ID NUMBER 1

Morphologie. 2007 Mar;91(292):38-43.

Anatomy of the deep fascia of the upper limb. Second part: study of innervation.

Stecco C[1], Gagey O, Belloni A, Pozzuoli A, Porzionato A, Macchi V, Aldegheri R, De Caro R, Delmas V.

Author information

Abstract

Analysis of specimens taken from different areas of the deep fascia in 20 upper limbs was made in order to establish which kind of nerve fibres and endings are present in the deep muscular fascia. The flexor retinaculum and the lacertus fibrosus were also evaluated because they are anatomically hardly separable from the deep muscularfascia, although they have different functions. In particular, specimens were taken at the level of: (a) the expansion of pectoralis major onto the bicipital fascia, (b) the middle third of the brachial fascia, (c) the lacertus fibrosus, (d) the middle third of the antebrachial fascia, (e) the flexor retinaculum. This study demonstrated an abundant innervation of the fascia consisting in both free nerve endings and encapsulated receptors, in particular, Ruffini and Pacini corpuscles. However, differences in innervation were verified: the flexor retinaculum was resulted the more innervated element whilst lacertus fibrosus and the pectoralis major expansion the less innervated. These results suggest that the retinaculum has more a perceptive function whereas the tendinous expansions onto the fascia have mostly a mechanical role in the transmission of tension. The hypothesis that the fascia plays an important role in proprioception, especially dynamic proprioception, is therefore advanced. In fact, the fascia is a membrane that extends throughout the whole body and numerous muscular expansions maintain it in a basal tension. During a muscular contraction these expansions could also transmit the effect of the stretch to a specific area of the fascia, stimulating the proprioceptors in that area.

PMID:17574469 [PubMed - indexed for MEDLINE]

ID NUMBER 2

J Bodyw Mov Ther. 2009 Jan;13(1):53-62. doi: 10.1016/j.jbmt.2007.04.009. Epub 2007 Jun 28.

Anatomical study of myofascial continuity in the anterior region of the upper limb.

Stecco A[1], Macchi V, Stecco C, Porzionato A, Ann Day J, Delmas V, De Caro R.

Author information

Abstract

Fifteen unembalmed cadavers were dissected in order to study the "anatomical continuity" between the various muscles involved in the movement of flexion of the upper limb. This study demonstrated the existence of specificmyofascial expansions, with a nearly constant pattern, which originate from the flexor muscles and extend to the overlying fascia. The clavicular part of the pectoralis major sends a myofascial expansion, with a mean length of 3.6cm, to the anterior region of the brachial fascia, and the costal part sends one to the medial region of the brachial fascia (mean length: 6.8cm). The biceps brachii presents two expansions: the lacertus fibrosus, oriented medially, with a mean height of 4.7cm and a base of 1.9cm, and a second, less evident, longitudinal expansion (mean length: 4.5cm, mean width: 0.7cm). Lastly, the palmaris longus sends an expansion to the fascia overlying the thenar muscles (mean length: 1.6cm, mean width: 0.5cm). During flexion, as these muscles contract, the anterior portion of the brachial and antebrachial fascia is subject to tension. As the fascia is rich in proprioceptive nerve endings, it is hypothesized that this tension activates a specific pattern of receptors, contributing to perception of motor direction. If the muscular fascia is in a non-physiological state, these mechanisms are altered, and the proprioceptors in the fascia may be incorrectly activated, thus giving rise to many types of extra-articular pain.

PMID:19118793 [PubMed - indexed for MEDLINE]

ID NUMBER 3

J Bodyw Mov Ther. 2009 Jan;13(1):73-80. doi: 10.1016/j.jbmt.2008.06.002. Epub 2008 Jul 26.

Treating patellar tendinopathy with Fascial Manipulation.

Pedrelli A[1], Stecco C, Day JA.

Author information

Abstract

According to Fascial Manipulation theory, patellar tendon pain is often due to uncoordinated quadriceps contraction caused by anomalous fascial tension in the thigh. Therefore, the focus of treatment is not the patellar tendon itself, but involves localizing the cause of this incoordination, considered to be within the muscular fascia of the thigh region. Eighteen patients suffering from patellar tendon pain were treated with the Fascial Manipulation technique. Pain was assessed (in VAS) before (VAS 67.8/100) and after (VAS 26.5/100) treatment, plus a follow-up evaluation at 1 month (VAS 17.2/100). Results showed a substantial decrease in pain immediately after treatment ($p<0.0001$) and remained unchanged or improved in the short term. The results show that the patellar tendon may be only the zone of perceived pain and that interesting results can be obtained by treating the muscular fascia of the quadriceps muscle, whose alteration may cause motor incoordination and subsequent pathology.

PMID:19118795 [PubMed - indexed for MEDLINE]

ID NUMBER 4

J Bodyw Mov Ther. 2010 Oct;14(4):318-25. doi: 10.1016/j.jbmt.2010.04.006. Epub 2010 May 20.

How much time is required to modify a fascial fibrosis?

Ercole B[1], Antonio S, Julie Ann D, Stecco C. (Borgini E, Stecco A, Day JA, Stecco C)

Author information

Abstract

SUMMARY:

The perception of what appears to be connective tissue fibrosis, and its consequent modification during therapy, is a daily experience for most manual therapists. The aim of this study was to evaluate the time required tomodify a palpatory sensation of fibrosis of the fascia in correlation with changes in levels of patient discomfort in 40 subjects with low back pain utilizing the Fascial Manipulation technique. This study evidenced, for the first time, that the time required to modify an apparent fascial density differs in accordance with differences in characteristics of the subjects and of the symptoms. In particular, the mean time to halve the pain was 3.24 min; however, in those subjects with symptoms present from less than 3 months (sub-acute) the mean time was lesser (2.58 min) with respect to the chronic patients (3.29 min). Statistically relevant ($p < 0.05$) differences were also evidenced between the specific points treated.

PMID:20850038 [PubMed - indexed for MEDLINE]

ID NUMBER 5

Cells Tissues Organs. 2010;191(1):47-56. doi: 10.1159/000226276. Epub 2009 Jun 24.

Histotopographic study of the fibroadipose connective cheek system.

Macchi V[1], Tiengo C, Porzionato A, Stecco C, Vigato E, Parenti A, Azzena B, Weiglein A, Mazzoleni F, De Caro R.

Author information

Abstract

The purpose of this study was to investigate the morphology of the superficial musculoaponeurotic system (SMAS). Eight embalmed cadavers were analyzed: one side of the face was macroscopically dissected; on the other side, full-thickness samples of the parotid, zygomatic, nasolabial fold and buccal regions were taken. In all specimens, a laminar connective tissue layer (SMAS) bounding two different fibroadipose connective layers was identified. The superficial fibroadipose layer presented vertically oriented fibrous septa, connecting the dermis with the superficial aspect of the SMAS. In the deep fibroadipose connective layer, the fibrous septa were obliquely oriented, connecting the deep aspect of the SMAS to the parotid-masseteric fascia. This basic arrangement shows progressive thinning of the SMAS from the preauricular district to the nasolabial fold ($p < 0.05$). In the parotid region, the mean thicknesses of the superficial and deep fibroadipose connective tissues were 1.63 and 0.8 mm, respectively, whereas in the region of the nasolabial fold the superficial layer is not recognizable and the mean thickness of the deep fibroadipose connective layer was 2.9 mm. The connective subcutaneous tissue of the face forms a three-dimensional network connecting the SMAS to the dermis and deep muscles. These connective laminae connect adipose lobules of various sizes within the superficial and deep fibroadipose tissues, creating a three-dimensional network which modulates transmission of muscle contractions to the skin. Changes in the quantitative and qualitative characteristics of the fibroadipose connective system, reducing its viscoelastic properties, may contribute to ptosis of facial soft tissues during aging.

PMID:19556742 [PubMed - indexed for MEDLINE]

ID NUMBER 6

Surg Radiol Anat. 2011 Dec;33(10):881-90. doi: 10.1007/s00276-011-0784-z. Epub 2011 Feb 9.

RMI study and clinical correlations of ankle retinacula damage and outcomes of anklesprain.

Stecco A[1], Stecco C, Macchi V, Porzionato A, Ferraro C, Masiero S, De Caro R.

Author information

Abstract

Recent studies reveal the role of the ankle retinacula in proprioception and functional stability of the ankle, but there is no clear evidence of their role in the outcomes of ankle sprain. 25 patients with outcomes of ankle sprain were evaluated by MRI to analyze possible damage to the ankle retinacula. Patients with damage were subdivided into two groups: group A comprised cases with ankle retinacula damage only, and group B those also with anterior talofibular ligament rupture or bone marrow edema. Both groups were examined by VAS, CRTA and static posturography and underwent three treatments of deep connective tissue massage (Fascial Manipulation technique). All evaluations were repeated after the end of treatment and at 1, 3 and 6 months. At MRI, alteration of at least one of the ankle retinacula was evident in 21 subjects, and a further lesion was also identified in 7 subjects. After treatment, VAS and CRTA evaluations showed a statistically significant decrease in values with respect to those before treatment ($p < 0.0001$). There were also significant improvements ($p < 0.05$) in stabilometric platform results. No significant difference was found between groups A and B. The initial benefit was generally maintained at follow-up. The alteration of retinacula at MRI clearly corresponds to the proprioceptive damage revealed by static posturography and clinical examination. Treatment focused on the retinacula may improve clinical outcomes and stabilometric data.

PMID: 21305286 [PubMed - indexed for MEDLINE]

ID NUMBER 7 – Fascia anatomy Surg Radiol Anat Editorial 2011 DOI 10.1007/ s00276-011-0899-2

ID NUMBER 8

Surg Radiol Anat. 2011 Dec;33(10):835-42. doi: 10.1007/s00276-010-0772-8. Epub 2011 Jan 7.

Layers of the abdominal wall: anatomical investigation of subcutaneous tissue andsuperficial fascia.

Lancerotto L[1], Stecco C, Macchi V, Porzionato A, Stecco A, De Caro R.

Author information

Abstract

INTRODUCTION:

In recent times new surgical approaches have been developed, in which subcutaneous tissue is the primary object, such as flaps and fat removal techniques, but different descriptions and abundance of terminology persist in Literature about this tissue.

AIM AND METHODS:

In order to investigate the structure of abdominal subcutaneous tissue, macroscopic and microscopic analyses of its layers were performed in 10 fresh cadavers. Results were compared with in vivo CT images of the abdomen of 10 subjects.

RESULTS:

The subcutaneous tissue of the abdomen comprises three layers: a superficial adipose layer (SAT), a membranous layer, and a deep adipose layer (DAT). The SAT presented fibrous septa that defined polygonal-oval lobes of fat cells with a mean circularity factor of 0.856 ± 0.113. The membranous layer is a continuous fibrous membrane rich in elastic fibers with a mean thickness of 847.4 ± 295 μm. In the DAT the fibrous septa were predominantly obliquely-horizontally oriented, defining large, flat, polygonal lobes of fat cells (circularity factor: mean 0.473 ± 0.07). The CT scans confirm these findings, showing a variation of the thickness of the SAT, DAT and membranous layer according with the subjects and with the regions.

DISCUSSION:

The distinction of SAT and DAT and their anatomic differences are key elements in modern approaches to liposuction. The membranous layer appears to be also a dissection plane which merits further attention. According with the revision of Literature, the Authors propose that the term "superficial fascia" should only be used as a synonym for the membranous layer.

PMID:21212951 [PubMed - indexed for MEDLINE]

ID NUMBER 9

Surg Radiol Anat. 2011 Dec;33(10):891-6. doi: 10.1007/s00276-011-0876-9. Epub 2011 Oct 2.

Hyaluronan within fascia in the etiology of myofascial pain.

Stecco C[1], Stern R, Porzionato A, Macchi V, Masiero S, Stecco A, De Caro R.

Author information

Abstract

The layers of loose connective tissue within deep fasciae were studied with particular emphasis on the histochemical distribution of hyaluronan (HA). Samples of deep fascia together with the underlying muscles were taken from neck, abdomen and thigh from three fresh non-embalmed cadavers. Samples were stained with hematoxylin-eosin, Azan-Mallory, Alcian blue and a biotinylated HA-binding protein specific for HA. An ultrasound study was also performed on 22 voluntary subjects to analyze the thickness of these deep fasciae and their sublayers. The deep fasciapresented a layer of HA between fascia and the muscle and within the loose connective tissue that divided different fibrous sublayers of the deep fascia. A layer of fibroblast-like cells that stained prominently with Alcian blue stain was observed. It was postulated that these are cells specialized for the biosynthesis of the HA-rich matrix. These cells we have termed "fasciacytes", and may represent a new class of cells not previously recognized. The ultrasound study highlighted a mean thickness of 1.88 mm of the fascia lata, 1.68 mm of the rectus sheath, and 1.73 mm of the sternocleidomastoid fascia. The HA within the deep fascia facilitates the free sliding of two adjacent fibrous fascial layers, thus promoting the normal function associated with the deep fascia. If the HA assumes a more packed conformation, or more generally, if the loose connective tissue inside the fascia alters its density, the behavior of the entire deep fascia and the underlying muscle would be compromised. This, we predict, may be the basis of the common phenomenon known as "myofascial pain."

PMID: 21964857 [PubMed - indexed for MEDLINE]

ID NUMBER 10

Cranio. 2012 Apr;30(2):95-102.

Myofascial pain of the jaw muscles: comparison of short-term effectiveness of botulinumtoxin injections and fascial ma nipulation technique.

Guarda-Nardini L[1], Stecco A, Stecco C, Masiero S, Manfredini D.

Author information

Abstract

A randomized controlled trial was performed to compare the short-term effectiveness of botulinum toxin injections and physiatric treatment provided by means of Fascial Manipulation techniques in the management of myofascial pain of jaw muscles. Thirty patients with a Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) diagnosis of myofascial pain were randomized to receive either single-session botulinum toxin injections(Group A) or multiple-session Fascial Manipulation (Group B). Maximum pain levels (VAS ratings) and jaw range of motion in millimeters (maximum mouth opening, protrusion, right and left laterotrusion) were assessed at baseline, at the end of treatment, and at a three-month follow-up. Both treatment protocols provided significant improvement over time for pain symptoms. The two treatments seem to be almost equally effective, Fascial Manipulation being slightly superior to reduce subjective pain perception, and botulinum toxin injections being slightly superior to increase jaw range of motion. Differences between the two treatment protocols as to changes in the outcome parameters at the three-months follow-up were not relevant clinically. Findings from the present investigation are in line with literature data supporting the effectiveness of a wide spectrum of conservative treatment approaches to myofascial pain of the jaw muscles. Future studies on larger samples over a longer follow-up span are needed on the way to identify tailored treatment strategies.

PMID: 22606852 [PubMed - indexed for MEDLINE]

ID NUMBER 11

J Hand Surg Am. 2010 May;35(5):746-53. doi: 10.1016/j.jhsa.2010.01.031. Epub 2010 Mar 25.

