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Fascia Insights

Peer-Reviewed Myofascial Intervention Study on Lumbar Microcirculation

By Lina Amy Hack, Certified Advanced Rolfer®, Andreas Brandl, MS, DO, and Robert Schleip, PhD, Rolfing® Instructor

ABSTRACT *Researchers Andreas Brandl, DO, and Robert Schleip, PhD, Rolfing® Instructor, discuss their 2023 peer-reviewed publication about the increase of microcirculation observed in thoracolumbar fascia after a myofascial release protocol. Study design, measurement tools, and application for manual therapy practitioners are considered.*

Authors' note: This article is a collaboration done over correspondence between Lina Amy Hack, who submitted the questions and context to Andreas Brandl, DO, and Robert Schleip, PhD; they wrote their responses and returned them. Together, the authors edited the piece.

Lina Amy Hack: Congratulations on publishing your myofascial release and microcirculation study in the *Journal of Clinical Medicine* in 2023. The title is "Immediate Effects of Myofascial Release Treatment on Lumbar Microcirculation: A Randomized, Placebo-Controlled Trial." [https://pubmed.ncbi.nlm.nih.gov/36835784/], Rolfers® and structural integration practitioners need to know about this study.

My goal for this article is to discuss your primary finding: manual myofascial compression and shearing treatment significantly increased the microcirculation of blood flow in the thoracolumbar fascia by 31.6% more than in the control group, which did not receive the intervention. The increase in blood flow persisted after one hour and increased to 48.7% more local blood flow.

Let me take a moment to provide the readers with the necessary background and standard safety information about this

study. This study followed standardized protocols concerning ultrasound of the thoracolumbar region. The measurement of microcirculation seems like a new way to collect data. I hope you'll tell us about that as we go along.

The study protocol was prospectively registered with the German Clinical Trials Register (DRKS00028780) on April 8th, 2022. Participant selection and all measurement techniques and therapeutic interventions were described.

Before doing any of the clinical investigations, the research design protocol that the public participants would be subjected to was reviewed and approved by the ethical committee of the Diploma Hochschule, Germany (Nr. 1014/2021). It is essential to mention these critical review steps. There should be an experienced researcher when the public is exposed to experimental conditions; Dr. Robert Schleip in this case, guiding, reviewing, and supporting the researchers. There are standard protocols that should be adhered to. An ethics review board should be involved. This study was carried out in accordance with the Declaration of Helsinki and had the written informed consent from all thirty participants

Colleague to colleague, thank you to the whole team for acquiring the training to manage a study such as this. I want to declare from the mountaintop – *we have peer-reviewed evidence of the benefit of fascial manual therapy work*! Thanks to your efforts and, of course, many other folks as well.

Andreas Brandl: When I worked with my patients, I often observed immediate changes in pelvic obliquity, particularly after myofascial treatment of the thoracolumbar fascia and its surroundings.

Andreas Brandl, can you tell us about yourself, your area of study, clinical work, and research interests in general? What led you to think about conducting the study at your clinic?

Andreas Brandl: Well, I am a German osteopath working to complete my PhD in Sports Science at the University of Hamburg. To answer your question, I need to go back a few years. When I worked with my patients, I often observed immediate changes in pelvic obliquity, particularly after myofascial treatment of the thoracolumbar fascia and its surroundings. Therefore, the idea grew to where I investigated this phenomenon for my master's degree in osteopathy.

I wanted to know if my observation was just my therapeutic imagination, which unfortunately often happens in our profession of manual therapy. We wish something would happen, and in our mind, it does happen. But in fact, it is not happening. In this case, changes in pelvic obliquity weren't my imagination. My colleagues and I have shown that the pelvis can change immediately after treatment, which we found out in a randomized controlled trial with ninety back pain patients.

After that was the first lockdown of the COVID-19 pandemic. The blessing in disguise was that I met Robert. We both worked in the same department at the university. To cut a long story short, with Robert's great support and experienced advice, we published a randomized controlled trial (Brandl, Egner, and Schleip 2021). However, as with any serious research, more questions arose than were answered, so to answer your question, this inquiry had a course we have been following.

