis, or tela subcutanea. While myofascia tends to get most of the press, I have recently been discovering how effective and dramatic structural change can be evoked by contacting this upper zone of the body, and the nerves therein, and have come to realize how the superficial fascia is largely underappreciated for its role in aberrant structural and movement patterns, as well as in pain generation. In this paper, I would like to share some observations and experiences from my recent focus on using the integument and superficial fascia literally as a handle to free nerves, access deeper tissues, and aid in restoring structural alignment in my clients. I would also like to bring into discussion some research findings related to the cell biology of the extracellular matrix, particularly hyaluronic acid (or hyaluronan) and proteoglycans, both of which are components of the ground substance and are found in large quantities in the skin, the underlying layers, and within the nerves themselves. My laboratory research over the years has focused on these components, and there are a number of interesting findings in this area that we may relate directly to our work as Rolfers as we explore the superficial realms.

For me, interest in the superficial fascia was first sparked through reading *The Endless Web* by Louis Schultz and Rosemary Feitis[1] and their fascinating description of the various body retinacula – bands that run horizontally around the body like retaining belts holding in the soft tissue. These include the eye band, the chin band, the collar band, the chest band, the umbilical band, the inguinal band, and the groin band. These body straps were hardly discussed in most of my Rolfing® classes, with the wrist and ankle retinacula tending to get the most airtime. These other body straps would seem to be relatively independent of the deeper myofascial anatomy of the body; however, in practice lately, I find them to be extremely important, and addressing the thickened matrix just under the skin helps tremendously in resolving structural issues. This is mostly due to the fact that many cutaneous nerves traverse these straps – under and/or within the thickened tissue. Therefore, the possibility of tethering of the nerves in these locations should always be assessed. I know that my tendency had always been to go for the deeper myofascia first, often missing much of the important stuff in the first available layer of the sleeve.

A recent DVD by our colleague, Gil Hedley, entirely devoted to the superficial fascia,[2] piqued my curiosity about this layer even further. In it he shows the incredible intricacy of the areolar tissue and the adipose layer – like a fleecy set of pajamas under the skin. This pajama layer can get twisted and saggy, or fibrous, thin and dehydrated, thus trapping, tethering and pulling on the branching networks of the cutaneous nerves and, ultimately, the deeper nerves, deeper fascia, and joint capsules. We will see below how variability in the thickness and texture of the superficial fascia and overlying skin can give us clues about whether the nerves below or in the vicinity are inflamed or otherwise unhappy.

Don Hazen, Christoph Sommer, and Jon Martine have been instrumental in fostering the recent interest in peripheral nerve manipulation in the structural integration (SI) community. I'll be forever grateful to Don for this new insight into the value of nerve work for Rolfing Structural Integration. For interesting reading on the subject, I recommend Don Hazen's website (www.dhazen.com), as well as *Manual Therapy for the Peripheral Nerves* by Jean-Pierre Barral and Alain Crobier.[3] I also highly recommend taking a class in releasing entrapped nerves. I'm glad to see there is growing recognition that mechanical irritation of the peripheral nerves, especially the cutaneous nerves, is driving much of the inflammation and subsequent pain, strain, joint restriction, and fibrosis in the body. Adding neurofascial work to our repertoire is a notion whose time has come for the Rolfing community to embrace, and more discussion of the superficial layers can expand our abilities to help our clients. Increased attention to superficial fascia and neurofascial work has been an incredibly valuable addition to my understanding, palpatory skills, and toolset, and has provided greater possibilities for pain relief and structural change in my clients than ever before.

One goal of neural mobilization is to restore proper longitudinal and lateral glide of the peripheral nerve and its sheath where it becomes tethered in the fascia. At the cellular level, substances released by mechanically or chemically irritated nerves[4] can exacerbate the formation of myofibroblasts (cells that produce fibers in the myofascia in response to inflammation), matrix stiffening, and fascial restrictions, as well as swelling and edema that involve hyaluronan and proteoglycan deposition in the tissue. The outgrowth of neurites (small neuronal processes) underlies the phenomenon of arborization of nerves (growth of small nerve branches) and may occur during neurogenic inflammation. Thus, there can be a vicious cycle of inflammation, fibrosis and tissue contraction and hardening, more nerve irritation, etc. Neurite outgrowth is influenced by hyaluronan and can be blocked and/or guided by deposits of the chondroitin sulfate proteoglycans, which interact with hyaluronan.[5,6]

