



EDITORIAL

Signposts

In April 2003 JBMT published an article by German Rolfer Robert Schleip, on the subject of fascial plasticity. In his article Schleip reported on the remarkable discovery in the mid-1990s, by [Staubesand and Li \(1996\)](#), of the presence of smooth muscle cells (SMC) in crural fascia.

Just how much research has been undertaken since that discovery is partially reflected in the reference list at the end of this editorial, based on a literature search utilising Medline and Science-Direct.

What emerges is simply revolutionary (at least to this reader):

- Contractile actin in SMC has been found to be abundantly present in fascia/connective tissue, body wide—for example in the cruciate ligaments ([Murray and Spector, 1999](#)), crural ligament ([Staubesand and Li, 1996](#)), meniscus of the knee ([Ahluwalia, 2001](#)), intervertebral discs ([Hastreiter et al., 2001](#)), venous structures ([Weirich, 2004](#))—and even in bone ([Kinner and Spector, 2002](#)).

What is the function of this contractility of actin fibres in connective tissue? Although there are clues the answers are not yet fully available, with a typical conclusion from one of the various studies listed below, being: "Further work is necessary to elucidate the role of the various fibroblast phenotypes in the maintenance of the human anterior cruciate ligament" ([Murray and Spector, 1999](#)).

So we must wait on further research to discover what the functions of contractile SMC in bone, ligaments, and intervertebral discs and even within the fascial structures between the cranial sutures, are?

There is however some conjecture.

- They might, for example, be involved in architectural stability. In human lumbar discs there is a gradation of density of contractile SMCs so that a "fourfold increase in cell density was found in proceeding from the nucleus pulposus (NP) to

the outer annulus (OA) of the intervertebral disc.Virtually all of the cells in the NP and 40% of those in the OA were round [i.e. smooth muscle cells]. Moreover, notable percentages (12–15%) of the cells in the NP and inner annulus (IA) contained [contractile] alpha-smooth muscle actin...Perhaps in disc cells, smooth muscle actin functions as a cytoskeletal protein necessary to maintain cell shape under high external stresses. [Buckley and Porter \(1967\)](#) report that the presence of actin microfilaments may not always be associated with cell contraction. Rather, they may also play a role in anchorage to a substratum or maintenance of cell shape" ([Hastreiter et al., 2001](#)).

- Or these cells might be involved in repair function. "The demonstration of cells with contractile capability in the meniscus could help to explain its response to injury and the process of healing. A recent study of the bovine meniscus ([Mueller et al., 1999a](#)) demonstrated the presence of a contractile actin isoform, alpha-smooth muscle actin (SMA), in 10% of the fibrochondrocytes in the intact, uninjured tissue...Prior studies have demonstrated the capability of SMA-containing chondrocytic cells isolated from meniscus ([Mueller et al., 1999b](#)) and intervertebral disk ([Schneider, 1999](#)) to contract a collagen-glycosaminoglycan analog of extracellular matrix. Differential functions of smooth muscle actin in cells of chondrocytic and fibroblastic morphology need additional study" ([Ahluwalia, 2001](#)).
- SMC contraction is provoked by (among other factors) a calcium release, caused as pH increases [Ca^{2+} influx] as carbon-dioxide levels drop during overbreathing, resulting in respiratory alkalosis. "The major conclusion of this study is that, under conditions of metabolic alkalosis with compensatory hypercapnia, endothelin mediates the subsequent constriction of the basilar artery due to lowered $p\text{CO}_2$ " ([Yoon, 2000](#); [Weirich, 2004](#)).

- Robert Schleip (personal communication, 2003), mentioned earlier, who is currently involved in a doctoral research into “Active contractility of the human lumbodorsal fascia”, notes that there exists a range of opinion in regard to the SMC found in connective tissue:” “Not all [these] cells are considered as really mature contractile SMC, by some authors. On the other hand SM-like cells in the anterior cruciate ligament have the features of mature SMC, not just myofibroblast-like cells. And of course many of the visceral ligaments are known to contain contractile SMC: e.g. lig. teres uteri, lig. cardinale, periurethral connective tissues.”¹

There are additional, wider, aspects to this area of enquiry:

- Breathing pattern disorders (BPD) are more common in hypermobile individuals (where fascial stability is most needed)—often associated with chronic pain syndromes (Bulbena et al., 1993; Martin-Santos et al., 1998; Chaitow et al., 2002). The question could well be asked: Is the altered breathing pattern functional—a means of increasing tone and stability in lax structures via the effect on contractile SMC in connective tissue?
- Overbreathing is more common in women. A reasonable question therefore is: Is there a connection between BPD, and the resulting respiratory alkalosis (or metabolic alkalosis), and fibromyalgia—a condition that is also more common in women, and where the incidence of hypermobility is also noted to be high? (Acasuso-Diaz et al., 1998; Loeppky et al., 2001).

There seem to be more questions than answers in this synthesis of information

Other questions might include:

- If the documented hyperventilation (hyperventilation syndrome—HVS) tendency noted in hypermobile individuals is indeed functional ...enhancing stability, what is the clinician’s responsibility—towards maintaining stability, or easing the distress of HVS, or both? And if so ‘how’?
- Does the increased contractility of SMC encourage the likelihood of trigger point formation in these relatively ischemic tissues? And are such triggers potentially ‘functional’ and useful, since they represent an energy efficient means of

assisting sustained increased tone in local and target tissues? (Simons et al., 1999)

- What are the effects of overbreathing on ‘normal’ fascial (smooth muscle) tone?
- Does the contractility of SMC have any bearing on cranial concepts of synchronous sacral movement, via a dural link?

Above all...how can we best use the knowledge offered by this burgeoning research into contractile SMC presence, and the influence on these cells of BPD.

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¹Robert Schleip would welcome international collaboration in his research, and can be reached at robert.schleip@t-online.de

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L. Chaitow
*School of Integrated Health, University of
Westminster, 115 Cavendish Street,
London W1M 8JS, UK*
E-mail address: leon@bodymove.demon.co.uk

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