ROLE OF FASCIA IN NON-SPECIFIC LOW BACK PAIN

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In the back we can recognize a multilayered myofascial and aponeurotic structure whose characteristics change according to its location. The most famous and known fascial structure of the back is the thoracolumbar fascia (TLF), but many other fascial structures exist in the trunk, and they play an essential role in the transfer of loads between the trunk and extremities and help to maintain the stability of the lumbosacral area. The good way to understand the fascial anatomy of low back and pelvis is to follow the anatomical planes. So, we can recognize one superficial fascia (related with the hypodermis), three layers of deep fasciae (related with the locomotor system) and various internal fasciae (related with the internal organs) (Stecco, 2015).

The Superficial Fascia: In the trunk the superficial fascia is easily recognized as a white, fibrous layer of connective tissue dividing the hypodermis in two sublayers: the superficial and deep adipose tissue. It is called in different ways according with the various regions: Scarpa's fascia in the abdomen, Colles's fascia in the pelvis, Dartos muscle in the scrotum, dorsal thoracic fascia in the parascapular region, etc. Really, it forms a continuum through the trunk. The superficial fascia envelopes the superficial vessels and nerves and is richly innervated. Sometimes inside the superficial fascia of the trunk some striated muscular fibers are observed. In particular, they are always present and well organized around the anus, forming the external anal sphincter. The superficial fascia is connected to the skin (retinaculum cutis superficialis) and to the deep fascia (retinaculum cutis profundus) by fibrous septa, forming a three-dimensional network between the fat lobules of the hypodermis. This network provides a dynamic anchor of the skin to underlying tissues and permits a flexible and yet resistant mechanism of transmission of mechanical loads from multi-directional forces. Their quantity and morphological characteristics vary according to the region of the body. For example the thigh has the highest average number of retinacula cutis while in the penis and in the scrotum the adipose tissue and the retinacula cutis are absent, and so the skin shows an increased mobility with respect to the underlying planes. From a clinical point of view, the superficial fascia probably has not a role in muscular force transmission and motor coordination, but it plays a key role in skin tropism, subcutaneous fat tissue organization (and cellulitis), lymph drainage, thermoregulation, venous return, etc. Consequently it is important to maintain its elasticity and mobility. Probably the foam rollers and soft massages can affect the superficial fascia.

The Deep Fascia: in the trunk the deep (or muscular) fascia is organized in three different layers. The superficial layer invests the trapezius, the latissimus dorsi, the gluteus maximus, the pectoralis major, the oblique external muscle and includes the posterior layer of the thoracolumbar fascia. Besides, it continues in the pelvis with the Buck's fascia (in the penis), with the superficial transverse perineal muscle and Gallaudet fascia, the central tendon of perineum, the external anal sphincter and the superficial portion of the anococcygeal ligament (Ramin et al, 2016). This myofascial layer plays a key role in the coordination between trunk and extremities and in the spiral movements.

The intermediate layer is formed by the rhomboid and the serratus posterior muscles with their fascia. Distally this complex fuses with the inner aspect of the posterior layer of the thoracolumbar fascia. Anteriorly it continues with the serratus anterior fascia and then with the clavipectoral fascia. This myofascial layer allows a perfect plane of gliding between the superficial muscles and to the deeper muscles and it connects all the muscles involved in the scapular stability.

The deep layer includes the anterior (or middle layer, in the three layers model, Willard et al, 2012) layer of the thoracolumbar fascia, the erector spinae muscles, the transversus abdominis and oblique internal muscles. From an evolutionary point of view, the rectus abdominis, transversus, quadrates lomborum and psoas muscles derive from the hypoaxial muscles. The hypoaxial muscles are divided from the epiaxial muscles by a septum, which in human correspond to the anterior layer of the thoracolumbar fascia (in the two layers model). The mass of the hypoaxial muscles evolved around the visceral cavity of the abdomen to form the various muscles, but the fascia maintains the connection among the various elements. In the pelvis this layer continues, from the front to the back, in the urogenital diaphragm, central tendon of perineum, levator ani muscle, deep portion of the anococcygeal ligament, presacral fascia. The levator ani muscle could be assumed as an ideal boundary line stretching the urogenital triangle anteriorly and the deep transverse perineal muscle posteriorly. This deep myofascial layer has an important role in posture and weight bearing.