Comparison of transverse carpal ligament and flexor retinaculum terminology for thewrist.

Stecco C[1], Macchi V, Lancerotto L, Tiengo C, Porzionato A, De Caro R.

Author information

Abstract

PURPOSE:

To investigate the macroscopic anatomy and histological characteristics of the transverse carpalligament and the flexor retinaculum of the wrist and to investigate their anatomical relationships and define appropriate terminology.

METHODS:

The volar regions of the wrists of 30 unembalmed subjects were examined by dissection and by histological and immunohistochemical staining. In vivo magnetic resonance imaging studies were also carried out on 10 subjects.

RESULTS:

The dissection study showed that the antebrachial fascia at the volar aspect of the wrist presents a reinforcement. From a histological point of view, it is composed of 3 layers of undulated collagen fiber bundles. Adjacent layers show different orientations of the collagen fibers. Many nerve fibers and Pacini and Ruffini corpuscles were found in all specimens. Under this fibrous plane is another fibrous structure, placed transversely between the ulnar-sided hamate and pisiform bones, and the radial-sided scaphoid and trapezium bones. The deeper fibrous structure shows completely different histological characteristics, having parallel, thicker collagen fiber bundles and few nerve fibers. Magnetic resonance images confirm the presence of 2 clearly distinguished fibrous structures in the wrist, the first in continuity with the antebrachial fascia and the second located in a deeper plane between the hamate and scaphoid.

CONCLUSIONS:

Two different fibrous structures with different histological characteristics are present in the volarwrist: the more superficial one is in continuity with the antebrachial fascia and could be considered its reinforcement; the deeper one is composed of strong lamina, with histological features similar to those of a ligament. For these reasons, we suggest that the term transverse carpal ligament should be used to indicate the fibrous lamina connecting the hamate and pisiform to the scaphoid and trapezium and that the term flexor retinaculum of the wristshould be abandoned because it does not correspond to any specific, autonomous structure.

PMID: 20346594 [PubMed - indexed for MEDLINE]

ID NUMBER 12

Surg Radiol Anat. 2009 Aug;31(7):523-9. doi: 10.1007/s00276-009-0474-2. Epub 2009 Feb 26.

Mechanics of crural fascia: from anatomy to constitutive modelling.

Stecco C[1], Pavan PG, Porzionato A, Macchi V, Lancerotto L, Carniel EL, Natali AN, De Caro R.

Author information

Abstract

Ten dissections of inferior limbs and histological studies were performed to describe the structural conformation of the muscular fascia of the leg (crural fascia) and to propose a constitutive model to be adopted for the analysis of its biomechanical behaviour. The crural fascia had a mean thickness of 924 microm and was composed of three layers (mean thickness 277.6 microm) of parallel, collagen fibre bundles separated by a thin layer of loose connective tissue (mean thickness 43 microm). Only a few elastic fibres were highlighted. The disposition of the collagen fibres gives the crural fascia anisotropic characteristics. In addition, their crimped conformation is the cause of the non-linear elastic behaviour of the tissue. Both these aspects are included in the constitutive model. The constitutivemodelling of the crural fascia represents a useful tool to rationally interpret the correlation between functional behaviour and structural conformation.

Comment in

- Kumka's response to Stecco's fascial nomenclature editorial. [J Bodyw Mov Ther. 2014]
- Natale et. al.'s response to Stecco's fascial nomenclature editorial. [J Bodyw Mov Ther. 2014]

PMID: 19242635 [PubMed - indexed for MEDLINE]

ID NUMBER 13

Surg Radiol Anat. 2013 Jul;35(5):369-76. doi: 10.1007/s00276-012-1058-0. Epub 2012 Dec 25.

Fascia redefined: anatomical features and technical relevance i n fascial flap surgery.

Stecco C[1], Tiengo C, Stecco A, Porzionato A, Macchi V, Stern R, De Caro R.

Author information

Abstract

Fascia has traditionally been thought of as a passive structure that envelops muscles, and the term "fascia" was misused and confusing. However, it is now evident that fascia is a dynamic tissue with complex vasculature and innervation. A definition of fascia as an integral tissue has been provided here, highlighting the main features of the superficial and deep fasciae. Wide anatomic variations and site-specific differences in fascial structure are described, coupled with results of our extensive investigations of fascial anatomy. This will enable surgeons to make better decisions on selecting the appropriate fascia in the construction of fascial flaps. The use of the superficial or deep fasciae in the creation of a fascial flap cannot be selected at random, but must be guided by the anatomicalfeatures of the different types of fasciae. In particular, we suggest the use of the superficial fascia, such as the parascapular fascio-cutaneous free flap or any cutaneous flap, when a well-vascularized elastic flap, with the capacity to adhere to underlying tissues, is required, and a fascio-cutaneous flap formed by aponeurotic fascia to resurface any tendon or joints exposures. Moreover, the aponeurotic fascia, such as the fascia lata, can be used as a surgical patch if the plastic surgeon requires strong resistance to stress and/or the capacity to glide freely. Finally, the epimysial fascia, such as in the latissimus dorsi flap, can be used with success when used together with the underlying muscles. Clearly, extensive clinical experience and judgment are necessary for assessment of their potential use.

PMID: 23266871 [PubMed - indexed for MEDLINE]

ID NUMBER 14

J Bodyw Mov Ther. 2012 Jan;16(1):67-75. doi: 10.1016/j.jbmt.2011.09.004.

Fascia research--a narrative review.

Findley T[1], Chaudhry H, Stecco A, Roman M.
Author information

Erratum in

- J Bodyw Mov Ther. 2012 Apr;16(2):270.

Abstract

This article reviews fascia research from our laboratory and puts this in the context of recent progress in fasciaresearch which has greatly expanded during the past seven or eight years. Some readers may not be familiar with the terminology used in fascia research articles and are referred to LeMoon (2008) for a glossary of terms used infascia-related articles.

PMID: 22196430 [PubMed - indexed for MEDLINE]

ID NUMBER 15

J Bodyw Mov Ther. 2012 Jul;16(3):372-80. doi: 10.1016/j.jbmt.2012.01.003. Epub 2012 Feb 1.

From clinical experience to a model for the human fascial system.

Day JA[1], Copetti L, Rucli G.

Author information

Abstract

Studies of fascial anatomy, histology, and physiology are changing comprehension of the role of fascia in many body functions. In the light of these studies, evidence-based models of the human fascial system that provide immediateclinical applications for manual therapists working with movement dysfunctions and pain are necessarily evolving. This paper presents an overview of one proposed biomechanical model and discusses some of its underlying hypotheses. Developed initially from extensive review of anatomical texts and clinical experience, subsequent anatomical dissections, histological, biomechanical, and some clinical studies have investigated this model. These studies are discussed, also in reference to other contemporary musculoskeletal research. This model for the humanfascial system could represent new perspectives for clinicians and researchers regarding the functional integration offascia within the musculoskeletal system.

PMID: 22703750 [PubMed - indexed for MEDLINE]

ID NUMBER 16

Chir Organi Mov. 2008 May;92(1):7-10. doi: 10.1007/s12306-008-0033-8. Epub 2008 Mar 1.

Historical review of carpal tunnel syndrome.

Stecco C[1], Aldegheri R.

Author information

Abstract

The first description of median nerve compression in the carpal tunnel goes back to 1854, but it was only a century later that the term "carpal tunnel syndrome" (CTS) appeared in print. Until then, patients with symptoms, which we now know were due to CTS, were sometimes diagnosed as having acroparaesthesia, and at other times compression of the motor branch of the median nerve or the brachial plexus. The first description of an operation to open thecarpal tunnel goes back to 1933, but only with Brain and Phalen was idiopathic CTS defined from both clinical and anatomopathological viewpoints. Since 1960, CTS has become the most frequently diagnosed of peripheral compression-induced neuropathies. The last part of this paper reports the latest theories giving an aetiological explanation of cases of CTS until now considered to be idiopathic.

PMID: 18566759 [PubMed - indexed for MEDLINE]

ID NUMBER 17

Curr Pain Headache Rep. 2013 Aug;17(8):352. doi: 10.1007/s11916-013-0352-9.

Fascial components of the myofascial pain syndrome.

Stecco A[1], Gesi M, Stecco C, Stern R.

Author information

Abstract

Myofascial pain syndrome (MPS) is described as the muscle, sensory, motor, and autonomic nervous system symptoms caused by stimulation of myofascial trigger points (MTP). The participation of fascia in this syndrome has often been neglected. Several manual and physical approaches have been proposed to improve myofascial function after traumatic injuries, but the processes that induce pathological modifications of myofascial tissue after trauma remain unclear. Alterations in collagen fiber composition, in fibroblasts or in extracellular matrix composition have been postulated. We summarize here recent developments in the biology of fascia, and in particular, its associated hyaluronan (HA)-rich matrix that address the issue of MPS.

PMID: 23801005 [PubMed - indexed for MEDLINE]

ID NUMBER 18

J Bodyw Mov Ther. 2013 Oct;17(4):512-7. doi: 10.1016/j.jbmt.2013.04.004. Epub 2013 May 11.

The anatomical and functional relation between gluteus maxim us and fascia lata.

Stecco A, Gilliar W, Hill R, Fullerton B, Stecco C.
Author information

Erratum in

- J Bodyw Mov Ther. 2014 Jan;18(1):93. Antonio, Stecco [corrected to Stecco, Antonio]; Wolfgang, Gilliar [corrected to Gilliar, Wolfgang]; Robert, Hill [corrected to Hill, Robert]; Carla, Stecco [corrected to Stecco, Carla].

Abstract

There is not full agreement regarding the distal insertions of the gluteus maximus muscle (GM), particularly the insertions into the iliotibial band and lateral intermuscular septum. 6 cadavers, 4 males and 2 females, mean age 69 yr, were dissected to evaluate the insertions of the GM into the iliotibial band, fascia lata, lateral intermuscular septum and femur. The iliotibial band is a reinforcement of the fascia lata and cannot be separated from it. Its inner side is in continuity with the lateral intermuscular septum, which divides the quadriceps from the hamstring. In all subjects the gluteus maximus presented a major insertion into the fascia lata, so large that the iliotibial tract could be considered a tendon of insertion of the gluteus maximus. The fascial insertion of the gluteus maximus muscle could explain the transmission of the forces from the thoracolumbar fascia to the knee.

KEYWORDS:

Fascia lata; Gluteus maximus; Iliotibial band; Myofascial insertion

PMID: 24139012 [PubMed - indexed for MEDLINE]

ID NUMBER 19

J Bodyw Mov Ther. 2013 Jan;17(1):95-102. doi: 10.1016/j.jbmt.2012.06.001. Epub 2012 Jul 4.

The muscular force transmission system: role of the intramuscular connective tissue.

Turrina A[1], Martínez-González MA, Stecco C.

Author information

Abstract

The objective of this review is to analyze in detail the microscopic structure and relations among muscular fibers, endomysium, perimysium, epimysium and deep fasciae. In particular, the multilayer organization and the collagen fiber orientation of these elements are reported. The endomysium, perimysium, epimysium and deep fasciae have not just a role of containment, limiting the expansion of the muscle with the disposition in concentric layers of the collagen tissue, but are fundamental elements for the transmission of muscular force, each one with a specific role. From this review it appears that the muscular fibers should not be studied as isolated elements, but as a complex inseparable from their fibrous components. The force expressed by a muscle depends not only on its anatomical structure, but also the angle at which its fibers are attached to the intramuscular connective tissue and the relation with the epimysium and deep fasciae.

PMID: 23294690 [PubMed - indexed for MEDLINE]

ID NUMBER 20

Surg Radiol Anat. 2014 Aug;36(6):561-72. doi: 10.1007/s00276-013-1244-8. Epub 2013 Dec 8.

The paratendineous tissues: an anatomical study of their role in the pathogenesis oftendinopathy.

Stecco C[1], Cappellari A, Macchi V, Porzionato A, Morra A, Berizzi A, De Caro R.

Author information

Abstract

The aim of this paper was to examine the macroscopic and microscopic characteristics of the paratendineoustissues (paratenon, epitenon and endotenon) of the calcaneal tendon to better understand their role in thepathogenesis of "tendinopathy". Ten non-embalmed legs from cadavers were used. Histological and immunohistochemical studies were done at the middle third of the tendon. Magnetic resonance images of the hind foot were made in 60 living subjects to analyze the morphological alterations of tendon and paratenon. The paratenon is a thick fibrous layer with few elastic fibers, continuous with the crural fascia, well vascularized and innervated. It forms a sheath around the tendon similar to a synovial layer, but less organized. Indeed, it has no complete epithelium, but only some cells producing hyaluronan, called fasciacytes. Crural fascia and paratenon can be clearly observed by MRI, appearing as homogeneous, low signal intensity bands, sharply defined in the context of subcutaneous tissue in T1-weighted sequences. The mean thickness of the crural fascia was 1.11 mm in healthy subjects and 1.30 mm in patients ($p < 0.005$). The mean value of paratenon thickness in patients was 1.34 mm, 0.85 in healthy ($p < 0.0001$). The paratenon is more highly vascularized and innervated than the tendon, supporting the hypothesis that it is the origin of pain in tendinopathy. The imaging study suggests that, an increase in the thickness of the paratenon more than 1.35 mm is predictive of paratendinopathy, even before tendon damage.

PMID: 24318515 [PubMed - indexed for MEDLINE]

ID NUMBER 21

Surg Radiol Anat. 2014 Apr;36(3):243-53. doi: 10.1007/s00276-013-1185-2. Epub 2013 Aug 23.

Ultrasonography in myofascial neck pain: randomized clinical t rial for diagnosis and follow-up.

Stecco A[1], Meneghini A, Stern R, Stecco C, Imamura M.

Author information

Abstract

OBJECTIVE:

A definitive diagnosis of chronic neck pain (CNP) is sometimes not possible. The aim of this study was to understand the possible role of the deep fasciae in CNP and the utility of the ultrasonography in the diagnosisof myofascial neck pain.

METHODS:

The morphometric and clinical data of 25 healthy subjects and 28 patients with CNP were compared. For all subjects, the active and passive cervical range of motion (ROM) was analyzed and the neck pain disability questionnaire (NDPQ) was administered. The fascial thickness of the sternal ending of the sternocleidomastoid and medial scalene muscles was also analyzed by ultrasonography.

RESULTS:

There were significant differences between healthy subjects and patients with CNP in the thickness of the upper side of the sternocleidomastoid fascia and the lower and upper sides of the right scalene fascia both at the end of treatment as during follow-up. A significant decrease in pain and thickness of the fasciae were found. Analysis of the thickness of the sub-layers showed a significant decrease in loose connective tissue, both at the end of treatment and during follow-up.