AB: [A]s part of my PhD, I have been working with Robert and other dear colleagues on how the thoracolumbar fascia is neuromotorically and biomechanically connected to the body. This includes, for example, its contribution to back pain, athletic performance, stress, exhaustion, and well-being, the last three being my most recent research interests.

Since then, as part of my PhD, I have been working with Robert and other dear colleagues on how the thoracolumbar fascia is neuromotorically and biomechanically connected to

the body. This includes, for example, its contribution to back pain, athletic performance, stress, exhaustion, and well-being, the last three being my most recent research interests. The investigation of microcirculation in the myofascial tissue of the back was, therefore, a logical continuation. We reasoned that the earlier observation that even posture can change immediately after a relatively light touch intervention, that change was likely to be associated with neuromotor and autonomic changes in the nervous system. We think this may then lead to changes in blood flow in the richly innervated fascia.

LAH: This is music to my ears. Dr. Schleip, I see your signature in the study design. The small decisions in this study seem to me to have come from the previous findings that you've published in years past. Altogether, here, you have the topics of fascial stiffness, density, fibrosis, contractility, and so much more. You and your colleagues are answering the questions that Rolfers® have been asking for decades – how can we possibly study structural integration?

This study used two types of direct tissue measurement: blood flow measurements and ultrasound to measure thoracolumbar fascia morphology. Measurements were taken three times: before and immediately after Andreas administered a standardized myofascial therapeutic protocol[1], and then a third measurement was made an hour after the therapy. The participant lay motionless and prone between the second and third set of measurements.

The images of the thoracolumbar fascia morphology were characterized by its layers (see Figure 1) and the thoracolumbar fascia layers were rated as either very disorganized, somewhat disorganized, somewhat organized, or very organized at all measurements. You had two physicians and one osteopath independently assess each ultrasound image with these fascia ratings. The raters were blind as to what images related to which participant, their group allocation, and the timing of the image. The ratings and the blood flow measurements were evaluated for statistical differences between the experimental group (fifteen people) that received the myofascial intervention and the control group (fifteen people) that did not.

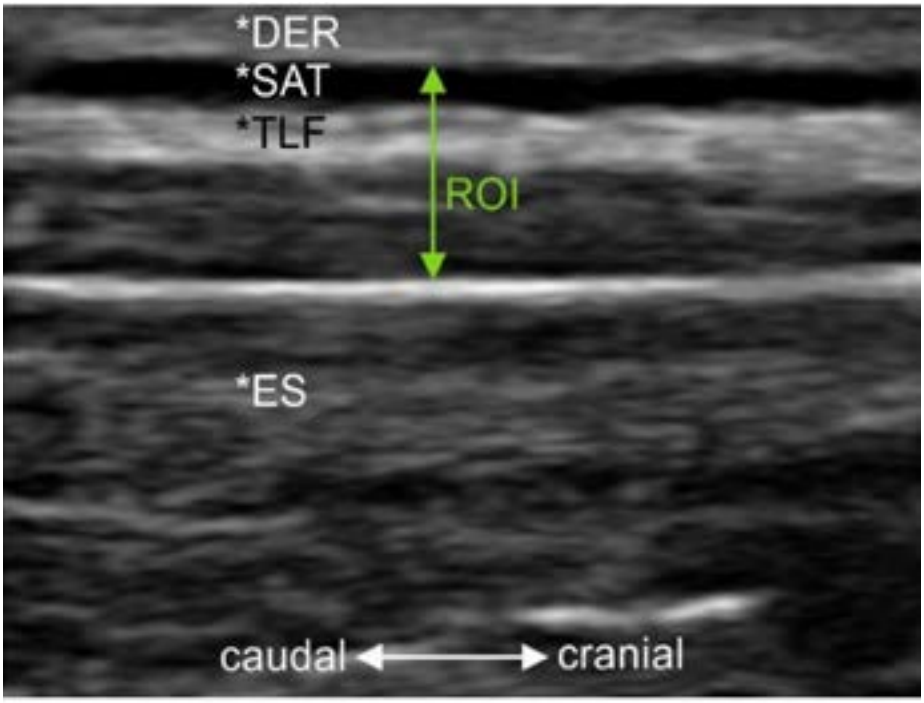

Figure 1: Sample ultrasound image section of thoracolumbar complex: *DER indicates dermis, *SAT indicates subcutaneous adipose tissue, *TLF indicates thoracolumbar fascia, *ES indicates erector spinae muscle, and ROI is the region of interest. [Permission to publish images allowed under Creative Commons Attribution (CC BY) license from Brandl et al. (2023).]