Among these fascial layers, some "lines of fusion" can be recognized. They are well defined points where the muscles and fasciae of one layer merge with the muscles and fasciae of an adjacent layer. These lines of fusion guarantee the coordination among the various muscular groups. The most important lines of fusion are the linea alba and the semilunar line (or Spigelian line) in the abdomen, the lateral raphe and the line over the spinous process in the back, and the central tendon of perineum in the pelvic floor. These lines have the role of re-distributing the muscular tensions, permitting a better balance of the body. If these myofascial layers and lines of adhesions are analyzed in a transversal section of the trunk, it is evident as a perfect symmetry between the erector spinae in the back, enveloped by the TLF, and the rectus abdominis in the front, enveloped by the rectus sheath. The fasciae of the large abdominal muscles connect and stretch both the fascial envelopes during every muscular contraction. So, the fascial anatomy can better explain the concept of core, and as the abdominal muscles can play a role in the spine stability.

The deep fasciae are fibrous layers of connective tissue, perfect to transmit the forces at a distance. This function was demonstrated by Vleeming (1995) for the posterior layer of the thoracolumbar fascia. Indeed, it permits a definite coupling between the gluteus maximus and the contralateral latissimus dorsi muscle. Both of these muscles conduct the forces contra laterally during gait and tense the TLF. In so doing they are important in rotation of the trunk and stabilization of the lower lumbar spine and sacroiliac joints. Due to the different fiber directions of the latissimus dorsi and gluteus maximus, the posterior layer of the TLF has a cross-hatched appearance. Therefore, we can consider the posterior layer of the thoracolumbar fascia as a big retinaculum that connect the two halves of the body with the upper and lower limbs. This structure allows proper balance and distribution of forces that act in the lumbosacral region during movements, notably the pendulum-like actions of the contralateral arms and legs during walking and running. This knowledge emphasizes the fact that local pain for example in the sacroiliac joint may be due to any of the structures associated with the transfer of forces from for example, the biceps femoris to the sacrotuberous ligament, to the erector spinae to the thoracolumbar fascia to the contralateral latissimus dorsi. Really, to understand the biomechanics of this region and to implement the effective rehabilitation in individuals with low back and pelvic girdle pain, we have to consider also the anatomical continuity of the TLF with the abdominal muscles and pelvic floor. Lower back symptoms may find origin and explanation in pelvic floor diseases. Vleeming with his study group (1997) have shown that pain and tenderness in palpation of the long dorsal sacroiliac ligament is a common finding among patients with pelvic girdle dysfunction. Besides, muscle contraction tensions the fascia which is one of the key elements in the pelvic force closure. Movement control disorders and impaired pelvic force closure are common findings among patients suffering from non specific low back pain. Fascia in richly innervated (Tesarz et al 2011) so its tensioning has impact on the muscle recruitment and movement control. Dysfunctioning of the fascia can cause changes in the timing and synergistic function of the muscles, and consequently abnormal loading on many of the structures and it can result in pain. This knowledge could improve the understanding of clinical presentation and treatment of pelvic pain, such as in the case of pelvic pain resulting from abdominal (eg. caesarean section, abdominal surgery) or lumbar injuries. This new concept could improve the treatment of chronic pain and lead to an important enhancement in the current anatomical knowledge and therapies. For example usually, the pelvic pain and knee pain are considered two separate problems, evaluated by different specialists and treated in different manner (Pasini et al, 2016). Really, if we consider that the deep fascia of the thigh connects the pelvic floor with the knee, we can image that the two problems are connected. In this way a deeper analysis of the patients with pelvic pain in combination with other pain, or surgery, or traumas, should be done to better outline the situation.

The fascial anatomy permits a change of perspective, suggesting that when a patient complains low back or pelvic pain, it is important to investigate if there are also other symptoms or problems associated. The severity and the timing of appearance of the various pains can help to understand what is the main problem of that patients and what are the compensations. Surely, only a global treatment of all the problems of that patients, analyzed according with the fascial continuity, can permit a complete and durable result.

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