CONCLUSIONS:

The data support the hypothesis that the loose connective tissue inside the fasciae may plays a significant role in the pathogenesis of CNP. In particular, the value of 0.15 cm of the SCM fascia was considered as a cut-off value which allows the clinician to make a diagnosis of myofascial disease in a subject with CNP. The variation of thickness of the fascia correlated with the increase in quantity of the loose connective tissue but not with dense connective tissue.

PMID: 23975091 [PubMed - indexed for MEDLINE]

ID NUMBER 22

Surg Radiol Anat. 2015 Apr;37(3):281-5. doi: 10.1007/s00276-014-1338-y. Epub 2014 Jul 22.

Comparative ultrasonographic evaluation of the Achilles paratenon in symptomatic andasymptomatic subjects: an imaging study.

Stecco A[1], Busoni F, Stecco C, Mattioli-Belmonte M, Soldani P, Condino S, Ermolao A, Zaccaria M, Gesi M.

Author information

Abstract

Achilles tendon analysis represents one of the most frequently requested ultrasonographic evaluations, due to the high incidence of tendinopathy. Various authors have described inflammatory features of the paratenon recruited 22subjects complaining of pain in the mid-portion of the Achilles tendon and 22 healthy subjects. Both groups underwent ultrasonographic examination and Victorian Institute of Sport Assessment-Achilles questionnaire administration. It was found statistically significant inter-group differences of the paratenon ($p = 0.0001$) as well as tendon thickness ($p < 0.0001$). Our results show that Achilles symptoms could also be associated with an increase in the paratenon thickness. We suggest that clinicians should carefully analyze paratenon thickness when evaluating patients with Achillodynia using ultrasound. It may be that the paratenon, when thickened, may explain some of the painful symptoms reported by patients and it is associated with a tendinopathy process, hence we suggest careful analysis in patients with Achillodynia.

PMID: 25047541 [PubMed - in process]

ID NUMBER 23

J Bodyw Mov Ther. 2015 Jan;19(1):113-8. doi: 10.1016/j.jbmt.2014.08.002. Epub 2014 Aug 11.

Conservative treatment of carpal tunnel syndrome: compariso n between laser therapy and Fascial Manipulation(®).

Pratelli E[1], Pintucci M[2], Cultrera P[3], Baldini E[4], Stecco A[5], Petrocelli A[1], Pasquetti P[1].

Author information

Abstract

The etiopathogenesis of Carpal Tunnel Syndrome (CTS) is multifactorial and most cases are classified as idiopathic (Thurston 2013). A randomized controlled trial was performed to compare the effectiveness of FascialManipulation(®) (FM) and Low-Level Laser Therapy (LLLT) for CTS. This prospective trial included 42 patients (70 hands with symptoms) with clinical and electroneuromyographic diagnosis of CTS. The patients were randomly assigned to receive multiple sessions of FM or multiple session of LLLT. The Visual Analogic Scale (VAS) and Boston Carpal Tunnel Questionnaire (BCTQ) were performed at baseline, end of treatment and after three months. The group that received FM showed a significant reduction in subjective pain perception and an increased function assessed by BCTQ at the end of the treatment and follow-up. The group that received LLLT showed an improvement in the BCTQ at the end of the treatment but the improvement level was not sustained at the three month follow-up. FM is a valid alternative treatment for CTS.

KEYWORDS:

Carpal tunnel syndrome; Fascial manipulation; Low level laser therapy; Manual therapy

ID NUMBER 24

J Bodyw Mov Ther. 2014 Jul;18(3):462-8. doi: 10.1016/j.jbmt.2013.11.020. Epub 2013 Dec 3.

Case study: could ultrasound and elastography visualized densified areas i nside thedeep fascia?

Luomala T[1], Pihlman M[2], Heiskanen J[3], Stecco C[4].

Author information

Abstract

Many manual techniques describe palpable changes in the subcutaneous tissue. Many manual therapists have perceived palpable tissue stiffness and how it changes after treatment. No clear demonstration exists of the presence of specific alterations in the subcutaneous tissue and even less a visualization of their changes following manual therapy. This case study visualizes by ultrasound and elastography an alteration of the deep fascia in a 40-year-old male with subacute pain in the calf area. Ultrasound and elastography permits visualization of gliding, echogenicity and elasticity of deep fascia and their changes, after manual therapy (Fascial Manipulation(©)). Thisstudy suggests the possible use of the ultrasound and elastography to furnish a more objective picture of the "sensations" that are commonly reported by manual therapists, and which supports clinicians in the diagnosis of the myofascial pain.

KEYWORDS:

Densification; Fascia; Fascial manipulation; Gliding; Manual therapy; Myofascial pain; Sliding system

PMID: 25042323 [PubMed - indexed for MEDLINE]

ID NUMBER 25

J Bodyw Mov Ther. 2014 Oct;18(4):608-15. doi: 10.1016/j.jbmt.2013.12.011. Epub 2013 Dec 25.

Fascial Manipulation(®) method applied to pubescent postural hyperkyphosis: A pilotstudy.

Ćosić V[1], Day JA[2], Iogna P[3], Stecco A[4].

Author information

Abstract

BACKGROUND:

Treatment of pubescent postural hyperkyphosis commonly includes postural exercises and auto-elongation. Myofascial imbalances can be involved in functional, sagittal plane deviations of spinal curves. This pilot-study assesses the effects of one manual therapy approach that addresses fascial dysfunctions (FascialManipulation(®)) in pubescent subjects with postural hyperkyphosis.

METHODS:

17 subjects (mean age 11.8 DS 0.8; 9 males, 8 females) were evaluated for familiarity; psychological aspects; sport; pain; anteposition of shoulders, head, and pelvis; distance C7 and L3 from plumb-line; distance fingers to floor on forward bend. Each subject received 2-4 weekly sessions of Fascial Manipulation(®). Parameters were evaluated before and after manual treatment, with a follow-up at 7 months.

RESULTS:

A statistically significant difference ($p < 0.05$) was present in all the parameters analysed before and after treatment and at a 7 month follow-up.

CONCLUSIONS:

Results suggest that Fascial Manipulation(®) could represent an approach to integrate into treatment of postural hyperkyphosis in pubescent subjects.

KEYWORDS:

Fascia; Fascial Manipulation; Manual therapy; Postural hyperkyphosis

PMID: 25440216 [PubMed - indexed for MEDLINE]

ID NUMBER 26

Curr Pain Headache Rep. 2014;18(8):441. doi: 10.1007/s11916-014-0441-4.

Painful connections: densification versus fibrosis of fascia.

Pavan PG[1], Stecco A, Stern R, Stecco C.

Author information

Abstract

Deep fascia has long been considered a source of pain, secondary to nerve pain receptors becoming enmeshed within the pathological changes to which fascia are subject. Densification and fibrosis are among such changes. They can modify the mechanical properties of deep fasciae and damage the function of underlying muscles or organs. Distinguishing between these two different changes in fascia, and understanding the connective tissue matrix within fascia, together with the mechanical forces involved, will make it possible to assign more specific treatment modalities to relieve chronic pain syndromes. This review provides an overall description of deep fasciae and the mechanical properties in order to identify the various alterations that can lead to pain. Diet, exercise, and overuse syndromes are able to modify the viscosity of loose connective tissue within fascia, causing densification, an alteration that is easily reversible. Trauma, surgery, diabetes, and aging alter the fibrous layers of fasciae, leading to fascial fibrosis.

PMID: 25063495 [PubMed - indexed for MEDLINE]

ID NUMBER 27

J Anat. 2013 Dec;223(6):665-76. doi: 10.1111/joa.12111. Epub 2013 Sep 12.

Plantar fascia anatomy and its relationship with Achilles tendon and paratenon.

Stecco C[1], Corradin M, Macchi V, Morra A, Porzionato A, Biz C, De Caro R.

Author information

Abstract

Although the plantar fascia (PF) has been studied quite well from a biomechanical viewpoint, its microscopic properties have been overlooked: nothing is known about its content of elastic fibers, the features of the extracellular matrix or the extent of innervation. From a functional and clinical standpoint, the PF is often correlated with the triceps surae muscle, but the anatomical grounds for this link are not clear. The aim of this work was to focus on the PF macroscopic and microscopic properties and study how Achilles tendon diseases might affect it. Twelve feet from unembalmed human cadavers were dissected to isolate the PF. Specimens from each PF were tested with various histological and immunohistochemical stains. In a second stage, 52 magnetic resonance images (MRI) obtained from patients complaining of aspecific ankle or foot pain were analyzed, dividing the cases into two groups based on the presence or absence of signs of degeneration and/or inflammation of the Achilles tendon. The thickness of PF and paratenon was assessed in the two groups and statistical analyses were conducted. The PF is a tissue firmly joined to plantar muscles and skin. Analyzing its possible connections to the sural structures showed that this fascia is more closely connected to the paratenon of Achilles tendon than to the Achilles tendon, through the periosteum of the heel. The PF extended medially and laterally, continuing into the deep fasciae enveloping the abductor hallucis and abductor digiti minimi muscles, respectively. The PF was rich in hyaluronan, probably produced by fibroblastic-like cells described as 'fasciacytes'. Nerve endings and Pacini and Ruffini corpuscles were present, particularly in the medial and lateral portions, and on the surface of the muscles, suggesting a role for the PF in the proprioception of foot. In the radiological study, 27 of the 52 MRI showed signs of Achilles tendoninflammation and/or degeneration, and the PF was 3.43 ± 0.48 mm thick (99%CI and SD = 0.95), as opposed to 2.09 ± 0.24 mm (99%CI, SD = 0.47) in the patients in which the MRI revealed no Achilles tendon diseases; this difference in thickness of 1.29 ± 0.57 mm (99%CI) was statistically significant ($P < 0.001$). In the group of 27/52 patients with tendinopathies, the PF was more than 4.5 mm thick in 5, i.e. they exceeded the threshold for a diagnosis of plantar fasciitis. None of the other 25/52 paitents had a PF more than 4 mm thick. There was a statistically significant correlation between the thicknesses of the PF and the paratenon. These findings suggest that the plantar fascia has a role not only in supporting the longitudinal arch of the foot, but also in its proprioception and peripheral motor coordination. Its relationship with the paratenon of the Achilles tendon is consistent with the idea of triceps surae structures being involved in the PF pathology, so their rehabilitation can be considered appropriate. Finally, the high concentration of hyaluronan in the PF points to the feasibility of using hyaluronan injections in thefascia to treat plantar fasciitis.

KEYWORDS:

Achilles tendon; fasciacyte; hyaluronan; paratenon; plantar aponeurosis; plantar fascia; plantar fasciitis

PMID: 24028383 [PubMed - indexed for MEDLINE]

ID NUMBER 28

Int J Comput Assist Radiol Surg. 2015 Mar 6. [Epub ahead of print]

A semiautomatic method for in vivo three-dimensional quantitative analysis of fasciallayers mobility bas ed on 3D ultrasound scans.

Condino S[1], Turini G, Parrini S, Stecco A, Busoni F, Ferrari V, Ferrari M, Gesi M.
Author information

Abstract

PURPOSE:

Recently, there has been an increasing interest in the role of deep fascia mobility in musculoskeletal dynamics and chronic pain mechanisms; however, no strategies have been presented so far to study in vivo fascialmotion in 3D. This paper presents a semiautomatic method, based on ultrasound (US) imaging, enabling a 3Devaluation of fascia mobility.

METHODS:

The proposed approach relies on the acquisition of 3D US datasets at rest and during a voluntary muscular contraction and consists of two phases: 3D US dataset analysis and generation of a displacement vector field using a block matching technique (Phase 1) and validation and filtering of the resulting displacement vector field for outliers removal (Phase 2). The accuracy and effectiveness of the proposed method were preliminarily tested on different 3D US datasets, undergoing either simulated (procedural) or real (muscular contraction) deformations.

RESULTS:

As for the simulated deformation, estimated displacement vectors resulting from Phase 1 presented a mean magnitude percentage error of 8.05 % and a mean angular error of [Formula: see text] which, after Phase 2, were reduced by 69.44 and by 83.05 %, respectively. Tests on real deformations further validated the effectiveness of Phase 2 in the removal of outliers from the displacement vector field.

CONCLUSIONS:

Obtained results preliminarily demonstrate the viability of the proposed algorithm for the analysis of fascia mobility. Such analysis can enable clinicians to better understand the fascia role in musculoskeletal dynamics and disorder. Further experiments are needed to optimize the method in consideration of the anatomical region to be studied.

PMID: 25740204 [PubMed - as supplied by publisher]

ID NUMBER 29

PM R. 2015 Jun 14. pii: S1934-1482(15)00292-0. doi: 10.1016/j.pmrj.2015.06.006. [Epub ahead of print]

Fascial Disorders: Implications for Treatment.

Stecco A[1], Stern R[2], Fantoni I[3], De Caro R[3], Stecco C[3].

Author information

Abstract

In the past 15 years, multiple articles have appeared that target fascia as an important component of treatment in the field of physical medicine and rehabilitation. To better understand the possible actions of fascial treatments, there is a need to clarify the definition of fascia and how it interacts with various other structures: muscles, nerves, vessels, organs. Fascia is a tissue that occurs throughout the body. However, different kinds of fascia exist. In this narrative review, we demonstrate that symptoms related to dysfunction of the lymphatic system, superficial vein system, and thermoregulation are more related to dysfunction involving superficial fascia. Dysfunction involving alterations in mechanical coordination, proprioception, balance, myofascial pain, and cramps are more related to deep fascia and the epimysium. Superficial fascia is obviously more superficial than the other types and contains more elastic tissue. Consequently, effective treatment can probably be achieved with light massage or with treatment modalities that use large surfaces that spread the friction in the first layers of the subcutis. The deep fasciae and the epymisium requiretreatment that generates enough pressure to reach the surface of muscles. For this reason, the use of small surface tools and manual deep friction with the knuckles or elbows are indicated. Due to different anatomical locations and to the qualities of the fascial tissue, it is important to recognize that different modalities of approach have to be taken into consideration when considering treatment options.

PMID: 26079868 [PubMed - as supplied by publisher]

ID NUMBER 30

J Bodyw Mov Ther. 2009 Apr;13(2):128-35. doi: 10.1016/j.jbmt.2008.04.044. Epub 2008 Jun 24.

Application of Fascial Manipulation technique in chronic shoulder pain--anatomical basis and clinical implications.

Day JA[1], Stecco C, Stecco A.

Author information

Abstract

Classical anatomy still relegates muscular fascia to a role of contention. Nonetheless, different hypotheses concerning the function of this resilient tissue have led to the formulation of numerous soft tissue techniques for the treatment of musculoskeletal pain. This paper presents a pilot study concerning the application of one such manual technique, Fascial Manipulation, in 28 subjects suffering from chronic posterior brachial pain. This method involves a deep kneading of muscular fascia at specific points, termed centres of coordination (cc) and centres of fusion (cf), along myofascial sequences, diagonals, and spirals. Visual Analogue Scale (VAS) measurement of pain administered prior to the first session, and after the third session was compared with a follow-up evaluation at 3 months. Results suggest that the application of Fascial Manipulation technique may be effective in reducing pain in chronic shoulder dysfunctions. The anatomical substratum of the myofascial continuity has been documented by dissections and the biomechanical model is discussed.