In looking at the fascia in a study like this, with pre- and post-testing compared to a control group, does the design of this study seem like a collection of your previous fascial research, all together in one question?

Robert Schleip: Yes, this study was also, for me, a new and important

Robert Schleip: Like several other researchers in the structural integration field, I was intrigued by the idea of exploring whether a dynamic change in microcirculation could be investigated with the novel O2C assessment technology[2] that has recently become available.

culmination of previous investigations and related insights in the field of fascia research. For example, a Brazilian study showed that the application of a Rolfing-inspired myofascial massage on the thoracolumbar fascia of mice elicited an enhanced expression of anti-inflammatory cytokines like IL-4 and IL-6 (França et al. 2020). And a study with humans in Poland revealed that the application of ten sessions in structural integration was associated with increased superficial blood perfusion (Jędrzejewski et al. 2020). An enhancement of microcirculation is also seen as a positive factor for injury prevention (Wezenbeek et al. 2018).

Like several other researchers in the structural integration field, I was intrigued by the idea of exploring whether a dynamic change in microcirculation could be investigated with the novel O2C assessment technology[2] that has recently become available. Needless to say, I rearranged my schedule to be personally present during the first of these exciting measurements, which my colleague Andreas Brandl was spearheading here in Germany.

LAH: And why choose the thoracolumbar fascia as the body location for the study?

RS: Because the morphological changes in the thoracolumbar fascia associated with chronic low back pain have been previously documented; and also, because our knowledge about the related fascial layers in this part of the human is quite good.

AB: Robert has probably given the best reason for our choice. The thoracolumbar fascia is an extensively studied structure of the fascial system, and the results of research over the last decade have provided some evidence of its contribution to low back pain. Another issue was the technical requirements of the new O2C device. It was primarily developed to avoid tissue necrosis due to reduced capillary blood flow in transplanted tissues, such as after breast reduction. The thoracolumbar fascia was, therefore, ideal to fulfill all criteria for the use of this cutting-edge device.

LAH: The consistency of ratings between the three experts about the fascia morphology was excellent with high intra-rater reliability. This means that the ratings about fascia organization were very similar between these unbiased and blind experts. For me, because they are in agreement, it means fascia quality is a concrete, objectively observable nature of the tissue. Was it satisfying to see that fascia research and evaluation have this level of reliability for its direct measures?

RS: Yes, this aspect is often not so important for laypersons who read science articles in order to improve their practical work. However, for professional scientists this is a very crucial question to look at how reliable a given measurement method is. How much do different investigators agree with each other if they measure the same patient in the same situation independently from each other? We know, for example, in many palpation tests and also ultrasound examinations, the reliability and repeatability of these tests are often less than perfect. But in this investigation and with this measurement technology, it was very good, and that was very satisfying.

AB: Robert mentioned an important point – reliability in the field of manual therapies often does not live up to what some professionals claim. This is a general problem in our field. But if we take a closer look at the reliability studies of our profession, we find serious methodological flaws in a large number of them. Often students measure yes-no agreement without standardized criteria on non-pathological subjects, mostly students as well.

Thanks to Robert's knowledge, we used a method that had previously been scientifically evaluated. De Connick et al. (2018) had thirty physicians, physiotherapists, and radiologists evaluate thirty ultrasound images of the thoracolumbar fascia with different morphological features using a Likert scale[3] and well-defined criteria. They found almost the same agreement as we did.

This highlights the importance of a thorough study design in our field, and as far as I know, Robert is already working on this issue and has put a lot of effort into this important project.

LAH: Yes, reliability is essential to credible findings. Your study's strength lies in these details: excellent reliability of the measures, careful study design, and standardization in its execution. Let's talk about the results: Did the ratings of the fascia morphology change before and after the myofascial intervention?

AB: We separated this project into two study objectives. Our primary aim was to investigate the changes in blood flow due to the intervention. The second aim was to find suspected correlations between fascia morphology and blood flow, as we assumed that morphology cannot change in such a short period of time.

