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A Review of Cervical Spondylosis under a Holistic View of Fascial Chains

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Abstract: *In traditional Chinese medicine, the concept of the human body as a whole is proposed, which refers to the physiological and pathological correlation and influence of various tissues and organs of the human body. Modern fascial theories also emphasize a holistic view of the fascial network. Long term chronic pain is often induced outside the pain zone, and looking for abnormalities based on the fascial chain can often find abnormalities at the distal end, such as nodules, excessively tense fasciae, changes in the skeletal system, and so on. The treatment and rehabilitation of patients are also a holistic process that can be evaluated, treated, and rehabilitated through exercise based on the fascia chain theory. The author discusses the treatment of cervical spondylosis from the perspective of the whole fascia.*

Keywords: *Fascial network; Fascial chain; Holism; Cervical spondylopathy; review*

1. Introduction

Neck pain is currently the most common disease problem in society. Under the influence of work and lifestyle patterns, cervical spondylosis, mainly characterized by neck pain, is on the rise year by year, and the age groups related to the disease are gradually involving young people and children. According to the survey of global epidemiology of neck pain [1] in 2022, the global age standardized prevalence and incidence rate of neck pain are 4. 2017/35511 and 806. 6/100000, respectively. The treatment of neck pain and the associated physical, social, psychological, and personal risk factors caused by pain are key to clinical treatment and rehabilitation.

Cervical spondylosis is a type of cervical spondylosis classification, characterized by abnormal sensations mainly in the occipital, cervical, and shoulder areas. Corresponding pain points can be palpated in the relevant muscle groups, excluding pain in neck related areas caused by other diseases. Imaging studies may be accompanied by cervical degenerative changes, but due to limited research on the association between imaging parameters of cervical spondylosis and cervical degenerative changes, we cannot confirm a positive correlation between the two [2]. At present, the treatment methods for cervical spondylosis are mainly divided into drugs (acetaminophen and other non steroidal anti-inflammatory drugs [NSAIDs], opioids, skeletal muscle relaxants [SMRs], benzodiazepines, antidepressants, anticonvulsants and systemic corticosteroids) and non drugs (psychotherapy, multidisciplinary rehabilitation, spinal massage, acupuncture and moxibustion, massage, sports and related therapies, as well as various physical methods) [3]. If chronic neck pain caused by neurological reasons can be treated by nerve block and radiofrequency denervation [4].

Thanks to relevant theories at home and abroad, we have sufficient theoretical knowledge and clinical practice in the treatment and rehabilitation of cervical spondylosis. This article explores the connotation of fascial chain theory, the correlation between fascial chain theory and cervical spondylosis, and provides new ideas and plans to guide our clinical treatment of cervical spondylosis.

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2. Fascia

2.1. Naming of fascia

In 1989, the Federal Council on Anatomical Terminology (FCAT) introduced the terms "superficial fascia" and "deep fascia".

2.2. Anatomy of fascia

The book "Anatomy Train" [5] points out that there are three major networks in the anatomical system of the human body, namely neural network, humoral network, and fibrous (fascial) network, which are both independent and interconnected, connecting the entire body of the human body. The fiber (fascia) network, as an independent overall structure, is filled with various cells and organs of the human body in its internal structural system.

2.3. Fascia theory

The fascia theory has broad and narrow definitions. Broadly speaking, fascia can be simply understood as the connective tissue of the human body, while narrowly defined fascia divides it into superficial fascia and deep fascia. The superficial fascia is the subcutaneous fascia that covers the entire body and forms loose connective tissue; The deep fascia includes myofascia and tendon fascia, which are important components of the motor system.

3. Fascial Chain Theory

3.1. Connotation of Fascial Chain Theory

Fascial chain is a clinically significant body structure analysis method constructed based on the fascial theory.