PMID: 19329049 [PubMed - indexed for MEDLINE]

ID NUMBER 31

Int J Ther Massage Bodywork. 2010 Mar 17;3(1):38-40.

The fascial manipulation technique and its biomechanical model: a guide to the human fascial system.

Stecco C[1], Day JA.
Author information

KEYWORDS:

Fascia; Fascial Manipulation technique; fascial anatomy; manual therapy

PMID: 21589701 [PubMed]

PMCID: PMC3091422

Free PMC Article

ID NUMBER 32

Eur J Phys Rehabil Med. 2011 Dec;47(4):561-8. Epub 2011 Jul 28.

Effects of myofascial technique in patients with subacute whiplash associated disorders: a pilot study.

Picelli A[1], Ledro G, Turrina A, Stecco C, Santilli V, Smania N.

Author information

Abstract

BACKGROUND:

Whiplash associated disorders commonly affect people after a motor vehicle accident, causing a variety of disabling manifestations. Some manual and physical approaches have been proposed to improve myofascial function after traumatic injuries, in order to effectively reduce pain and functional limitation.

AIM:

To evaluate whether the application of the Fascial Manipulation© technique could be more effective than a conventional approach to improve cervical range of motion in patients with subacute whiplash associated disorders.

DESIGN:

Pilot randomized clinical trial.

METHODS:

Eighteen patients with subacute whiplash associated disorders were randomized into two groups. Group A (N.=9) received three, 30-minute sessions, (every five days during a two week period) of neck FascialManipulation©. Group B (N.=9) received ten, 30-minute sessions (five days a week for two consecutive weeks) of neck exercises plus mobilization. Patients were evaluated before, immediately after and two weeks post-treatment.

PRIMARY OUTCOME MEASURES:

cervical active range of motion (flexion, extension, right lateral-flexion, left lateral-flexion, right rotation, and left rotation).

RESULTS:

A statistically significant improvement in neck flexion was found after treatment in favour of Group A (60.2±10.8°) compared with Group B (46.3±15.1°). No differences were found between groups for the other primary outcomes at post-treatment or follow-up.

CONCLUSION:

The Fascial Manipulation© technique may be a promising method to improve cervical range of motion in patients with subacute whiplash associated disorders.

CLINICAL REHABILITATION IMPACT:

Myofascial techniques may be useful for improving treatment of subacute whiplash associated disorders also reducing their economic burden.

PMID:

21796089

[PubMed - indexed for MEDLINE]

Free full text

ID NUMBER 33

J Am Osteopath Assoc. 2013 Aug;113(8):600-10. doi: 10.7556/jaoa.2013.021.

Mathematical analysis of the flow of hyaluronic acid around fascia during manual therapy motions.

Roman M[1], Chaudhry H, Bukiet B, Stecco A, Findley TW.

Author information

Abstract

CONTEXT:

More research is needed to understand the flow characteristics of hyaluronic acid (HA) during motions used in osteopathic manipulative treatment and other manual therapies.

OBJECTIVE:

To apply a 3-dimensional mathematical model to explore the relationship between the 3 manual therapy motions (constant sliding, perpendicular vibration, and tangential oscillation) and the flow characteristics of HA below the fascial layer.

METHODS:

The Squeeze Film Lubrication theory of fluid mechanics for flow between 2 plates was used, as well as the Navier-Stokes equations.

RESULTS:

The fluid pressure of HA increased substantially as fascia was deformed during manual therapies. There was a higher rate of pressure during tangential oscillation and perpendicular vibration than during constant sliding. This variation of pressure caused HA to flow near the edges of the fascial area undermanipulation, and this flow resulted in greater lubrication. The pressure generated in the fluid between the muscle and the fascia during osteopathic manipulative treatment causes the fluid gap to increase. Consequently, the thickness between 2 fascial layers increases as well. Thus, the presence of a thicker fluid gap can improve the sliding system and permit the muscles to work more efficiently.

CONCLUSION:

The mathematical model employed by the authors suggests that inclusion of perpendicular vibration and tangential oscillation may increase the action of the treatment in the extracellular matrix, providing additional benefits in manual therapies that currently use only constant sliding motions.

PMID: 23918911 [PubMed - indexed for MEDLINE]

ID NUMBER 34

Ann Acad Med Stetin. 2014;60(2):59-64.

[USE OF THE STRUCTURAL TENSEGRATION CONCEPT IN THE STECCO FASCIALMANIPULATION METHOD].

[Article in Polish]

Mikolajczyk A, Kocięcki M, Zaklukiewicz A, Listewnik M, Gębska M.

Abstract

Low therapeutic efficacy in a number of cases involving the musculoskeletal system may be caused by a wrong diagnosis, the misunderstanding of the essence of the problem, pathogen or improper treatment. Therapy may be applied to the wrong area (at the site of pain) or may cover an area that is too small. The paper presents the theory of structural tensegrity (along with the anatomical and physiological grounds), which is based on a number of modern holistic therapies. One such method is the method of fascial manipulation by Stecco, described in outline in this article. This article also describes the structure and functions of the fasciasince understanding of this structure was the cause of the emergence of new concepts and therapies.

PMID: 26591110 [PubMed - indexed for MEDLINE]

ID NUMBER 35

Version 2. F1000Res. 2015 Nov 3 [revised 2016 Jan 8];4:1208. doi: 10.12688/f1000research.6890.2. eCollection 2015.

Fascial Manipulation® for chronic aspecific low back pain: a single blinded randomized controlled trial.

Branchini M[1], Lopopolo F[2], Andreoli E[3], Loreti I[4], Marchand AM[5], Stecco A[6].
Author information

Abstract

BACKGROUND:

The therapeutic approach to chronic aspecific low back pain (CALBP) has to consider the multifactorial aetiology of the disorder. International guidelines do not agree on unequivocal treatment indications. Recommendations for fascial therapy are few and of low level evidence but several studies indicate strong correlations between fascial thickness and low back pain. This study aims at comparing the effectiveness of Fascial Manipulation® associated with a physiotherapy program following guidelines for CALBP compared to a physiotherapy program alone.

METHODS:

24 subjects were randomized into two groups, both received eight treatments over 4 weeks. Outcomes were measured at baseline, at the end of therapy and at a 1 month and a 3 months follow-up. Pain was measured with the visual analogue scale (VAS) and the brief pain inventory (BPI), function with the Rolland-Morris disability questionnaire (RMDQ), state of well-being with the short-form 36 health-survey (SF-36). The mean clinical important difference (MCID) was also measured.

RESULTS:

Patients receiving Fascial Manipulation® showed statistically and clinically significant improvements at the end of care for all outcomes, in the short (RMDQ, VAS, BPI) and medium term for VAS and BPI compared to manual therapy. The MCID show significant improvements in the means and percentage of subjects in groups in all outcomes post-treatment, in the short and medium term.

CONCLUSION:

Fascial tissues were implicated in the aetiology of CALBP and treatment led to decreased symptomatic, improved functional and perceived well-being outcomes that were of greater amplitude compared to manual therapy alone.

KEYWORDS:

low back pain; myofascial pain; nonspecific pain; thoracolumbar fascia

PMID: 26834998 [PubMed]

ID NUMBER 36

PM R. 2016 May 19. pii: S1934-1482(16)30150-2. doi: 10.1016/j.pmrj.2016.04.007. [Epub ahead of print]

Fascial Manipulation® associated with standard care compared to only standard post-surgical care for total hip arthroplasty: a randomized controlled trial.

Busato M[1], Quagliati C[1], Magri L[1], Filippi A[1], Sanna A[2], Branchini M[3], Marchand AM[4], Stecco A[5].

Author information

Abstract

BACKGROUND:
Increasing evidence has suggested that botulinum toxin A (BoNT/A) can inhibit the release of selected neuropepetide transmitters from primary sensory neurons. Thus, intraarticular (IA) injection therapies with BoNT/A may reduce pain in patients with knee osteoarthritis (OA).
OBJECTIVE:
To investigate the effects of landmark-guided IA injection of BoNT/A on patients with knee OA.
DESIGN:
A prospective randomized controlled trial.
SETTING:
A rehabilitation clinic of a private teaching hospital.
PATIENTS:
A total of 46 patients with symptomatic knee OA (mostly Kellgren/Lawrence grade 2-3).
METHODS:
The patients were randomly assigned to one of the following groups: BoNT/A group (BoNT/A injection; n = 21) or control group (education only; n = 20). The patients in the BoNT/A group received an IA injection of 100 units of BoNT/A into the affected knee.
MAIN OUTCOME MEASURES:
The short-term (1 week posttreatment) and long-term (6 months posttreatment) effects were evaluated using the pain visual analog scale (VAS) and questionnaires concerning functional status, including the Lequesne and Western Ontario and McMaster Universities (WOMAC) indexes.
RESULTS:
The between group comparison revealed significant differences with regard to the pain VAS score at 1 week ($P < .001$) and at 6 months ($P = .001$) posttreatment. Similar findings for the between group comparison were observed for the WOMAC and Lequene indexes at 6 months ($P < .05$) posttreatment. The pain VAS score in the BoNT/A group significantly decreased from 5.05 ± 1.12 (pretreatment) to 2.89 ± 1.04 at 1 week ($P < .001$) and 3.45 ± 1.70 at 6 months posttreatment ($P < .001$) but not in the control group ($P = .476$).
CONCLUSIONS:
The IA injection of BoNT/A provided pain relief and improved functional abilities of patients with knee OA in both the short- and long-term follow-up.

KEYWORDS:
Botulinum toxin; Intraarticular injection; Knee; OsteoarthritiS
PMID:

27210234

[PubMed - as supplied by publisher]

ID 37

Ital J Anat Embryol. 2005 Oct-Dec;110(4):247-54.

Histotopographic study of the rectovaginal septum.

Stecco C[1], Macchi V, Porzionato A, Tiengo C, Parenti A, Gardi M, Artibani W, De Caro R.
Author information

Abstract

The rectovaginal septum (RVS) is described as a strong connective tissue between the rectum and the vagina. The aim of the present study was to investigate the topography and histological structure of the RVS in 20 cadavers (age range: 54-72 years). After in situ formalin fixation, the pelvic viscera and the surrounding connective tissue were removed, together with the pelvic floor. In 8 cases, the topographical relationships of the septum with the vagina and rectum were studied during dissection. In 8 other cases, serial macrosections of the bladder base, vagina, lower rectum and pelvic floor complex were stained with hematoxylin-eosin, azan-Mallory and Weigert Van Gieson. RVS thickness was evaluated on transverse sections collected at the cranial and caudal levels of the middle third of the vagina (level II) and inferior third (level III). In the other 4 cases, specimens were cut with a slicer in 2-3 mm thick axial slices and plastinated using the von Hagens E12 technique. The RVS is located in an oblique coronal plane, close to the posterior vaginal wall, and is formed of a network of collagen, elastic fibres, smooth muscle cells with nerve fibres, emerging from the autonomic inferior hypogastric plexus, and variable numbers of small vessels. The RVS was thicker at cranial levels II and III, with respect to caudal level II, both in the midline (1.75 and 1.70 vs 0.2 mm, $p<0.05$) and lateral portions of the septum (2.67 and 2.64 vs 0.17 mm, $p<0.05$). At caudal level II, there was no statistically significant difference between the thicknesses of the lateral portions and the midline (0.17 vs 0.2 mm, $P>0.05$). The RVS resembles an hourglass, with a flattened central portion in the frontal plane. Given its position in the centre of the pelvis, the RVS plays a connecting role between the perineal body and the overlying portions of the endopelvic fascia, and may also play an active role in modulating the tone of the musculature of the pelvic walls during variations in endorectal pressure.

PMID: 16536055 [PubMed - indexed for MEDLINE]

ID 38

Clin Anat. 2007 Mar;20(2):157-62.

Medial and lateral pectoral nerves: course and branches.

Macchi V[1], Tiengo C, Porzionato A, Parenti A, Stecco C, Mazzoleni F, De Caro R.
Author information

Abstract

During modified radical mastectomy or cosmetic surgery, denervation of the lower part of the pectoralis major frequently occurs and may reduce muscle spasm, with consequent better reconstruction of the breast. The aim of this study was to determine the relationship between the pectoral nerves and the pectoral muscles. Eight unembalmed female cadavers were dissected and vascular and radiologic studies performed. The lateral pectoral nerves showed a constant course, parallel to the thoraco-acromial vessels. They coursed for 55 +/- 7 mm inferomedially on the deep surface of pectoralis major, under its fascia. The medial pectoral nerves showed two main patterns of branching, which correlated with the extent of the costal attachments of the pectoralis minor muscles. In pattern A (56%), associated with costal attachments narrower than 6.0 cm, the nerve pierced the deep aspect of the pectoralis minor as a single trunk, ramified in the muscle, and gave some branches that appeared on the superficial aspect to enter the pectoralis major. In pattern B (44%), associated with costal attachments wider than 6.6 cm, the nerve divided before entering pectoralis minor and its branches passed through the muscle or round its lower border to reach pectoralis major. The most medial branch of the medial pectoral nerve directed to the pectoralis major muscle emerged from pectoralis minor at the third intercostal space in the midclavicular line, a mean of 10.3 cm lateral to the margin of the sternum. Knowledge of the relationship between the extent of the costal attachment of pectoralis minor and the two patterns of branching of the medial pectoral nerve may be useful when performing elective denervation of the major pectoralis muscle.

PMID: 16583383 [PubMed - indexed for MEDLINE]

ID 39

Clin Anat. 2006 Sep;19(6):554-7.

Epifascial accessory palmaris longus muscle.

Tiengo C[1], Macchi V, Stecco C, Bassetto F, De Caro R.
Author information

Abstract

In hand reconstructive surgery the palmaris longus muscle is one of the most utilized donor site for tendon reconstruction procedures. However, its anatomic position is variable and anatomic variations may be responsible for median nerve compression. We report the case of a 40-year-old, right-handed woman, who presented with numbness and paresthesias in the palm and in the flexor aspect of the first, second, and third fingers of her right hand for the preceding 5 months, coinciding with increase of office work (typing). The clinical examination and radiological investigations (ultrasound and magnetic

resonance) revealed a subcutaneous mass (15 mm x 2.3 mm x 6 cm), with a lenticular shape and definite edges at the level of the volar aspect of the distal third of the forearm. The fine-needle aspiration biopsy revealed the presence of striated muscle fibers. During surgery, a muscle belly was found in the epifascial plane. This muscle originated from subcutaneous septa in the middle forearm and inserted on to the superficial palmar aponeurosis with fine short tendon fibers. Exposure of the antebrachial fascia did not reveal any area of weakness or muscle herniation. The palmaris longus tendon, flexor digitorum superficialis tendons, and flexor carpi radialis tendon showed usual topography under the antebrachial fascia. The accessory muscle was excised and histology revealed unremarkable striated muscle fibers, limited by a thin connective sheath. The presence of an accessory palmaris longus (APL) located in the epifascial plane could be ascribed to an unusual migration of myoblasts during the morphogenesis. Although extremely rare, APL is worth bearing in mind as a possible cause of median nerve compression and etiology of a volar mass in the distal forearm.