In January, however, we carried out a time series analysis of the deformability of the thoracolumbar fascia and collaborated with the Laboratory of Psychoneuroimmunology at Innsbruck University Hospital. We were stunned when we looked at the data. Our initial analysis shows that what we call morphology can probably actually change within days and is also related to the activity of the autonomic nervous system. So, we think that what we see on the ultrasound images are changes due to the different hydration status in the fascial tissue. Perhaps, it therefore makes a lot of sense in a future study to also look for direct changes in morphology rating values.

LAH: Wow, that is so meaningful for manual therapy practitioners. What led you to focus on measuring microcirculation as a construct to quantify the state of the fascia?

RS: Microcirculation is, of course, only one aspect of fascial health. But it seems to be a very important one, and an aspect that is more related to the liquid properties of fascia, and how well fascia is connected with the autonomic nervous system. We know that the sympathetic free nerve endings in fascia constitute the largest innervation type within fascia, and we know that most of these nerve endings are related to regulating microcirculation. Myofascial pain pathologies are often associated with a stagnation within that liquid flow (Tuckey et al. 2021). If you put that together with the finding of an improved injury prevention with increased microcirculation (see above), then this feature of how much blood flow you have within the tiny capillaries of the fascia tissues becomes a very fascinating one.

LAH: Yes! I encourage people to look up this article and read it for themselves. [https://pubmed.ncbi.nlm.nih.gov/36835784/] I find the steps it took to ask and answer these questions quite thought-provoking. If readers do look it up, then they can read about the ANOVA analyses and all the statistical analyses that were done to arrive at these results. Let's look at the graphs that demonstrate the data you collected (see Figure 2).