Figure 1 shows a cross section through a nerve. Manipulation of the epineurium of the larger peripheral nerves and their smaller branches probably affects both the fibroblasts of the sheath and the surrounding areolar tissue of the

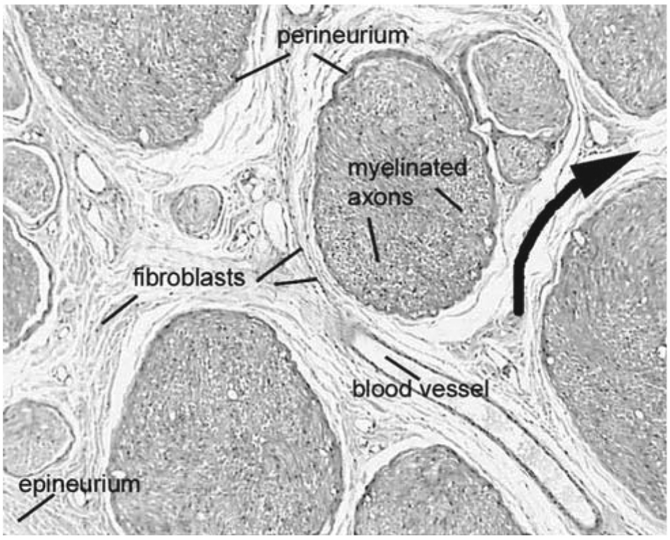

Figure 1: Histology of a nerve – cross-section showing various parts of a nerve. The arrow shows how nerve manipulation can create shear along the nerve bundles, thus affecting the fibroblasts in the surrounding areolar tissue and in the perineurium.

mesoneurial gliding structures, as well as nociceptive endings (pain receptors) and tiny neurites of the nervi nervorum.4 The interface between the perineurium (the connective tissue surrounding a single fascicle of nerve fibers) and the epineurial interfascicular tissues would also be affected. The connecting areolar tissues in the superficial layers, as well as the dermis and lower layers of the epidermis, are rich in the watery, hyaluronan matrix that serves as a lubricant for proper gliding that must take place in healthy tissues as we move and stretch. Hyaluronan itself is a huge, water-loving and space-filling molecule, capable of undergoing profound structural changes on a nanosecond time scale. The ground substance, including hyaluronan and proteoglycans, represents that primitive binding and communication material, the slimy biofilm used by cells when they first started aggregating into multicellular organisms; in other words, the ground substance is alive and responsive.

A memorable film by Jean Claude Guimberteau, *Strolling Under the Skin*, shows well the dynamic nature of the gliding mechanisms of skin and tendons, and the lubricating qualities of this watery matrix. Research has shown that hyaluronan in the pericellular matrix of fibroblasts may serve an antiadhesive function and aids the cell when it releases tensional hold on a substrate under certain conditions.[7] Fibroblasts also respond to acute stretching by forming a pericellular matrix rich in hyaluronan, and this may help explain the hydrated quality of the tissues following fascial manipulations. This is also why joints get lubricated when we move them. When we touch tissues with the intention, pressure and shear focused on this watery interface where the cell membrane meets the pericellular matrix, I'm convinced it can allow tissue to release more easily and minimize cellular damage. At the very least, connecting more consciously with the matrix immediately surrounding cells can be helpful in encouraging tissue melting. In addition, those seams of areolar tissue between dense fiber bundles are a good place to aim with fingertips or fingernails.