The traditional view of physiological movement is based on muscles as independent executive units, but in 1997 Myers, 2014 Wilke et al. proposed a new hypothesis that fascia is a tension network structure that connects skeletal muscles. In this hypothetical perspective, Frieder Krause's systematic research and analysis based on anatomy and relevant literature have proven that intermuscular forces exist through the mechanical conduction of fascial chains, providing evidence for the existence of fascial chains [6]. Professor Guan Ling mentioned that "an ideal spatial and mechanical equilibrium (tension and contraction) is a condition for disease recovery. The support of the human body system is only tension and contraction force. For example, when tightening a rope, the rope itself generates a contraction force perpendicular to the tension and towards the inside of the rope. When squeezing the rubber pad, the rubber pad itself generates a tension force perpendicular to the compression force and towards the outside of the rubber pad (formally in the form of tension). The combination of various modes of tensile force (which is often in the form of tension in the human body) and compressive force forms the most basic mechanical structure in the human body, namely the tensioned integral structure. In the human movement system, fascia (not just tendons or ligaments) serves as the tension element, while bones (not individual bones) serve as the pressure element. Only when the tension of fascia inward or the thrust of bones outward is balanced, can the overall structure be stabilized [7]. The overall tension structure is composed of several local tension structures, and under such biomechanics, the skeletal muscle system conducts force transmission or force "signal transmission" for coordinated movement of the whole body.

The anatomical knowledge of the movement system in modern medicine usually divides bones and muscles. Under such anatomical concepts, the human movement system localizes and isolates movement, simply presenting human movement as a simple mechanical pattern. However, in actual human movement, local movements will affect the whole because of the existence of the fascial network, which links the musculoskeletal system into a tight whole. Local movements will receive a global response under the coordination of the fascial network. The holistic view is the core of the "myofascial chain" theory.

3.2. Distribution of fascial chains

THOMAS has summarized 12 types of fascial chains that travel on the surface of the human body

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during stationary or specific joint activities, namely the human skeletal muscles and muscle attachment points that form the human fascial force lines under the direct or indirect action of the fascia. There are 12 common myofascial chains that have been proven by practical experimental evidence [8], including the anterior surface line, posterior surface line, lateral line, spiral line, anterior deep line of the arm, anterior surface line of the arm, posterior deep line of the arm, posterior surface line of the arm, posterior functional line, anterior functional line, ipsilateral functional line, and anterior deep line [9].

3.3. Fascial Chain Theory and Traditional Chinese Medicine Meridian and Muscle Theory

Under the support of anatomy, soft tissues such as muscles, tendons, ligaments, and joint capsules are collectively referred to as "meridian tendons", which is the definition of meridian tendons in terms of content; In the "Shuowen Jiezi", it is explained that "tendons are the power of flesh; meridians are woven", which means that meridians are distributed in the human body without entering the inner body, connecting the limbs and bones, and regulating movement. This is a functional clarification of meridians.

With the support of fascial anatomy, the fascial chain not only shares similarities with the meridians in terms of circulation, but also most of the acupoints in the meridians are located at the bone muscle junction points and travel trajectories on the fascial chain that share similarities with this meridian [10]; The movement structure composed of tendons and bones is also a "tensioned whole structure", and the fascial chain and tendons follow the multidimensional three-dimensional structure of the body's construction [11]. The integrity, functionality, and treatment principles of the structural fascial chain are closely related to the meridian theory.

When exploring the close relationship between meridians and fascial chains in depth, it is not difficult to find that the two have a high degree of fit at the anatomical and functional levels. According to the latest research in fascial anatomy, the fascial chain, as a continuous and complex fiber network in the human body, not only corresponds to the meridian pathways described in ancient medical texts in terms of appearance, but also plays a role similar to that of meridians in function - connecting the limbs and bones, coordinating and dominating the body's motor functions.

Specifically, the corresponding tendon of each meridian can often be found in the fascial chain system, along with its corresponding bone muscle junction point and walking trajectory. For example, the Hand Tai Yin Lung Meridian runs along the inner front edge of the upper limb, involving key areas such as fingers, wrist joints, and elbow joints. The corresponding fascial chains tightly surround these areas, forming a stable support and movement network. Similarly, the meridians covered by the Foot Yangming Stomach Meridian ascend from the anterior lateral side of the lower limbs to the abdomen, and are closely intertwined with the fascial chain responsible for transmitting and maintaining lower limb strength, jointly maintaining complex movements such as standing, walking, and running in the human body.