You chose to represent the three recording times as t_0, the baseline

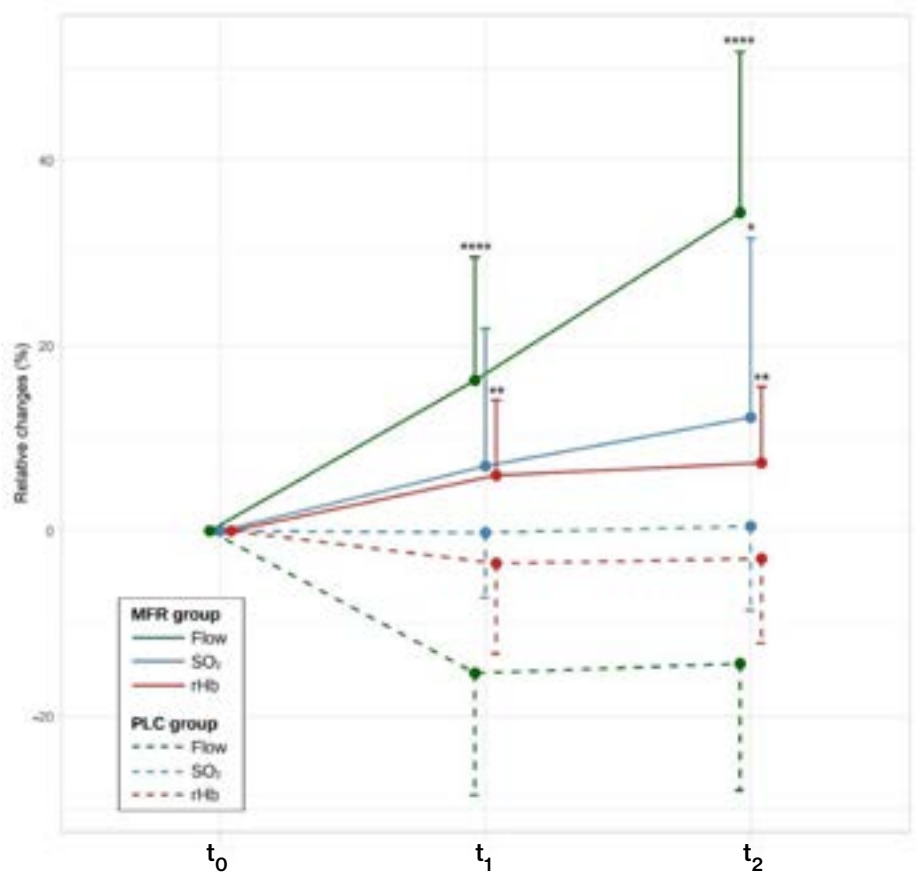

Figure 2: Shows relative changes in percent compared to each participant's baseline measurement. The error bars are only shown on one side for better readability; they represent one standard deviation. The x-axis is the baseline measurement (t_0), measurement after treatment (t_1), and measurement after forty minutes (t_2). Oxygen saturation is indicated by 'SO_2', blood flow by 'Flow', and relative hemoglobin by 'rHb'. Permission to publish images is allowed under a Creative Commons Attribution (CC BY) license.

measurement before the intervention, t_1 as the measurement directly after the treatment, and t_2, taken forty minutes after the treatment. You calibrated the microcirculation measurement for each participant at t_0, essentially calling that point of everyone's measure zero. And then each individual's blood flow would either decrease by a measurable proportion, stay the same, or increase by a measurable proportion.

The control group microcirculatory blood flow (indicated by flow, SO_2, and rHb measurements) went down at t_1 and t_2 was about the same as t_1 – why did you expect this result in the control group?

AB: Well, we used a very similar setting to the intervention in the control group. We placed the hands in exactly the same position as in the myofascial treatment group, but only touched them lightly. This was an important step in the study design to avoid psychological or other biases. Otherwise, it could be assumed that human affection or other effects could distort the study results. Therefore, in randomized control trial experiments, it is important the people in the control group experience the same conditions as the experimental group, the only difference the participants experience should be either the myofascial treatment or the placebo protocol.

The results suggest that blood flow in the control group was more likely to be affected by the prolonged resting state of the participants' bodies, where a lower microcirculation is expected due to a decrease in heart rate-time volume. Normally, the pulse rate decreases after a few minutes of rest, so microcirculation in the body will also decrease. For our participants in the control group, after light touch was administered, it was expected participants would have a decreased heart rate and corresponding microcirculation in the thoracolumbar fascia.

LAH: Participants were randomly assigned to the treatment group that received the myofascial intervention or the control group with the placebo condition. The myofascial intervention participants had their thoracolumbar treated with pressure, traction, and stretching.[1] While the control group received surface skin contact at the same locations for the same time, no pressure and no shearing.

The microcirculation blood flow increased by 31.6% at t_1 and 48.7% at t_2, an hour after the treatment for the myofascial manipulation group. What mechanism in the tissue do you propose linked compression and shearing in the fascia to changes in the microcirculation? And what does the change in SO_2 and rHb, as seen in Figure 2, indicate?

AB: Both groups received stimulation of the skin receptors by touch, but the myofascial intervention also reached deeper structures such as free nerve endings. In some of them, mechanosensitive axonal widenings that store neuropeptides and neurophines were found in the vicinity of the capillary vessels (Mense 2019). Our fascia techniques are able to mechanically induce the release of these contents. They are known for their vasodilatory function. Another effect could be the morphology of the thoracolumbar fascia itself. The penetrated blood vessels could be restricted by the fascial deformation, which was probably counteracted by the intervention.

The blood flow in terms of the O2C measurement describes the total quantity of erythrocytes in the capillary area of the device sensor. It can be determined by the Doppler effect of a laser. If a different wavelength of light is used, hemoglobin characteristics such as SO_2 and rHb can be detected. SO_2 represents the total oxygen content, while rHb indicates the relative proportion of hemoglobin. By looking at these parameters differently, various microcirculatory disorders (e.g. venous congestion, ischemia, and inflammation) that are important in transplantation medicine can be detected.

The increase in all parameters after myofascial release treatment in our study indicates an improvement in the overall microcirculation in the fasciae.

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LAH: One of the participants from the treatment group suffered from an unexpected flare of non-specific low back pain, registering a pain score of ten out of ten; I believe they showed up for their first treatment with this back pain. So, you imaged their thoracolumbar fascia that day according to the plan and adhesions were visible (see Figure 3). The participant agreed to move forward with the experiment, and ten days after the myofascial release treatment, the previously observed adhesions had disappeared, and the pain had subsided completely. Tell us about that. What did that teach you as a clinician and a researcher?