PMID: 16917822 [PubMed - indexed for MEDLINE]

ID 40

Ital J Anat Embryol. 2006 Apr-Jun;111(2):105-10.

Histological characteristics of the deep fascia of the upper limb.

Stecco C[1], Porzionato A, Macchi V, Tiengo C, Parenti A, Aldegheri R, Delmas V, De Caro R.

Author information

Abstract

Post-mortem specimens taken from the antebrachial and brachial fasciae of 20 upper limbs were studied by histological and immunohistochemical staining in order to evaluate collagen fibre bundle arrangement, the presence of elastic fibres, and the density of innervation in deep muscular fascia. The study demonstrated that the fasciae are formed of numerous layers of undulating collagen fibre bundles. In each layer, the bundles are parallel to each other, whereas adjacent layers show different orientations. Each layer is separated from the adjacent one by a thin layer of adipose tissue, like plywood. Many elastic fibres and a variety of both free and encapsulated nerve endings, especially Ruffini and Pacini corpuscles, are also present, suggesting a proprioceptive capacity of the deep fascia. Thanks to the undulating collagen fibre bundles and elastic fibres, the fasciae can adapt to stretching, but this is only possible within certain limits, beyond which nerve terminations are activated by stretching. This mechanism allows a sort of "gate control" on the normal activation of intrafascial receptors. The capacity of the various collagen layers to slide over each other may be altered in cases of over-use syndrome, trauma or surgery. In such cases, the amortising mechanism of thefascia on the nervous terminations is lost, causing incorrect paradoxical activation of nerve receptors within the fascia, resulting in the propagation of a nociceptive signal even in situations of normal physiological stretch. At the same time, the layered collagen fibres allow transmission of tension according to the various lines of force. This structure of the muscular fascia guarantees perceptive and directional continuity along a particular myokinetic chain, acting like a transmission belt between two adjacent joints and also between synergic muscle groups.

PMID: 16981399 [PubMed - indexed for MEDLINE]

ID 41

Morphologie. 2007 Mar;91(292):29-37.

Tendinous muscular insertions onto the deep fascia of the upper limb. First part: anatomical study.

Stecco C[1], Gagey O, Macchi V, Porzionato A, De Caro R, Aldegheri R, Delmas V.

Author information

Abstract

We examined 30 upper limbs in order to study the tendinous muscular insertions into the deep fascia and to verify whether they have a specific anatomical arrangement and to measure their resilience to traction. We have found that the fascia receives many tendinous muscular insertions, which are always present and exhibit a constant anatomical structure. In particular, the pectoralis major fascia always continues with the brachialfascia in two distinct ways: the fascia overlying the clavicular part of pectoralis major had an expansion towards the anterior brachial fascia, whereas the fascia covering its costal part extended into the medial brachial fascia and the medial intermuscular septum. The lacertus fibrosus was also composed by two groups of fibres: the main group was oriented downwards and medially, the second group longitudinally. The palmaris longus opened out into a fan-shape in the palm of the hand and sent some tendinous expansions to the flexor retinaculum and fascia overlying the thenar eminence muscles. In the posterior region of the arm, the fascia of the latissimus dorsi sent a fibrous lamina to the triceps brachial fascia. The triceps tendon inserted partially into the antebrachial fascia, while the extensor carpi ulnaris sent a tendinous expansion to the fascia of the hypothenar eminence. It is hypothesized that the tendinous muscular insertions maintain the fascia at a basal tension and create myofascial continuity between the different muscles actuating flexion and extension of the upper limb, stretching the fascia in different ways according to the different motor directions.

PMID: 17574470 [PubMed - indexed for MEDLINE]

ID 42

Ital J Anat Embryol. 2007 Oct-Dec;112(4):247-53.

Anatomo-radiological study of the superficial musculo-aponeurotic system of the face.

Macchi V[1], Tiengo C, Porzionato A, Stecco C, Galli S, Vigato E, Azzena B, Parenti A, De Caro R.

Author information

Abstract

The aim of the study was to analyse the appearance of the superficial muscolo-aponeurotic system (SMAS) in radiological images (Magnetic Resonance -MR- and Computed tomography -CT- scans, 10M, 10F randomly selected) in the three regions of the face (the parotid and cheek regions and the nasolabial fold). In axial CT images, the SMAS appears as a relatively hyperdense tortuous line between the hypodense superficial fibroadipose tissue (SAT) and the hypodense deep adipose tissue (DAT). In parotid region SAT is well represented (mean thickness 4.32 +/- 2.9 mm), whereas DAT is very thin (0.33 +/- 0.48 mm); SMAS appears as a thin hyperdense line, close to the parotid gland (0.76 +/- 0.43 mm). In cheek region, SAT is well represented (5.57 +/- 1.17 mm), whereas DAT is thinner (2.94 +/- 0.62 mm), and SMAS is well recognisable (1.69 +/- 0.52 mm). At the level of the nasolabial fold, the SAT is poorly represented (0.37 +/- 0.06 mm); the SMAS continues in the mimic muscles (2.41 +/- 0.05 mm), and DAT shows a mean thickness of 2.15 +/- 0.63 mm. In the MR examination, the SMAS appears as a thin continuous line hypointense in the T1-and T2-weighted sequence, from parotid region to nasolabial fold, comprising mimic muscles in the anterior region of the cheek and at the level of the nasolabial fold. No significative differences in thickness between CT and MR were found. Our anatomo-radiological study confirms that the subcutaneous architecture of the face consists of multiple layers of tissues that connect facial muscles with the dermis. This pattern of arrangement shows a progressive centrifugal thinning towards the adjacent regions.

PMID: 18333409 [PubMed - indexed for MEDLINE]

ID 43

Cells Tissues Organs. 2008;188(3):320-9. doi: 10.1159/000121433. Epub 2008 Mar 19.

The expansions of the pectoral girdle muscles onto the brachial fascia: morphological aspects and spatial disposition.

Stecco C[1], Porzionato A, Macchi V, Stecco A, Vigato E, Parenti A, Delmas V, Aldegheri R, De Caro R.

Author information

Abstract

BACKGROUND/AIMS:

The aim of this study was to analyse the relationships between the expansions of the pectoral girdle muscles, i.e. pectoralis major, latissimus dorsi and deltoid, and the brachial fascia.

METHODS:

Thirty shoulder specimens from 15 unembalmed adult cadavers were studied by dissection and in vivo radiological studies were performed in 20 patients using magnetic resonance (MR) imaging.

RESULTS:

The clavicular part of the pectoralis major muscle sent a fibrous expansion onto the anterior portion of the brachial fascia, its costal part onto the medial portion and medial intermuscular septum. The latissimus dorsi muscle showed a triangular fibrous expansion onto the posterior portion of the brachial fascia. The posterior part of the deltoid muscle inserted muscular fibres directly onto the posterior portion of the brachialfascia, its lateral part onto the lateral portion and the lateral intermuscular septum. In MR images, the brachialfascia appeared as a low-signal-intensity sinuous line of connective tissue, sharply delineated in T(1)-weighted sequences.

CONCLUSION:

The expansions of the pectoral girdle muscles onto the brachial fascia were present in all the subjects and showed a quite constant course with a specific spatial organization. During the various movements of the arm, these expansions stretch selective portions of the brachial fascia, with possible activation of specific patterns of fascial proprioceptors.

PMID: 18349526 [PubMed - indexed for MEDLINE]

ID 44

Surg Radiol Anat. 2009 Jan;31(1):35-42. doi: 10.1007/s00276-008-0395-5. Epub 2008 Jul 29.

Pectoral and femoral fasciae: common aspects and regional specializations.

Stecco A[1], Macchi V, Masiero S, Porzionato A, Tiengo C, Stecco C, Delmas V, De Caro R.

Author information

Abstract

The aim of this study was to analyse the organization of the deep fascia of the pectoral region and of the thigh. Six unembalmed cadavers (four men, two women, age range 48-93 years old) were studied by dissection and by histological (HE, van Gieson and azan-Mallory) and immunohistochemical (anti S-100) stains; morphometric studies were also performed in order to evaluate the thickness of the deep fascia in the different regions. The pectoral fascia is a thin lamina (mean thickness +/- SD: 297 +/- 37 mum), adherent to the pectoralis major muscle via numerous intramuscular fibrous septa that detach from its inner surface. Many muscular fibres are inserted into both sides of the septa and into the fascia. The histological study demonstrates that the pectoralfascia is formed by a single layer of undulated collagen fibres, intermixed with many elastic fibres. In the thigh, the deep fascia (fascia lata) is independent from the underlying muscle, separated by the epimysium and a layer of loose connective tissue. The fascia lata presents a mean thickness of 944 mum (+/-102 mum) and it is formed by bundles of collagen fibres, arranged in two to three layers. In each layer, the fibres are parallel to each other, whereas the orientation of the fibres varies from one layer to the adjacent one. The van Gieson elastic fibres stain highlights the presence of elastic fibres only in the more external layer of the fascia lata. In the thigh the epimysium is easily recognizable under the deep fascia and presents a mean thickness of 48 mum. Both the fascia lata and pectoral fascia result innerved, no specific differences in density or type of innervations is highlighted. The deep fascia of the pectoral region is morphologically and functionally different from that of the thigh: the fascia lata is a relatively autonomous structure with respect to the underlying muscular plane, while the pectoralis fascia acts as an additional insertion for the pectoralis major muscle. Different portions of the pectoralis major muscle are activated according to the glenohumeral joint movements and, consequently, selective portions of the pectoral fascia are stretched, activating specific patterns of proprioceptors. So, the pectoralis muscle has to be considered together with its fascia, and so as a myofascial unit, acting as an integrated control motor system.

PMID: 18663404 [PubMed - indexed for MEDLINE]

ID 45

J Bodyw Mov Ther. 2008 Jul;12(3):225-30. doi: 10.1016/j.jbmt.2008.04.041. Epub 2008 Jun 13.

Histological study of the deep fasciae of the limbs.

Stecco C[1], Porzionato A, Lancerotto L, Stecco A, Macchi V, Day JA, De Caro R.
Author information

Abstract

The aim of this study is to analyse the deep fasciae of limbs in order to evaluate the collagen and elastic fibre arrangement and the types of innervation. Histological and immunohistochemical stains were performed in 72 specimens. The deep fascia of the limbs is a sheath presenting a mean thickness of 1mm, formed by two to three layers of parallel collagen fibre bundles. In the adjacent layers, they show different orientations. Each layer is separated from the adjacent one by loose connective tissue, permitting the sliding of the collagen layers. Nerve fibres were found in all specimens, while muscular fibres were evidenced only in one specimen. The described structure permits the fasciae of the limbs to have a strong resistance to traction, even when exercised in different directions. The capacity of the different collagen layers to glide one on the other could be altered in cases of overuse syndrome, trauma, or surgery.

PMID: 19083678 [PubMed - indexed for MEDLINE]

ID 46

Clin Anat. 2009 Mar;22(2):221-9. doi: 10.1002/ca.20747.

The palmaris longus muscle and its relations with the antebrachial fascia and the palmar aponeurosis.

Stecco C[1], Lancerotto L, Porzionato A, Macchi V, Tiengo C, Parenti A, Sanudo JR, De Caro R.

Author information

Abstract

The palmaris longus (PL) is a muscle of the forearm with a long distal tendon that is continuous with the palmar aponeurosis (PA). It is generally assumed that the muscle lies deep to the antebrachial fascia from origin to termination, but a detailed description is lacking. The relationship of the PL tendon with the antebrachial fascia was studied in 30 dissections. The PL was completely absent in six specimens (20%), whereas the PA was identified in all. Average length of the forearm was 25.5 cm (SD: 2.1 cm, range 22-29 cm), overall length of the PL muscle 26.9 cm (SD: 2.6 cm, range 22.5-31.5 cm), muscular belly 13.8 cm (SD: 3.4 cm, range 9.5-23 cm), tendon 13.1 cm (SD: 3.3 cm, range 8-15.5 cm). Proximally, the PL was situated deep to the antebrachial fascia, then in the lower third of the forearm its tendon perforated the antebrachialfascia (at 4.7 +/- 1.7 cm from the bistyloid line) moving to a suprafascial plane, inserting in the PA. The PA could be divided into two layers: the superficial one formed by longitudinal fibers and adherent to the skin, the deep one formed by transverse fibers continuous laterally with the deep fascia of the hand. The PL tendon was found to be in continuity only with the longitudinal fibers of the PA. Based on the anatomical findings, it may be suggested that the superficial part of the PA is situated in the subcutaneous planes of the palm, and that the muscle should be considered as a tensor of the superficial fascial system of the subcutaneous tissue.

PMID: 19208432 [PubMed - indexed for MEDLINE]

ID 47

J Bodyw Mov Ther. 2009 Jul;13(3):255-61. doi: 10.1016/j.jbmt.2008.04.036. Epub 2008 Jun 16.

The pectoral fascia: anatomical and histological study.

Stecco A[1], Masiero S, Macchi V, Stecco C, Porzionato A, De Caro R.

Author information

Abstract

AIM:

Analysis of the pectoral fascia from a macroscopic and histological point of view.

RESULTS:

The pectoral fascia appears as a thin collagen layer (mean thickness of 297 microm) formed by undulated collagen fibres and many elastic fibres, within which small nerves are highlighted. Numerous septa detach from its internal surface, creating an intimate connection between the fascia and the pectoralis major muscle.

DISCUSSION:

The pectoral fascia and the pectoralis major muscle should be considered together, given that the anatomical base is effectively a myofascial unit, term that defines the muscles and the fascia of a specific region that have a precise functional organization. The capacity of force transmission between the inferior and superior limbs needs to be attributed to this entire myofascial complex. We hypothesize that the superficial, large muscles of the trunk developed inside the superficial layer of the deep fascia to enhance modulation of tension transmission between the different segments of the body.

PMID: 19524850 [PubMed - indexed for MEDLINE]

ID 48

Connect Tissue Res. 2010 Oct;51(5):337-46. doi: 10.3109/03008200903389127.

A constitutive model for the mechanical characterization of the plantar fascia.

Natali AN[1], Pavan PG, Stecco C.