A little hyaluronic acid is probably a good thing, but too much can be a problem. Under inflammatory conditions (and in certain cancers), more hyaluronan and its fragments are produced, thus exacerbating the swelling in and around inflamed nerves, joint capsules, etc. In addition, hyaluronan also appears to be involved in the formation of myofibroblasts, and over-accumulation of hyaluronan and proteoglycans during inflammation tends to precede fibrosis. Our laboratory and others[8] recently found that the hyaluronan matrix produced under certain stimuli by fibroblasts, adipocytes, and synovial cells can be quite sticky and binding, thereby trapping inflammatory cells (see Figure 2). This is due, in large part, to an increase in proteoglycans and cross-linking of the matrix, which make it stiffer and more viscous. In looking at these images, it is easy to imagine how manual therapies can potentially be very effective at dislodging the stuck inflammatory cells and the viscous matrix around the fibroblasts. In a recent experiment, I found that an enzyme that degrades hyaluronic acid can change the appearance of a myofibroblastic synovial cell to that of a normal-looking fibroblast (unpublished observation). This enzyme also caused cells to retract fine microvillous protrusions, which they use to secrete the matrix and contact and pull on each other. Thus, our manual interventions may be affecting myofibroblast formation in part through the ground substance. Hyaluronan also has direct effects on inflammatory cells. We have recently found that binding of hyaluronan can activate the immunosuppressive ability of a subset of T-lymphocytes called Tregs[9], and this effect may underlie the benefits and growing popularity of hyaluronan as a supplement for joint pain.

Concerning the nerves themselves, hyaluronan and associated proteoglycans play important roles in the nerve sheath as a lubricant for proper glide. Excess amounts of this matrix could also act as a kind of glue as part of the pathophysiology of tethered nerves, which also includes edema and thickening of the nerve sheath, and thus more contractile, myofibroblast-like cells. Hyaluronan is also found in the endoneurium surrounding individual nerve fibers, and associated chondroitin

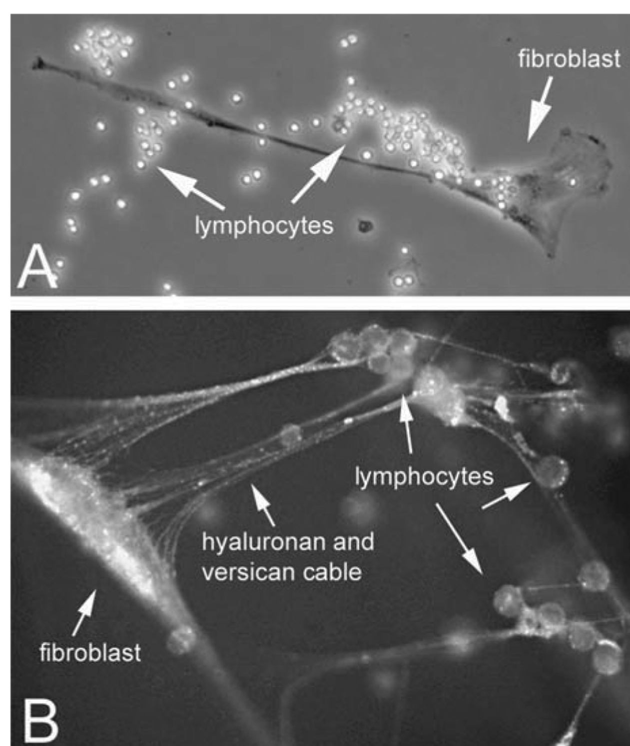

Figure 2: Hyaluronan and proteoglycan-rich pericellular matrix of fibroblasts in the form of sticky "cables" can trap inflammatory lymphocytes.

sulfate proteoglycans are found specifically in the nodes of Ranvier.[10] This suggests that the matrix may also play a role in nerve conduction.

Working with Superficial Fascia/Nerves

As we work in the superficial fascia, we can consciously connect with the pericellular matrix of the fibroblasts in the areolar tissue surrounding the nerve and in the sheath; and with inflammatory cells, through pressure and shear, we can interact directly with this primitive communication medium of the body. As Hazen has pointed out (and I find to be true), working with finger pads along tethered cutaneous nerves of the superficial fascia can be extremely effective at releasing them and pumping the inflammatory exudate that fills the nerve sheath and surrounding tissue into the lymphatic circulation (this fluid also contains the pain mediator peptide, Substance P, inflammatory cytokines – small proteins that promote inflammation – as well as the inflammatory cells themselves). Neurofascial manipulations, especially those that produce some rolling and shearing along the nerve, probably break up the viscous hyaluronan-rich matrix and fine cellular processes around the epineurial fibroblasts. Neural mobilization techniques probably also affect the microscopic neurites of the nervi nervorum as they arborize and potentially promote contraction of the tissues immediately surrounding the nerve sheath. The nervi nervorum monitor the tensional state of the nerve (among other things), and release of the nerve by manipulation may mediate the often rapid tissue softening, as well as some of the beneficial effects of our work on the nervous system and surrounding tissues. Robert Shleip gave a memorable presentation at the 2009 Rolf Institute® Membership Conference in which he discussed a role for the mechanoreceptors, such as the Ruffini corpuscles, in mediating tissue responses, as well as strategies for releasing them, such as skin rolling. This would also effectively release the finest nerve twigs reaching up to the surface endings or terminating in joint capsule tissues.