AB: As I mentioned earlier, we had not expected any immediate changes in the morphology of the dorsal fascia. Therefore, the surprise was great. On the other hand, it is very satisfying to see that our manual work on the tissue can lead to such results. I assume that what we see in the ultrasound as isolated adhesions can be favored by fluidal and hyaluronal changes.

As a researcher, I am trained to think that a single case does not provide evidence. As a clinician, I think it does. P-values and sample sizes are not always everything in science. Our treatment addresses a complex dynamic system, the human being, and some of the intertwined parameters we measure cannot be represented in a randomized control trial. However, I don't see any animosity between the scientist and the clinician in me. We need to put more effort into developing scientific approaches that can better represent people in highly

RS: [T]his study shows us again how our hands can significantly enhance the flow of the blood through the smallest capillaries, many of which are smaller than one can see with the naked eye. I think it is fascinating that we only know and understand a small fraction of what is happening, not only in the universe outside of our galaxy, but also directly under our hands while we are interacting with them with fascia.

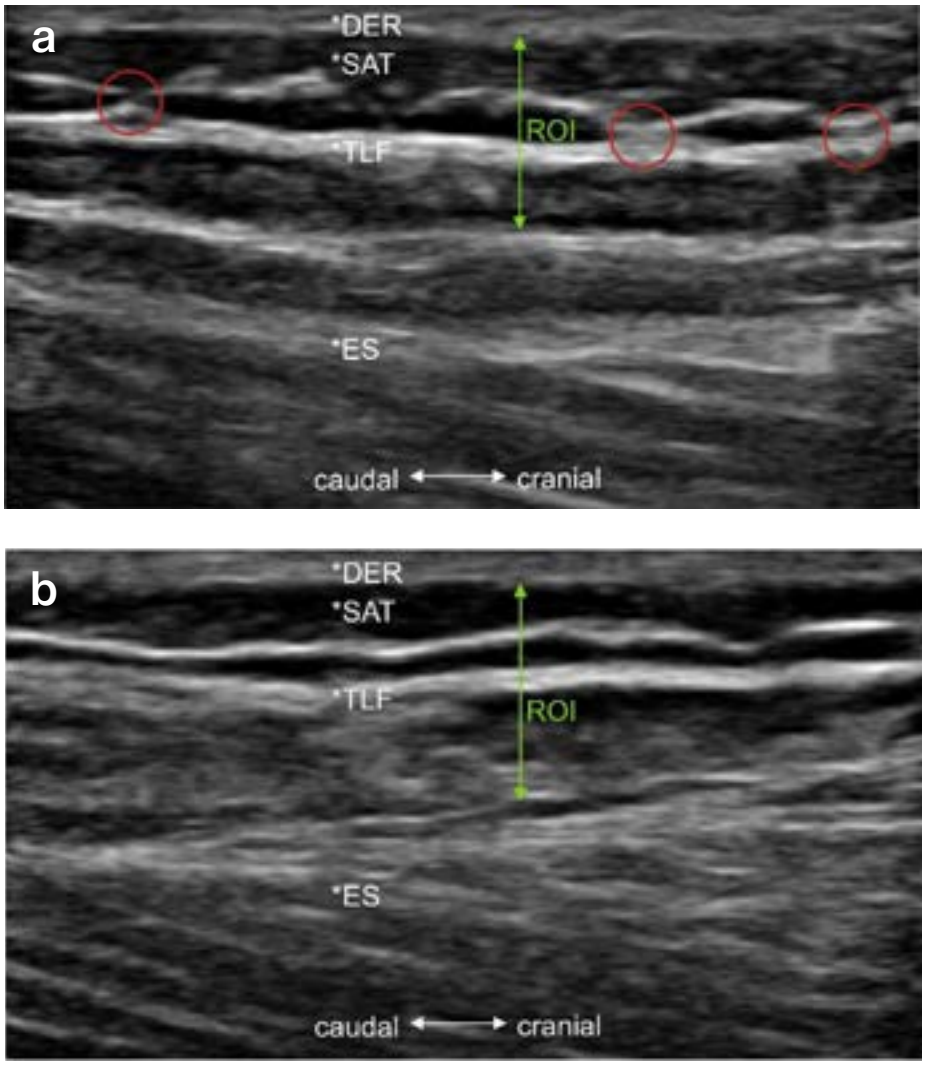

Figure 3: Thoracolumbar fascia of a participant from the myofascial treatment group with acute lumbar back pain. (a) Ultrasound before administering the myofascial release protocol. The circles show the adhesions between the fascial layers. Morphology rating was "somewhat disorganized" (Brandl et al. 2023, 12). (b) Ten days after the myofascial release treatment, the adhesions disappeared and the pain subsided completely. The fascia was rated as "very organized" (Brandl et al. 2023, 12). [*DER indicates dermis, *SAT indicates subcutaneous adipose tissue, *TLF indicates thoracolumbar fascia, *ES indicates erector spinae muscle, and ROI is the region of interest.] Permission to publish images allowed under Creative Commons Attribution (CC BY) license.

complex, sometimes even chaotic, real-world conditions. In science, there is a nice term for this: ecological validity (Seizer et al. 2023).

LAH: Poor blood flow is a remarkable aspect of disorganized tissue. What do you think happens in myofascial tissue if blood flow is poor over long periods?

AB: In line with what Robert has already said, I can add that *the rule of the artery is supreme*, attributed to Andrew Taylor Still [Founder of Osteopathy, (1828-1917)]. Yes, from what we have found out, it really is. Also, the autonomic nervous system and immune system are a part of this tissue. Long-term studies on the myofascial system would be very interesting. Until that happens, we can assume hypoxia-induced, low-grade inflammation, restrictions, and increased friction of the tissue may be happening. There could be increased friction of the tissue, mechanically altered immune-active substances such as TGF-ß, a lack of biomechanical support, and thus overuse of the musculoskeletal system. And much more that we probably haven't considered yet.

RS: This aspect reminds me of the famous expression by Dean Juhan in his pioneering book, *Job's Body* (1987) – *stagnancy breeds pestilence*. While this may be an over-description, it makes good sense to see the stagnation of the fluids within fascia, whether it is the blood in the tiny capillaries, the lymph, or the water in the ground substance, as a driving factor for fascial health.