Author information

Abstract

A constitutive model is proposed to describe the mechanical behavior of the plantar fascia. The mechanical characterization of the plantar fascia regards the role in the foot biomechanics and it is involved in many alterations of its functional behavior, both of mechanical and nonmechanical origin. The structural conformation of the plantar fascia in its middle part is characterized by the presence of collagen fibers reinforcing the tissue along a preferential orientation, which is that supporting the major loading. According to this anatomical evidence, the tissue is described by developing an isotropic fiber-reinforced constitutive model and since the elastic response of the fascia is here considered, the constitutive model is based on the theory of hyperelasticity. The model is consistent with a kinematical description of large strains mechanical behavior, which is typical of soft tissues. A fitting procedure of the constitutive model is implemented making use of experimental curves taken from the literature and referring to specimens of human plantar fascia. A satisfactory fitting of the tensile behavior of the plantar fascia has been performed, showing that the model correctly interprets the mechanical behavior of the tissue in the light of comparison to experimental data at disposal. A critical analysis of the model with respect to the problem of the identification of the constitutive parameters is proposed as the basis for planning a future experimental investigation of mechanical behavior of the plantar fascia.

PMID: 20175692 [PubMed - indexed for MEDLINE]

ID 49

Cells Tissues Organs. 2010;192(3):200-10. doi: 10.1159/000290225. Epub 2010 Feb 27.

The ankle retinacula: morphological evidence of the proprioceptive role of the fascial system.

Stecco C[1], Macchi V, Porzionato A, Morra A, Parenti A, Stecco A, Delmas V, De Caro R.

Author information

Abstract

STUDY DESIGN:
Research report.

OBJECTIVES:
To evaluate the anatomical characteristics of the ankle retinacula and their relationship with the fasciae and muscles in healthy subjects and in patients with ankle sprain outcomes.

BACKGROUND:
The role of the retinacula in proprioception has begun to emerge, but without clear anatomical bases or descriptions of their possible damage in patients with ankle sprain outcomes.

METHODS:
Dissection, histological and immunohistochemical analysis of 27 legs. An in vivo radiological study by MRI was also performed on 7 healthy volunteers, 17 patients with outcomes of ankle sprain, and 3 amputated legs.

RESULTS:
The retinacula are thickenings of the deep fascia presenting bone or muscular connections. They are formed of 2-3 layers of parallel collagen fibre bundles, densely packaged with a little loose connective tissue, without elastic fibres but many nervous fibres and corpuscles. By MRI, the retinacula appeared as low-signal-intensity bands with a mean thickness of 1 mm. In patients with outcomes of ankle sprain, MR findings were abnormal retinacula thickness, signal intensity, and full-thickness gap.

DISCUSSION:
The retinacula are not static structures for joint stabilisation, like the ligaments, but a specialisation of the fascia for local spatial proprioception of the movements of foot and ankle. Their anatomical variations and accessory bundles may be viewed as morphological evidence of the integrative role of the fascial system in peripheral control of articular motility.

PMID: 20197652 [PubMed - indexed for MEDLINE]

ID 50

Ital J Anat Embryol. 2011;116(3):127-38.

The fascia: the forgotten structure.

Stecco C[1], Macchi V, Porzionato A, Duparc F, De Caro R.

Author information

Abstract

This paper examines the main characteristics of the human fascial system, considered in its three-dimensional continuity. To better understand the anatomy of the human fascial system, a simple diagram of the subcutaneous tissue must be borne in mind. From the skin to the deepest plane, we find the superficial fascia, dividing the subcutaneous tissue into two fibroadipose layers, superficial and deep, and the deep fascia, which envelops all the muscles of the body, showing different characteristics according to region. Under the deepfascia is the epimysium, occurring in the limbs and some regions of the trunk. Skin ligaments connect the superficial fascia to the skin and to the deep fascia, forming a three-dimensional network among the fat lobules. The typical features of the superficial and deep fasciae and their relationships to nerves, vessels and muscles are reported here, highlighting the possible role of the deep fascia in proprioception and peripheral motor coordination. The main features of the fasciae with imaging techniques are also discussed. This knowledge may contribute to clinicians' understanding of the myofascial system and the role which the deep fasciae may play in musculoskeletal dysfunctions.

PMID: 22852442 [PubMed - indexed for MEDLINE]

ID 51

Surg Radiol Anat. 2011 Dec;33(10):855-62. doi: 10.1007/s00276-010-0757-7. Epub 2011 Jan 4.

3D reconstruction of the crural and thoracolumbar fasciae.

Benetazzo L[1], Bizzego A, De Caro R, Frigo G, Guidolin D, Stecco C.
Author information

Abstract

PURPOSE:
To create computerized three-dimensional models of the crural fascia and of the superficial layer of the thoracolumbar fascia.

METHODS:
Serial sections of these two fasciae, stained with Azan-Mallory, van Gieson and anti-S100 antibody stains, were recorded. The resulting images were merged (Image Zone 5.0 software) and aligned (MatLab Image Processing Toolkit). Color thresholding was applied to identify the structures of interest. 3D models were obtained with Tcl/Tk scripts and Paraview 3.2.1 software. From these models, the morphometric features of these fasciae were evaluated with ImageJ.

RESULTS:
In the crural fascia, collagen fibers represent less than 20% of the total volume, arranged in three distinct sub-layers (mean thickness, 115 μm), separated by a layer of loose connective tissue (mean thickness, 43 μm). Inside a single sub-layer, all the fibers are parallel, whereas the angle between the fibers of adjacent layers is about 78°. Elastic fibers are less than 1%. Nervous fibers are mostly concentrated in the middle layer. The superficial layer of the thoracolumbar fascia is also formed of three thinner sub-layers, but only the superficial one is similar to the crural fascia sub-layers, the intermediate one is similar to a flat tendon, and the deep one is formed of loose connective tissue. Only the superficial sub-layer has rich innervation and a few elastic fibers.

DISCUSSION:
Computerized three-dimensional models provide a detailed representation of the fascial structure, for better understanding of the interactions among the different components. This is a fundamental step in understanding the mechanical behavior of the fasciae and their role in pathology.

PMID: 21203765 [PubMed - indexed for MEDLINE]

ID 52

Surg Radiol Anat. 2011 Dec;33(10):905-11. doi: 10.1007/s00276-011-0873-z. Epub 2011 Sep 25.

Investigation of the mechanical properties of the plantar aponeurosis.

Pavan PG[1], Stecco C, Darwish S, Natali AN, De Caro R.

Author information

Abstract

INTRODUCTION:

The aim of this work was to obtain a preliminary investigation of the mechanical properties of the human plantar aponeurosis based on regional observation, in order to rationally plan a subsequent larger experimental campaign and develop suited constitutive models to characterize the mechanical response of this tissue.

MATERIALS AND METHODS:

Different in vitro mechanical tests were developed on eleven samples taken from the plantar aponeurosis of human cadaver (man, age 78 years). The samples were tested along the distal-proximal direction. Range of elasticity of the tissue, development of damage phenomena and stress relaxation at different levels of strain were evaluated.

RESULTS:

The strength of the tissue was found in the order of that proposed in previous works, with peak stress of about 12.5 MPa. The compliance of the plantar aponeurosis was in line with in vivo evaluation. A softening behaviour appeared for tensile strain larger than 12%. In relaxation tests, the stress was reduced of 35-40% in 120 s. The percentage stress relaxation was found independent on the level of the applied strain.

DISCUSSION:

The evaluation of the mechanical characteristics is fundamental for a subsequent development of numerical models of the plantar aponeurosis. Such approach is helpful to understand its response to overuse, but also to understand the clinical results of different manual and physical therapies that use warm, pressure or stretch to modify this tissue.

PMID: 21947015 [PubMed - indexed for MEDLINE]

ID 53

Surg Radiol Anat. 2014 Jan;36(1):25-32. doi: 10.1007/s00276-013-1152-y. Epub 2013 Jun 21.

Investigation of the mechanical properties of the human crural fascia and their possible clinical implications.

Stecco C[1], Pavan P, Pachera P, De Caro R, Natali A.

Author information

Abstract

The mechanical properties of deep fasciae strongly affect muscular actions, development of pathologies, such as acute and chronic compartment syndromes, and the choice of the various fascial flaps. Actually, a clear knowledge of the mechanical characterization of these tissues still lacks. This study focuses attention on experimental tests of different regions of human crural fascia taken from an adult frozen donor. Tensile tests along proximal-distal and medial-lateral direction at a strain rate of 120 %/s were performed at the purpose of evaluating elastic properties. Viscous phenomena were investigated by applying incremental relaxation tests at total strain of 7, 9 and 11 % and observing stress decay for a time interval of 240 s. The elastic response showed that the fascia in the anterior compartment is stiffer than in the posterior compartment, both along the proximal-distal and medial-lateral directions. This result can explain why the compartment syndromes are more frequent in this compartment with respect to posterior one. Furthermore, the fascia is stiffer along the proximal-distal than along medial-lateral direction. This means that the crural fascia can adapt to the muscular variation of volume in a transversal direction, while along the main axis it could be considered as a structure that contributes to transmitting the muscular forces at a distance and connecting the different segments of the limb. The stress relaxation tests showed that the crural fascia needs 120 s to decrease stress of 40 %, suggesting a similar time also in the living so that the static stretching could have an effect on the fascia.

PMID: 23793789 [PubMed - indexed for MEDLINE]

ID 54

Biorheology. 2013;50(3-4):191-202. doi: 10.3233/BIR-130631.

Squeeze film lubrication for non-Newtonian fluids with application to manual medicine.

Chaudhry H[1], Bukiet B, Roman M, Stecco A, Findley T.
Author information

Abstract

In this paper, we computed fluid pressure and force on fascia sheets during manual therapy treatments using Squeeze Film Lubrication theory for non-Newtonian fluids. For this purpose, we developed a model valid for three dimensional fluid flow of a non-Newtonian liquid. Previous models considered only one-dimensional flows in two dimensions. We applied this model to compare the one-dimensional flow of HA, considered as a lubricating fluid, around or within the fascia during sliding, vibration, and back-and-forth sliding manipulation treatment techniques. The fluid pressure of HA increases dramatically as fascia is deformed during manual therapies. The fluid force increases more during vertical vibratory manipulation treatment than in constant sliding, and back and forth motion. The variation of fluid pressure/force causes HA to flow near the edges of the fascial area under manipulation in sliding and back and forth motion which may result in greater lubrication. The fluid pressure generated in manual therapy techniques may improve sliding and permit muscles to work more efficiently.

PMID: 23863283 [PubMed - indexed for MEDLINE]

ID 55

J Anat. 2014 Aug;225(2):262-9. doi: 10.1111/joa.12206. Epub 2014 Jun 10.

The cubital tunnel: a radiologic and histotopographic study.

Macchi V[1], Tiengo C, Porzionato A, Stecco C, Sarasin G, Tubbs S, Maffulli N, De Caro R.

Author information

Abstract

Entrapment of the ulnar nerve at the elbow is the second most common compression neuropathy in the upper limb. The present study evaluates the anatomy of the cubital tunnel. Eighteen upper limbs were analysed in unembalmed cadavers using ultrasound examination in all cases, dissection in nine cases, and microscopic study in nine cases. In all cases, thickening of the fascia at the level of the tunnel was found at dissection. From the microscopic point of view, the ulnar nerve is a multifascicular trunk (mean area of 6.0 ± 1.5 mm(2)). The roof of the cubital tunnel showed the presence of superimposed layers, corresponding to fascial, tendineous and muscular layers, giving rise to a tri-laminar structure (mean thickness 523 ± 235 μm). This multilayered tissue was hyperechoic (mean thickness 0.9 ± 0.3 mm) on ultrasound imaging. The roof of the cubital tunnel is elastic, formed by a myofascial trilaminar retinaculum. The pathological fusion of these three layers reduces gliding of the ulnar nerve during movements of the elbow joint. This may play a role in producing the symptoms typical of cubital tunnel syndrome. Independent from the surgical technique, decompression should span the ulnar nerve from the triceps brachii muscle to the flexor carpi ulnaris fascia.

KEYWORDS:

Osborne's ligament; anatomy; cubital tunnel; radiological anatomy; retinaculum; ulnar nerve

PMID: 24917209 [PubMed - indexed for MEDLINE]

ID 56

J Bodyw Mov Ther. 2014 Jul;18(3):441-2. doi: 10.1016/j.jbmt.2014.04.013. Epub 2014 Apr 13.

Why are there so many discussions about the nomenclature of fasciae?

Stecco C[1].
Author information

Fascia is often described as an ubiquitous tissue that permeates the human body, organized as a three-dimensional network that surrounds, supports, suspends, protects, connects and divides muscular, skeletal and visceral components of the body (Tozzi, 2012). If we agree with this wide definition, then fasciae could include every connective tissue, loose or dense, regular and irregular, with so many functions that would be impossible to study and understand from a scientific point of view. Can we consider the loose connective tissue, that permits the gliding between different viscera, as fascia? And is it comparable with a fascia lata, that envelops all the muscles of the thigh? Could the peritoneum be considered a fascia? And is it more similar to loose or fibrous connective tissue? Have the visceral and parietal peritoneum the same structures and roles? Can we apply the knowledge that we have for the muscular fasciae to the visceral fasciae?

PMID: 25042316 [PubMed - indexed for MEDLINE]

ID 57

J Am Osteopath Assoc. 2014 Oct;114(10):780-7. doi: 10.7556/jaoa.2014.152.

Deformations experienced in the human skin, adipose tissue, and fascia in osteopathic manipulative medicine.

Chaudhry H[1], Bukiet B[2], Ji Z[1], Stecco A[1], Findley TW[1].

Author information

Abstract

CONTEXT:

Osteopathic manipulative medicine techniques involve compressive and tangential forces to target the fascia. These forces are transmitted to the skin and adipose tissue before the fascia is encountered. Knowing the extent of deformation of these 2 tissue layers relative to the fascia will assist osteopathic physicians in evaluating techniques for manual therapies and adjusting these therapies to reduce patient discomfort and improve results.

OBJECTIVE:

To determine the magnitude of the forces transmitted to the skin, adipose tissue, and fascia, and to determine the magnitude of deformation produced in the skin and adipose tissue relative to the fascia using a mathematical model.

METHODS:

The large deformation theory of elasticity, valid for 3-dimensional deformations, was used to evaluate the forces that need to be applied such that a specified deformation is produced in any region of the skin, adipose tissue, or fascia layers. Similarly, if the forces are specified, then the deformation produced can be determined.

RESULTS:

The normal and tangential forces required to produce a deformation of 9% compression and 4% shear for the skin were 50 N and 11 N, respectively. Normal and tangential forces of about 100 N and 22 N were found for a similar deformation of fascia. For adipose tissue, these forces were 36 N and 8 N, respectively. In addition, the skin experienced more compression and shear-about 1.5 times as much as thefascia, and the adipose tissue experienced about 2.5 to 3.5 times the deformation of the fascia and 50% more than the skin when a given force was applied to the skin.

CONCLUSION:

The forces applied to the surface of the skin were transmitted through this layer and the adipose layer entirely to the fascia. Therefore, the skin and adipose tissue experienced the same magnitude of force as the fascia. However, the skin and adipose tissue experienced more compression and shear than thefascia.