In addition, the movement structure constructed by tendons and bones is similar to the "tensioned whole structure" in modern mechanics, emphasizing the interaction and balance between various elements, which coincides with the multidimensional three-dimensional structure constructed by fascial chains in the body. This structure not only ensures the stability and flexibility of the human body, but also endows the body with the ability to quickly adjust and adapt to changes in the external environment.

In terms of treatment principles, the theory of meridians and tendons is also compatible with the concept of fascial chains. Whether it is through traditional Chinese medicine techniques such as acupuncture and moxibustion and massage to act on the tendons, or the techniques such as fasciolysis and muscle stretching in modern rehabilitation medicine to treat the fascial chain, its purpose is to restore the normal tension and function of the tissue, promote the circulation of qi and blood, so as to relieve pain and improve movement disorders. This interdisciplinary integration and complementarity not only enriches our understanding of human structure and function, but also provides broader ideas and means for clinical treatment.

4. Cervical pain under the theory of fascial chains

4.1. Pain under the theory of fascial chain

In fascial theory, dysfunction or organic lesions of the fascia are considered the source of pain. When pressure is applied, the fascia will change its tension state and transmit this change along its fascial force line [12]. At the cellular level, changes in this force can affect the gene expression of myofibroblasts, alter the extracellular matrix [13], and increase the secretion of inflammatory mediators. The local fascial

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network, such as fiber densification or increased matrix viscosity in fibers, can affect the functional changes of the skeletal muscle system. The nerve endings and proprioceptors that pass through the fascia sense this pathological change, leading to proprioceptive abnormalities and even pain in humans [14]. The densification of deep fascia tissue can alter its physical properties and further impair the function of muscles or organs enclosed within the deep fascia.

When delving into the complex functions of the fascial system and its association with pain, we have to examine its unique mechanical transmission mechanism from both micro and macro dimensions. The fascial system, as a broad network that runs through the whole body and connects muscles, bones, and internal organs, is filled with intricate fiber structures that not only provide support and stability for the body, but also play a central role in the transmission of mechanical signals.

From a microscopic perspective, physical changes within the fascia, such as fiber arrangement, tension changes, and water distribution, directly affect the adjustment of its mechanical properties. When the fascia in a certain area is subjected to external forces or internal lesions, local fibers may undergo densification, forming a so-called "blockage" phenomenon. This local variation can interfere with the smooth transmission of mechanical signals, leading to an imbalance in the mechanical environment of the region and its surrounding tissues. The abnormal transmission of mechanical signals further triggers a series of physiological reactions, including inflammatory reactions, activation of nerve endings, and sensitization of pain receptors, leading to pain.

From a macro perspective, the fascial chain theory provides us with a more comprehensive and dynamic framework for understanding. Under this framework, fascia is no longer an isolated structure, but a holistic network that connects and influences each other. When a local part of a fascial chain is damaged, this damage is not limited to the damaged point itself, but also affects other connected parts through the mechanical conduction of the fascial chain. This effect may be achieved through direct mechanical traction or indirect pathways such as neuromuscular reflexes and endocrine regulation. Therefore, the manifestation of pain is often not only a local problem that has already been clearly felt, but also a warning signal from potential problem areas in the distal fascia chain that have not yet shown obvious pain.

Further analysis shows that when a local part of a fascial chain is damaged, in order to maintain overall stability and function of the body, other fascial chains connected to it may be forced to bear more load. This overloaded working state is likely to cause secondary or compensatory damage to them as well [15]. Although these injuries may not initially cause significant pain sensation, over time and with the accumulation of injuries, they will eventually become an important source of pain. Therefore, when analyzing pain from the perspective of fascial chain theory, we need to have a global and dynamic view.