LAH: Is it possible to do a double-blind study of manual therapy interventions on myofascial tissue? Is it necessary to go that far?

RS: Yes, this has already been attempted by several groups. And our group is currently working together with several other researchers to develop some recommendations on how to best conduct such studies, as it is not easy to control for the important contextual factors in such treatments.

LAH: Great news that they are under development. Any final thoughts you'd like to let our readership know about this research project?

AB: I was really thrilled to see with some degree of evidence how effective myofascial interventions can be. My personal journey through the world of fascial tissue has taken me from

postural changes and other aspects to microcirculation and will hopefully take me beyond. It's like a journey in real life. At first, the big things catch our eye, but if we stay longer, with a kind of respect and some love for the place we visit, we discover more and more details that make the place unique and absolutely worth seeing.

RS: I would conclude that this significant study again reconfirms how much is happening in the fascial tissue during a treatment, that we have no idea of. In the previous examination, we had focused on biomechanical tissue changes, or on neurological-sensory aspects. But now, this study shows us again how our hands can significantly enhance the flow of the blood through the smallest capillaries, many of which are smaller than one can see with the naked eye. I think it is fascinating that we only know and understand a small fraction of what is happening, not only in the universe outside of our galaxy, but also directly under our hands while we are interacting with them with fascia.

Endnotes

1. The standardized myofascial release intervention was described in Brandl et al. (2023) as: "(1) Sustained manual pressure to the lateral raphe (Figure 4a), performed with the therapist's fingertips 1 to 4 [side-lying]. (2) Lateral stretching of the thoracolumbar fascia (Figure 4b) [prone], performed with the therapist's hands. (3) Longitudinal glide along the lumbar paravertebral muscles (Figure 4c), performed with the therapist's open fist [prone]. (4) Longitudinal stretch of the TLF (Figure 4d), performed with the therapist's hands [prone]. (5) Unilateral longitudinal stretch of the TLF (Figure 4e), performed with the therapist's hands [prone]" (Brandl et al. 2023, 5-6).
2. O2C assessment technology is a noninvasive measurement tool that quantifies tissue oxygenation using a combination of laser Doppler spectroscopy and tissue spectrometry (Beckert et al. 2004). Also called lightguide tissue spectrophotometry (O2C), it is used by many disciplines to evaluate tissue oxygen supply, specifically tissue oxygenation and microvascular blood flow.
3. The Likert-type scale used by De Coninck et al. (2018) ranked 1 = very disorganized to 10 = very organized. They reported that "medical practitioners agree on morphological features such as levels of organisation and disorganisation in ultrasound images of thoracolumbar fascia, regardless of experience. Further analysis by an expert panel is required to develop specific classification criteria for thoracolumbar fascia" (180).