PMID: 25288713 [PubMed - in process]

ID 58

Surg Radiol Anat. 2015 Nov;37(9):1119-27. doi: 10.1007/s00276-015-1480-1. Epub 2015 May 7.

Is the cervical fascia an anatomical proteus?

Natale G[1], Condino S[2], Stecco A[3], Soldani P[1], Belmonte MM[4], Gesi M[5,6].

Author information

Abstract

The cervical fasciae have always represented a matter of debate. Indeed, in the literature, it is quite impossible to find two authors reporting the same description of the neck fascia. In the present review, a historical background was outlined, confirming that the Malgaigne's definition of the cervical fascia as an anatomical Proteus is widely justified. In an attempt to provide an essential and a more comprehensive classification, a fixed pattern of description of cervical fasciae is proposed. Based on the morphogenetic criteria, two fascial groups have been recognized: (1) fasciae which derive from primitive fibro-muscular laminae (muscular fasciae or myofasciae); (2) fasciae which derive from connective thickening (visceral fasciae). Topographic and comparative approaches allowed to distinguish three different types of fasciae in the neck: the superficial, the deep and the visceral fasciae. The first is most connected to the skin, the second to the muscles and the third to the viscera. The muscular fascia could be further divided into three layers according to the relationship with the different muscles.

KEYWORDS:

Cervical fascia; Deep fascia; Superficial fascia; Visceral fascia

ID 59

Med Biol Eng Comput. 2015 Oct;53(10):951-9. doi: 10.1007/s11517-015-1308-5. Epub 2015 May 16.

Biomechanical behavior of human crural fascia in anterior and posterior regions of the lower limb.

Pavan PG[1,2], Pachera P[3,4], Stecco C[5,4], Natali AN[3,4].

Author information

Abstract

The present work focuses on the numerical modeling of the mechanical behavior of the crural fascia, the deepfascia enwrapping the lower limb muscles. This fascia has an important biomechanical role, due to its interaction with muscles during contraction and its association with pathological events, such as compartment syndrome. The mechanical response of the crural fascia is described by assuming a hyperelastic fiber-reinforced constitutive model, with families of fibers disposed according to the spatial disposition of the collagen network, as shown in histological analyses. A two-dimensional finite element model of a lower limb transversal section has been developed to analyze deformational behavior, with particular attention on interaction phenomena between crural fascia and enwrapped muscles. The constitutive model adopted for the crural fascia well fits experimental data taken along the proximal-distal and medial-lateral directions. The finite element analysis allows for interpreting the relation between change in volume and pressure of muscle compartments and the crural fascia deformation.

KEYWORDS:

Compartment syndrome; Constitutive modeling; Crural fascia; Finite element analysis; Hyperelasticity

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ID 60

J Anat. 2015 Nov;227(5):654-64. doi: 10.1111/joa.12371. Epub 2015 Sep 11.

The role of fasciae in Civinini-Morton's syndrome.

Stecco C[1], Fantoni I[1,2], Macchi V[1], Del Borrello M[3], Porzionato A[1], Biz C[2], De Caro R[1].
Author information

Abstract

This study evaluates the pathogenetic role of the perineural connective tissue and foot fasciae in Civinini-Morton's neuroma. Eleven feet (seven male, four female; mean age: 70.9 years) were dissected to analyse the anatomy of inter-metatarsal space, particularly the dorsal and plantar fasciae and metatarsal transverse ligament (DMTL). The macrosections were prepared for microscopic analysis. Ten Civinini-Morton neuromas obtained from surgery were also analysed. Magnetic resonance images (MRIs) from 40 patients and 29 controls were compared. Dissections showed that the width of the inter-metatarsal space is established by two fibrous structures: the dorsal foot fascia and the DMTL, which, together, connect the metatarsal bones and resist their splaying. Interosseous muscles spread out into the dorsal fascia of the foot, defining its basal tension. The common digital plantar nerve (CDPN) is encased in concentric layers of fibrous and loose connective tissue, continuous with the vascular sheath and deep foot fascia. Outside this sheath, fibroelastic septa, from DMTL to plantar fascia, and little fat lobules are present, further protecting the nerve against compressive stress. The MRI study revealed high inter-individual variability in the forefoot structures, although only the thickness of the dorsal fascia represented a statistically significant difference between cases and controls. It was hypothesized that alterations in foot support and altered biomechanics act on the interosseous muscles, increasing the stiffness of the dorsal fascia, particularly at the points where these muscles are inserted. Chronic rigidity of this fascia increases the stiffness of the inter-metatarsal space, leading to entrapment of the CDPN.

KEYWORDS:

Civinini-Morton's metatarsalgia; common digital plantar nerve; entrapment neuropathy; fascia; neurectomy; neurolysis; neuroma

PMID: 26467241 [PubMed - in process]

ID 61

F1000Res. 2015 Aug 25;4:622. doi: 10.12688/f1000research.6885.1. eCollection 2015.

Viscoelastic Properties of Hyaluronan in Physiological Conditions.

Cowman MK[1], Schmidt TA[2], Raghavan P[3], Stecco A[4].

Author information

Abstract

Hyaluronan (HA) is a high molecular weight glycosaminoglycan of the extracellular matrix (ECM), which is particularly abundant in soft connective tissues. Solutions of HA can be highly viscous with non-Newtonian flow properties. These properties affect the movement of HA-containing fluid layers within and underlying the deep fascia. Changes in the concentration, molecular weight, or even covalent modification of HA in inflammatory conditions, as well as changes in binding interactions with other macromolecules, can have dramatic effects on the sliding movement of fascia. The high molecular weight and the semi-flexible chain of HA are key factors leading to the high viscosity of dilute solutions, and real HA solutions show additional nonideality and greatly increased viscosity due to mutual macromolecular crowding. The shear rate dependence of the viscosity, and the viscoelasticity of HA solutions, depend on the relaxation time of the molecule, which in turn depends on the HA concentration and molecular weight. Temperature can also have an effect on these properties. High viscosity can additionally affect the lubricating function of HA solutions. Immobility can increase the concentration of HA, increase the viscosity, and reduce lubrication and gliding of the layers of connective tissue and muscle. Over time, these changes can alter both muscle structure and function. Inflammation can further increase the viscosity of HA-containing fluids if the HA is modified via covalent attachment of heavy chains derived from Inter-α-Inhibitor. Hyaluronidase hydrolyzes HA, thus reducing its molecular weight, lowering the viscosity of the extracellular matrix fluid and making outflow easier. It can also disrupt any aggregates or gel-like structures that result from HA being modified. Hyaluronidase is used medically primarily as a dispersion agent, but may also be useful in conditions where altered viscosity of the fascia is desired, such as in the treatment of muscle stiffness.

KEYWORDS:

fascia; hyaluronan; lubrication; viscoelasticity; viscosity

PMID: 26594344 [PubMed]

PMCID: PMC4648226

Free PMC Article

ID 62

Conf Proc IEEE Eng Med Biol Soc. 2015 Aug;2015:775-80. doi: 10.1109/EMBC.2015.7318477.

A 3D sparse motion field filtering for quantitative analysis of fascial layers mobility based on 3D ultrasound scans.

Turini G, Condino S, Stecco A, Ferrari V, Ferrari M, Gesi M.

Abstract

In the last few years, there has been an increasing interest in the role of deep fascia mobility in musculoskeletal dynamics and chronic pain mechanisms. In a previous paper we presented an innovative semiautomatic approach to evaluate the 3D motion of the fascia using ultrasound (US) imaging, generating a sparse deformation vector field. This paper presents an improvement of our original method, focusing on the filtering of the sparse vector field and its validation. Moreover, in order to evaluate the performance of the algorithm, a method is proposed to generate synthetic deformation vector fields, including: expansion, rotation, horizontal shear, and oblique shear components. Preliminary tests on the final synthetic deformation vector fields showed promising results. Further experiments are required in order to optimize the tuning of the algorithm.

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ID 63

J Bodyw Mov Ther. 2016 Jan;20(1):139-40. doi: 10.1016/j.jbmt.2015.11.012. Epub 2015 Nov 23.

A fascia and the fascial system.

Stecco C[1], Schleip R[2].
Author information

One of the main topics of the last Fascia Research Congress (Washington, 17–21 September 2015) was the terminology about fascia. Many researchers are convinced that the indiscriminate use of the term “fascia” in reference to various types of connective tissue often leads to confusion. Furthermore, inconsistent use of anatomical terms makes it difficult to compare results across research studies and to draw generalized conclusions (Langevin, 2014). This situation may be comparable to a time in anatomy history described by Adstrum (2014): “more than 50,000 terms were used to identify 5000 structures, so, anatomical terminology was in a state of chaos, incoherent, full of inequities, contradictions, and obscurities”.

PMID: 26891649 [PubMed - in process]

ID 64

Hernia. 2016 May 23. [Epub ahead of print]

The triangles of Grynfeltt and Petit and the lumbar tunnel: an anatomo-radiologic study.

Macchi V[1], Porzionato A[1], Morra A[2], Picardi EE[1], Stecco C[1], Loukas M[3], Tubbs RS[4], De Caro R[5].

Author information

Abstract

PURPOSE:

Lumbar hernias are protrusions of intra-abdominal contents classically through the superior (Grynfeltt) and inferior (Petit) lumbar triangles. The anatomy of the triangles is variable and quantitative data are few. No radiological data on the anatomy of the triangles are available.

METHODS:

Fifty computed tomography angiography of the upper abdomen (M25, F25, mean age 72.5-year-old) were analyzed. The dimensions and the contents of the lumbar triangles were analyzed. The characteristics of the space between the two triangles were also documented.

RESULTS:

The superior lumbar triangle showed a mean surface area of 5.10 ± 2.6 cm^2. In the area of the triangle, the 12th intercostal pedicle and the 1st lumbar branches of the iliolumbar vessels were found in 42 and 46 %, respectively. The inferior lumbar triangle had a mean surface of area 18.7 ± 8.4 cm^2. In this area, the 2nd, 3rd, and 4th lumbar branches were found in 9, 67, and 8 %, respectively. On oblique coronal images, a direct tunnel between the superior and the inferior lumbar triangles was found, showing an oblique course, with a postero-anterior direction (mean length 36.5 ± 5.8 mm, mean caliber 7.4 ± 3.1 mm).

CONCLUSIONS:

Among the anatomical factors of weakening of the abdominal wall, the course of branches of the lumbar vessels was documented not only in the superior but also in the inferior lumbar triangle. A real musculoaponeurotic tunnel between the superior and the inferior lumbar triangles located in the oblique coronal plane was found, that could play a role in the development of incarceration or strangulation of lumbar hernias.

KEYWORDS:

Computed tomography; Hernia; Inferior lumbar triangle; Radiologic anatomy; Superior lumbar triangle

PMID:27215430 [PubMed - as supplied by publisher]

ID 65

EBioMedicine. 2016 Jul;9:306-13. doi: 10.1016/j.ebiom.2016.05.014. Epub 2016 May 13.

Human Recombinant Hyaluronidase Injections For Upper Limb Muscle Stiffness in Individuals With Cerebral Injury: A Case Series.

Raghavan P[1], Lu Y[2], Mirchandani M[3], Stecco A[4].

Spasticity, muscle stiffness and contracture cause severe disability after central nervous system injury. However, current treatment options for spasticity produce muscle weakness which can impede movement, and do not di- rectly address muscle stiffness. Here we propose that the accumulation of hyaluronan within muscles promotes the development of muscle stiffness, and report that treatment with the enzyme hyaluronidase increases upper limb movement and reduces muscle stiffness without producing weakness. 20 patients with unilateral upper limb spasticity received multiple intramuscular injections of human recombinant hyaluronidase with saline at a single visit. The safety and efficacy of the injections, passive and active movement, and muscle stiffness at eight upper limb joints were assessed at four time points: pre-injection (T0), within 2 weeks (T1), within 4– 6 weeks (T2), and within 3–5 months post-injection (T3). There were no clinically significant adverse effects from the injections. Passive movement at all joints, and active movement at most joints increased at T1, and persisted at T2 and T3 for most joints. The modified Ashworth scores also declined significantly over time post-injection. Hyaluronidase injections offer a safe and potentially efficacious treatment for muscle stiffness in neurologically impaired individuals. These results warrant confirmation in placebo-controlled clinical trials.

KEYWORDS: Case series; Connective tissue; Fascia; Hyaluronidase; Hypertonia; Motor control; Spasticity; Stroke

PMID: 27333050 PMCID: PMC4972484 DOI: 10.1016/j.ebiom.2016.05.014

ID 66

J Bodyw Mov Ther. 2016 Oct;20(4):914-919. doi: 10.1016/j.jbmt.2016.04.002. Epub 2016 Apr 7.

Longterm impact of ankle sprains on postural control a nd fascial densification.

Kalichman L[1], Lachman H[2], Freilich N[2].
Author information

Abstract

OBJECTIVE:

To evaluate the effect of a past ankle sprain (AS) on postural control and fascial changes in the adjacent body segment.

METHODS:

20 young, healthy subjects with a history (≥6 months) of significant (Grades 2, 3) lateral ASs and 20 controls with no history of AS were recruited to cross-sectional case-control study. All subjects performed the Star Excursion Balance Test (SEBT). The Stecco method was used to evaluate fascial densification in the calf and upper foot areas.

RESULTS:

The leg with the AS in the study group vs. the right leg in the control group exhibited significant differences (lower scores of SEBT test in the AS group) for the following directions: anterior ($p < 0.001$), antero-lateral ($p < 0.001$), posterior ($P = 0.028$), postero-medial ($P = 0.001$), medial ($P = 0.001$), antero-medial ($p < 0.001$). A comparison between the leg with an AS in the study group and the right leg in the control group showed a significantly high prevalence of fascial densification for the talus internal rotation ($p = 0.014$), talus retromotion ($p = 0.001$), talus lateral ($p = 0.040$) and pes external rotation ($p = 0.060$) points.

CONCLUSIONS:

There are long term effects of an AS on postural control and on the sensitivity and movability of the fascia in the calf and foot.

KEYWORDS:

Ankle sprain; Case-control study; Fascia; Postural control

PMIDI 27814874 DOI: 10.1016/j.jbmt.2016.04.002

ID 67

PM R. 2016 Feb;8(2):161-8. doi: 10.1016/j.pmrj.2015.06.006. Epub 2015 Jun 14.

Fascial Disorders: Implications for Treatment.

Stecco A[1], Stern R[2], Fantoni I[3], De Caro R[4], Stecco C[5].