Recently, I have found that profound and rapid large-scale releases and effective differentiation of layers can be achieved by using my hands like a suction cup, engaging as much of a cutaneous nerve distribution as possible, first pressurizing to engage the nerve endings and pericellular matrix of the cells in the appropriate layer, and then listening for and coaxing the release by creating shear of varying degrees at the dermis/superficial fascia interface: *Pressurize, wait, listen, lift and shear*.

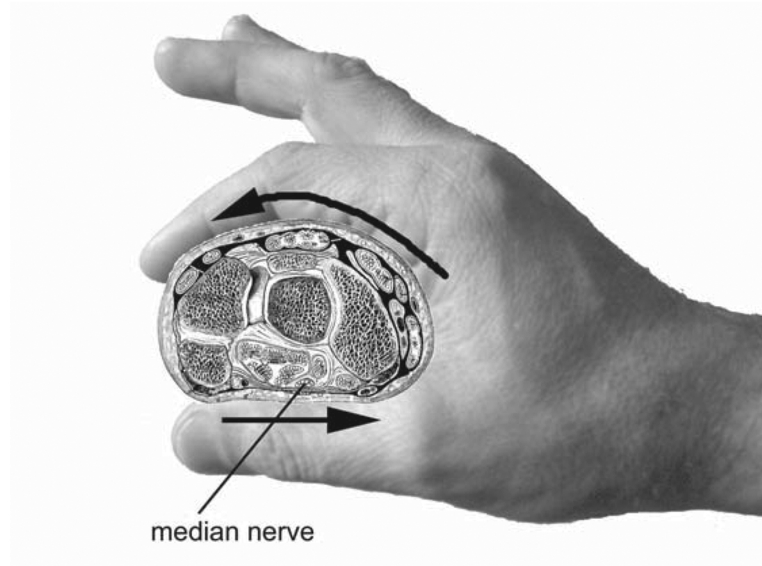

Figure 3: The retinaculum roll. Manipulation of the entire retinaculum to restore lateral glide to the nerves and tendons crossing below. Similar broad-hand techniques can be used to untwist the other body retinacula using the skin and superficial fascia as a handle.

This technique is focused in areas of clearly palpable tension in the cutaneous nerve distribution where the finest nerve twigs and endings reach up to the surface mechanoreceptors and along the length of the nerve itself. De-rotation of all the retinacula of the wrist or ankle, and restoration of lateral glide to the nerves therein, can be accomplished using a similar technique (see Figure 3). In addition, working at proximal and distal locations of a nerve by tugging gently along its length at the level of the superficial fascia, as described by Barral and Crobier, is also helpful.

Surface Indicators of Tethered Nerves

In clinical practice, there are several noticeable visual and textural indicators on the skin surface that can help us identify potential tethering and/or irritation of the cutaneous nerves directly below, due to twists in the body retinacula or sagging of the superficial fascia that can be tugging on a peripheral nerve. These include:

- **Stretch marks** – These represent, in part, a loss of elastin and alterations in collagen in the dermis along with thinning of the epidermis. It feels to me like the superficial fascia has been pulled into a somewhat corrugated texture by the tension generated in the nerve sheaths and surrounding areolar tissue, much like a drawstring in the waistband of sweatpants (this analogy borrowed from Kirstin Schumaker[11]), with the marks appearing along the corrugations. This pulling can potentially disrupt the normal relationships and communication between the fibroblasts in the dermis and the epidermal cells, which has been shown in laboratory studies to cause dramatic changes in the epidermis. Examples of cutaneous nerves that may contribute to stretch marks are the superior and middle cluneal nerves overlying the glutes, as well as the iliohypogastric nerve, where it emerges above the iliac crest, and as it passes down behind the greater trochanter. As Hazen and others have pointed out, these cutaneous nerves are very much involved in low back issues and the pain that is often mistakenly attributed to impingement of the sciatic nerve. I find that stretch marks are nearly always present over the cluneal nerves in such cases. With respect to the body retinacula, torque in either the inguinal strap or the groin strap will tug on these and other nerves, and should be checked.
- **Cellulite** – It seems to my touch and eye that cellulite is due to tension along the connective-tissue septa around and between fat lobules as the superficial

fascia sags, and probably involves tension along the sheaths of cutaneous nerves and nerve twigs. This tension seems to cause the tissue to pucker and can involve the entire nerve distribution. Cellulite usually occurs on the back and sides of the legs, so examples of the nerve fields involved are the posterior femoral cutaneous nerve (which should be checked in the case of a posteriorly tilted innominate) and the lateral femoral cutaneous nerve (which should be checked on the side of the anterior tilted pelvis), as well as the obturator nerve. There are probably other examples as well. Large-scale twists in the groin strap and the rest of the fascia lata, as well as the sagging in the overlying adipose layer, need to be addressed to help smooth these areas and to free and reposition these nerves more completely. An approach which seeks to lift the entire superficial fascia of the thigh upward works well to smooth this tissue out.

- **Dry, taut skin, dry hair, and eczema** – Tight, dry skin around the forearm and retinacula of the wrist involves the radial, ulnar, and median nerves. As mentioned above, I find that imparting a super-slow shearing action to untwist the flexor and extensor retinacula can be extremely effective for releasing the entire set of nerves crossing the wrist or any other retinaculum (see Figure 3). In clients with extremely tight cranial fascia, I look to release the occipital nerves, the auriculotemporal nerves, and supraorbital branches of the trigeminal nerve, etc. Tightening along the eye band distorts and irritates these nerves. In addition, eczema, which is known to have a neurogenic component, seems to respond very well to release of bound cutaneous nerves. In my practice, this has included the saphenous nerve, as well as cutaneous nerves over the calves (sural n.), forearms, and triceps (radial n.).
- **Moles, keratoses, and skin tags** – I suggest these as possibilities that you can explore for any relation to the cutaneous nerves. I will often find a raised mole or keratosis-like lesion near a side-bent and rotated vertebra or other places where nerves feel arborized, tethered, and perhaps overlapped with another nerve. There seems to be a pronounced unwinding in the superficial tissues when I put my finger directly on the mole. I have also noticed such moles over the long thoracic nerve, serratus anterior, and in the axillary region, where the chest band will bind the nerve and plaster the latissimus dorsi against the ribs, i.e., Third-Hour territory. Addressing the long thoracic nerve where it gets tethered under the chest strap and/or arborizes down to the pelvis is crucial in helping to release a kyphotic pattern.

Concluding Remarks

In our quest to help clients release their strain patterns, find tensional balance, and ease pain, it's easy to dive directly into the deeper myofascial layers, while ignoring or unconsciously missing important structural issues that are right on the surface. Sagging and contortion of the superficial fascia happens in all of us. Like rumpled, twisted pajamas, the superficial fascia can get seriously distorted depending on how we sit, sleep, work at the computer, or play. Nerves crossing the body retinacula within the superficial layers are frequently the issue in many painful situations. Tethering of the nerves in these locations should be checked and, if found, released for more effective pain relief and more complete structural integration. Broad-hand techniques can be used to untwist the body retinacula using the skin and superficial fascia as a handle. At the cellular level, focused intention on connecting with the dynamic, vibrating pericellular matrix can help us accomplish this goal.

Stephen Evanko, Ph.D, is a Certified Advanced Rolfer™ practicing in Seattle. He also serves part time as a Staff Scientist at The Benaroya Research Institute, Seattle, WA where he studies the biological properties of hyaluronic acid and proteoglycans. Before that he conducted biomechanical studies on tendons and fibrocartilage and the tissue response to cyclic compression, and has published several peer-reviewed papers on these topics.

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