Andreas Brandl, MS, works as an osteopath in his own practice in Germany. He is a research associate at the Vienna School of Osteopathy and the TUM School of Medicine and Health at the Technical University of Munich. As a member of the Fascia Research Group, he is doing his doctorate in sports science at the University of Hamburg on the subject of myofascial research.

Robert Schleip, PhD is an International Rolfing Instructor and International Fascial Anatomy Teacher. He has been an enthusiastic Certified Rolfer since 1978. In addition to his private practice and teaching, he directs the Fascia Research Project at the Technical University of Munich (TUM) University, which is at the forefront of international fascia research.

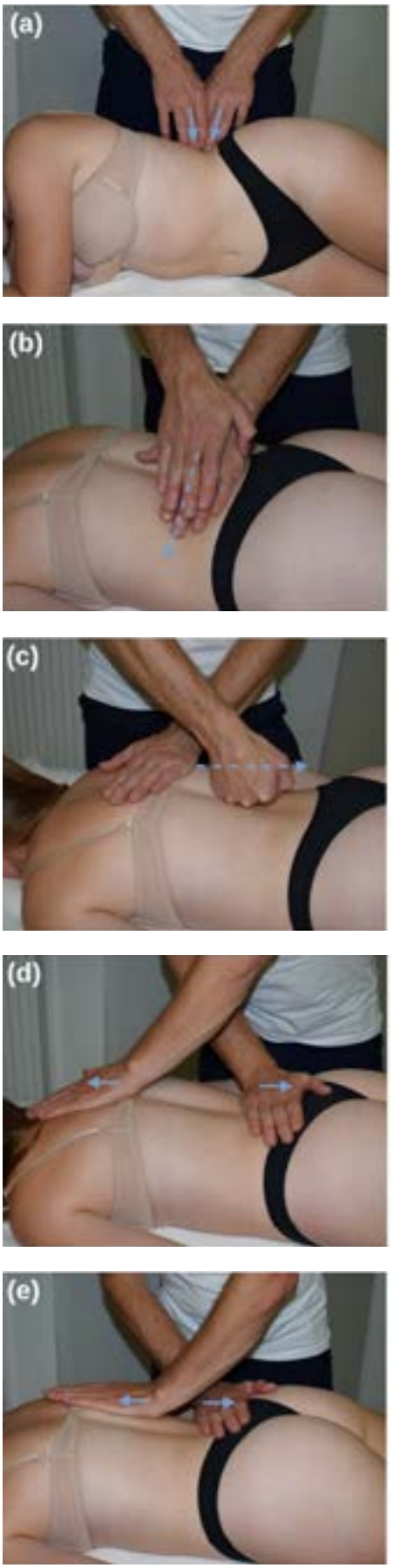

Figure 4: Images of the myofascial release treatment at the thoracolumbar fascia: (a) sustained manual pressure to lateral thoracolumbar fascia; (b) lateral stretching of thoracolumbar fascia; (c) longitudinal glide along the lumbar paravertebral muscles; (d) longitudinal stretch of the thoracolumbar fascia; and (e) unilateral longitudinal stretch of the thoracolumbar fascia. The direction of tissue stretch is indicated with arrows. For the control group, the practitioner administered a placebo treatment where their hands contacted the same body locations for the same time with minimal pressure. [Permission to publish images allowed under Creative Commons Attribution (CC BY) license from Brandl et al. (2023).]

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Keywords

fascia; fascia research; ultrasound; microcirculation; thoracolumbar fascia; myofascial release; study design; measurement; manual therapy; low back pain. ■