Abstract

In the past 15 years, multiple articles have appeared that target fascia as an important component of treatment in the field of physical medicine and rehabilitation. To better understand the possible actions of fascial treatments, there is a need to clarify the definition of fascia and how it interacts with various other structures: muscles, nerves, vessels, organs. Fascia is a tissue that occurs throughout the body. However, different kinds of fascia exist. In this narrative review, we demonstrate that symptoms related to dysfunction of the lymphatic system, superficial vein system, and thermoregulation are closely related to dysfunction involving superficial fascia. Dysfunction involving alterations in mechanical coordination, proprioception, balance, myofascial pain, and cramps are more related to deep fascia and the epimysium. Superficial fascia is obviously more superficial than the other types and contains more elastic tissue. Consequently, effective treatment can probably be achieved with light massage or with treatment modalities that use large surfaces that spread the friction in the first layers of the subcutis. The deep fasciae and the epymisium require treatment that generates enough pressure to reach the surface of muscles. For this reason, the use of small surface tools and manual deep friction with the knuckles or elbows are indicated. Due to different anatomical locations and to the qualities of the fascial tissue, it is important to recognize that different modalities of approach have to be taken into consideration when considering treatment options.

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DOI:10.1016/j.pmrj.2015.06.006

ID 68

J Bodyw Mov Ther. 2016 Jan;20(1):139-40. doi: 10.1016/j.jbmt.2015.11.012. Epub 2015 Nov 23.

A fascia and the fascial system.

Stecco C[1], Schleip R[2].

One of the main topics of the last Fascia Research Congress (Washington, 17–21 September 2015) was the terminology about fascia. Many researchers are convinced that the indiscriminate use of the term “fascia” in reference to various types of connective tissue often leads to confusion. Furthermore, inconsistent use of anatomical terms makes it difficult to compare results across research studies and to draw generalized conclusions (Langevin, 2014). This situation may be comparable to a time in anatomy history described by Adstrum (2014): “more than 50,000 terms were used to identify 5000 structures, so, anatomical terminology was in a state of chaos, incoherent, full of inequities, contradictions, and obscurities”.

ID 69

Eur J Histochem. 2016 Jun 28;60(2):2643. doi: 10.4081/ejh.2016.2643.

Expression of the endocannabinoid receptors in human fascial tissue.

Fede C[1], Albertin G, Petrelli L, Sfriso MM, Biz C, De Caro R, Stecco C.
Author information

Abstract

Cannabinoid receptors have been localized in the central and peripheral nervous system as well as on cells of the immune system, but recent studies on animal tissue gave evidence for the presence of cannabinoid receptors in different types of tissues. Their presence was supposed also in myofascial tissue, suggesting that the endocannabinoid system may help resolve myofascial trigger points and relieve symptoms of fibromyalgia. However, until now the expression of CB1 (cannabinoid receptor 1) and CB2 (cannabinoid receptor 2) in fasciae has not yet been established. Small samples of fascia were collected from volunteers patients during orthopedic surgery. For each sample were done a cell isolation, immunohistochemical investigation (CB1 and CB2 antibodies) and real time RT-PCR to detect the expression of CB1 and CB2. Both cannabinoid receptors are expressed in human fascia and in human fascial fibroblasts culture cells, although to a lesser extent than the control gene. We can assume that the expression of mRNA and protein of CB1 and CB2 receptors in fascial tissue are concentrated into the fibroblasts. This is the first demonstration that the fibroblasts of the muscular fasciae express CB1 and CB2. The presence of these receptors could help to provide a description of cannabinoid receptors distribution and to better explain the role of fasciae as pain generator and the efficacy of some fascial treatments. Indeed the endocannabinoid receptors of fascial fibroblasts can contribute to modulate the fascial fibrosis and inflammation.

PMID: 27349320

PMCID: PMC4933831

DOI: 10.4081/ejh.2016.2643

ID 70

Eur J Histochem. 2016 Nov 2;60(4):2710. doi: 10.4081/ejh.2016.2710.

Hormone receptor expression in human fascial tissue.

Fede C[1], Albertin G, Petrelli L, Sfriso MM, Biz C, De Caro R, Stecco C.
Author information

Abstract

Many epidemiologic, clinical, and experimental findings point to sex differences in myofascial pain in view of the fact that adult women tend to have more myofascial problems with respect to men. It is possible that one of the stimuli to sensitization of fascial nociceptors could come from hormonal factors such as estrogen and relaxin, that are involved in extracellular matrix and collagen remodeling and thus contribute to functions of myofascial tissue. Immunohistochemical and molecular investigations (real-time PCR analysis) of relaxin receptor 1 (RXFP1) and estrogen receptor-alpha (ERα) localization were carried out on sample of human fascia collected from 8 volunteers patients during orthopedic surgery (all females, between 42 and 70 yrs, divided into pre- and post-menopausal groups), and in fibroblasts isolated from deep fascia, to examine both protein and RNA expression levels. We can assume that the two sex hormone receptors analyzed are expressed in all the human fascial districts examined and in fascial fibroblasts culture cells, to a lesser degree in the post-menopausal with respect to the pre-menopausal women. Hormone receptor expression was concentrated in the fibroblasts, and RXFP1 was also evident in blood vessels and nerves. Our results are the first demonstrating that the fibroblasts located within different districts of the muscular fasciae express sex hormone receptors and can help to explain the link between hormonal factors and myofascial pain. It is known, in fact, that estrogen and relaxin play a key role in extracellular matrix remodeling by inhibiting fibrosis and inflammatory activities, both important factors affecting fascial stiffness and sensitization of fascial nociceptors.

PMID: 28076930

PMCID PMC5134680

DOI: 10.4081/ejh.2016.2710

ID 71

J Bodyw Mov Ther. 2017 Jan;21(1):173-177. doi: 10.1016/j.jbmt.2016.11.003. Epub 2016 Nov 16.

Defining the fascial system.

Adstrum S[1], Hedley G[2], Schleip R[3], Stecco C[4], Yucesoy CA[5].
Author information

Abstract

Fascia is a widely used yet indistinctly defined anatomical term that is concurrently applied to the description of soft collagenous connective tissue, distinct sections of membranous tissue, and a body pervading soft connective tissue system. Inconsistent use of this term is causing concern due to its potential to confuse technical communication about fascia in global, multiple discipline- and multiple profession-spanning discourse environments. The Fascia Research Society acted to address this issue by establishing a FasciaNomenclature Committee (FNC) whose purpose was to clarify the terminology relating to fascia. This committee has since developed and defined the terms a fascia, and, more recently, the fascial system. This article reports on the FNC's proposed definition of the fascialsystem.

KEYWORDS:

A fascia; Anatomical nomenclature; Anatomical terminology; Fascia; Fascial system; Terminologia anatomica

PMID: 28167173

DOI: 10.1016/j.jbmt.2016.11.003

ID 72

J Anat. 2017 May 3. doi: 10.1111/joa.12617. [Epub ahead of print]

Microscopic anatomy of the visceral fasciae.

Stecco C[1], Sfriso MM[1], Porzionato A[1], Rambaldo A[1], Albertin G[1], Macchi V[1], De Caro R[1].
Author information

Abstract

The term 'visceral fascia' is a general term used to describe the fascia lying immediately beneath the mesothelium of the serosa, together with that immediately surrounding the viscera, but there are many types of visceral fasciae. The aim of this paper was to identify the features they have in common and their specialisations. The visceral fascia of the abdomen (corresponding to the connective tissue lying immediately beneath the mesothelium of the parietal peritoneum), thorax (corresponding to the connective tissue lying immediately beneath the mesothelium of the parietal pleura), lung (corresponding to the connective tissue under the mesothelium of the visceralpleura), liver (corresponding to the connective tissue under the mesothelium of the visceral peritoneum), kidney (corresponding to the Gerota fascia), the oesophagus (corresponding to its adventitia) and heart (corresponding to the fibrous layer of the pericardial sac) from eight fresh cadavers were sampled and analysed with histological and immunohistochemical stains to evaluate collagen and elastic components and innervation. Although the visceral fasciae make up a well-defined layer of connective tissue, the thickness, percentage of elastic fibres and innervation vary among the different viscera. In particular, the fascia of the lung has a mean thickness of 134 μm (± 21), that of heart 792 μm (± 132), oesophagus 105 μm (± 10), liver 131 μm (± 18), Gerota fascia 1009 μm (± 105) and the visceral fasciaof the abdomen 987 μm (± 90). The greatest number of elastic fibres (9.79%) was found in the adventitia of the oesophagus. The connective layers lying immediately outside the mesothelium of the pleura and peritoneum also have many elastic fibres (4.98% and 4.52%, respectively), whereas the pericardium and Gerota fascia have few (0.27% and 1.38%). In the pleura, peritoneum and adventitia of the oesophagus, elastic fibres form a

well-defined layer, corresponding to the elastic lamina, while in the other cases they are thinner and scattered in the connective tissue. Collagen fibres also show precise spatial organisation, being arranged in several layers. In each layer, all the fibrous bundles are parallel with each other, but change direction among layers. Loose connective tissue rich in elastic fibres is found between contiguous fibrous layers. Unmyelinated nerve fibres were found in all samples, but myelinated fibres were only found in some fasciae, such as those of the liver and heart, and the visceral fascia of the abdomen. According to these findings, we propose distinguishing the visceral fasciae into two large groups. The first group includes all the fasciae closely related to the individual organ and giving shape to it, supporting the parenchyma; these are thin, elastic and very well innervated. The second group comprises all the fibrous sheets forming the compartments for the organs and also connecting the internal organs to the musculoskeletal system. These fasciae are thick, less elastic and less innervated, but they contain larger and myelinated nerves. We propose to call the first type of fasciae 'investing fasciae', and the second type 'insertional fasciae'.

KEYWORDS:

Gerota fascia; elastic lamina; pericardium; peritoneum; serous membrane; visceral fascia; visceral manipulation

PMID: 28466969

DOI: 10.1111/joa.12617

ID 73

J Bodyw Mov Ther. 2017 Apr;21(2):452-458. doi: 10.1016/j.jbmt.2016.08.014. Epub 2016 Sep 4.

Fascial Manipulation®
for persistent knee pain following ACL and meniscus repair.

Rajasekar S[1], Marchand AM[2].
Author information

Abstract

Fascial Manipulation® (FM) is a manual therapy approach for the treatment of musculoskeletal pain. Anomalous fascial tension is common following surgery due to surgical scar, inadequate mobility and fear of movement. Fascial tension may result in pain and loss of mobility. This case report aims at investigating the effectiveness of FM® on pain and function in a patient following knee surgery. A 32 years old male patient, with persisting knee pain following anterior cruciate ligament reconstruction (hamstring graft) and meniscal repair, underwent the systematic FM® assessment process, the selected centers of coordination of myofascial units were treated. KneeInjury Osteoarthritis Outcome Score (KOOS) questionnaire was obtained prior treatment and after 4 treatment sessions. Results showed clinically significant improvements in all subscales of KOOS after 4 weeks, the effect was maintained in subsequent follow-ups at 3 months, 6 months, one year and two years.

KEYWORDS:

Fascia; Fascial Manipulation(®); Persistent knee pain

PMID:28532890

DOI:10.1016/j.jbmt.2016.08.014

ID 74

Eur J Phys Rehabil Med. 2017 May 2. doi: 10.23736/S1973-9087.17.04732-3. [Epub ahead of print]

Evaluation of fascial manipulation in carpal tunnel synd rome: a pilot randomized clinical trial.

Pintucci M[1], Imamura M[2], Thibaut A[3], de Exel Nunes LM[4], Mayumi Nagato M[1], Hideko Seguchi Kaziyama H[1], Tomikawa Imamura S[1], Stecco A[5], Fregni F[6], Rizzo Battistella L[2].
Author information

PMID:

28466629

DOI:

10.23736/S1973-9087.17.04732-3

ID 75

Successful treatment of rotator cuff tear using Fascial Manipulation® in a stroke patient

Marco Pintucci, Marcel Simis, Marta Imamura, Elisa Pratelli, Antonio Stecco, Levent Ozcakar, Linamara Rizzo Battistella

Abstract

Rotator cuff tear is a common disease affecting patients after stroke. It's a cause of pain and dysfunction that may compromise normal stroke rehabilitation.

For many cases there is still controversy between whether to use surgical or conservative intervention. Treatment for cuff tears range from physical therapy to surgery. This paper describes for the first time the effect of Fascial Manipulation® (FM®) on rotator cuff tear in a post stroke patient.

A 69 year old female stroke patient with full absence of distal components of the tendons of the rotator cuff, functional limitations on active movement of shoulder flexion and abduction of the left arm and perceived pain scored 10/10 on the Visual Analogic Scale, was assessed and treat with one session of FM®

A basic theory that explains the healing results of FM® is that mechanoreceptors, such as spindle cells and other receptors, are located in the deep fascia and activated when movement are performed. Increased viscosity of the deep fascia and muscles due to increased viscosity of hyaluronic acid (HA) molecules prevents the normal gliding of fascia during movement inhibiting normal proprioception and muscle function.

Keywords:

Fascial Manipulation®, Rotator cuff tear, Stroke, Painful shoulder.

DOI: http://dx.doi.org/10.1016/j.jbmt.2016.12.007

ID 76

Orthopedic & Muscular System: Current Research

Kannabiran B et al., Orthop Muscular Syst 2017, 6:1 DOI: 10.4172/2161-0533.1000230

Effectiveness of Fascial Manipulation on Pain, Grip Strength, and Functional Performance in Chronic Lateral Epicondylitis Patients

Bhojan Kannabiran*, Rispal Manimegalai and Ramasamy Nagarani

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Abstract

Fascial manipulation is an effective tool in the management of the musculoskeletal disorders. This can be

used to address pain, grip strength, functional performance in tennis elbow (lateral epicondylitis patients) patients. The specific objective of the study was to evaluate the efficacy of fascial manipulation in tennis elbow its role in decreasing pain , improving the grip strength and overall functional performance is also evaluated. A total of twenty samples participated in the study. Reduction in pain intensity was significant, gaining the fascial connection of the neuromusculoskeletal system may also assist patients in accepting why movement of body parts distant from the site of symptoms may be used as a treatment approach to manipulate fascial tissues. Fascial manipulation techniques are passive manipulations on selected points that focus on restoring the ability of the fascial system to tolerate the normal compressive, friction, and tensile forces associated with daily and sport activities.

Question: Role of fascial manipulation in management of chronic lateral epicondylitis.

Design: Pre –post experimental study design.

Participants: Chronic lateral epicondylitis (tennis elbow) who have pain, decreased grip strength and disturbed functional performance in the Age group 25-40 include both sexes (male and female).

Intervention: Fascial manipulation technique on two centers of coordination and one center of fusion, stretching and ultrasound therapy.

Outcome measures: Pain and functional performance using Patient Rated Tennis Elbow Evaluation (PRTEE) questionnaire, grip strength was measured using hand dynamometer.

Results and conclusion: The result concluded that fascial manipulation is more effective than ultrasound therapy with stretching in the management of lateral epicondylitis subjects and hence it can be effectively used to reduce pain, increase grip strength and functional performance in lateral epicondylitis (tennis elbow) patients.