4.2. Evidence based pain in the fascial chain field of view

The painful area is often not the real lesion. The treatment of plantar fasciitis (PF) is difficult to solve the problem of recurrent pain in patients. While giving sufficient attention to the affected area, we should also search for lesions that cause abnormal tension in PF. Through ultrasound exploration on the posterior cingulate cortex, mechanical changes in the hamstring, gastrocnemius, and hip and hip muscles can all lead to abnormal conduction of force in the posterior cingulate cortex, inducing difficult to recover PF [16]. The same release of plantar fascia can effectively improve the tension and flexibility of the hamstring muscles [17]. Lower back pain is also related to abnormal myofascial force transmission through the sacral ligament of the hamstring muscles [18]; Neck, eye, and craniofacial pain are also related to the posterior fascia chain extending from the feet to the eyes. Abnormal fascial tension in the sacroiliac joint can lead to movement disorders in the contralateral shoulder joint [19]. Excessive internal rotation of the ankle and arch collapse can cause scoliosis or exacerbate spinal curvature through spiral chains [20]. The treatment of carpal tunnel syndrome by relieving the compression of the transverse carpal ligament on the nerves through surgery does not release the fascia of the anterior deep line of the arm, and postoperative trigger finger symptoms often occur [21]. The abnormal tension of a fascial node is often not caused by an imbalance in tension of a fascial chain. Lower back pain may be compensatory pain caused by an imbalance in the tension structure of one or more fascial chains in the posterior surface line, lateral body line, spiral line, or anterior deep line. The existing fascial chains can serve as a good basis for clinical evidence of chronic pain. Of course, we cannot be confined to the existing fascial chains. Pain evidence from the perspective of fascial chains only provides a valuable holistic thinking for finding the source of pain in clinical treatment.

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5. Treatment of cervical spondylosis under the perspective of fascial chain

5.1. Treatment ideas for cervical spondylosis under the perspective of fascial chain

Remote fascial release techniques along the fascial chain can effectively alleviate neck symptoms in patients [22]. The superficial and deep muscle groups in the neck have corresponding fascial chains, such as the posterior surface line erector spinae muscle; Anterior and lateral lines - sternocleidomastoid muscle; Lateral and spiral lines of the body - biceps; Spiral line - neck muscles; Brachial posterior surface line - trapezius muscle; The precursor line includes the anterior fascia, pharyngeal suture, scalene and middle scalene fascia, and cervical transverse process. These muscle groups and fascia not only affect the movement of the neck independently, but also cause neck pain and posture dysfunction due to the influence of the "stations and tracks" in their corresponding fascial chain sequence. Taking the posterior epiglottis as an example, the posterior epiglottis starts from the metatarsal surface of the phalanx and runs along the dorsal side of the human body to the brow arch of the frontal bone. When abnormal conditions such as hamstring shortening, pelvic anterior displacement, and extensor muscle enlargement occur during thoracic flexion, it will affect neck posture function along the fascial chain; For example, when cervical pain is caused by abnormal pathological posture of the thoracic vertebrae [23], we can effectively improve the pain by treating the thoracic vertebrae [24]; When the tension and contraction of the hamstring muscles cause neck posture dysfunction, static stretching of the hamstring and gastrocnemius muscles in the lower limbs effectively improves the flexion and extension range of motion of the cervical spine [25]. The pain of cervical spondylosis manifests as local and scapular pain. Based on local treatment, can we treat the fascial imbalance points affecting the neck according to the holistic concept of the fascial chain? Can we evaluate the patient's posture and provide a rehabilitation exercise treatment plan based on the fascial chain?

5.2. Treatment methods for cervical spondylosis under the perspective of fascial chain

Theory will guide practice. Based on the guidance of fascia and fascial chain theory, our clinical treatment methods play a greater role. Modern musculoskeletal ultrasound can clearly detect dense points in the fascia [26]. As mentioned earlier, traditional Chinese medicine acupoints share similarities with nodes in the fascia chain. Acupuncture at local and corresponding distal acupoints, Ashi points, or nodes on the fascia chain [27], or the use of small needle knives or floating needles [28], can relieve local fascial tension abnormalities and effectively improve neck pain [29]; Tuina techniques can effectively improve the abnormal tension on the fascial chain through the use of fascial cc points, thereby reducing neck pain; Neck fascial chain strength training [30] or exercise therapy such as Baduanjin [31] can increase the stability of neck muscle groups and maintain normal flexion posture of the neck. The above treatment methods can achieve good clinical efficacy in the treatment and rehabilitation of cervical spondylosis.

6. Summary

Cervical Neck Pain (CNP), also known as mechanical neck pain, has a pain mechanism that goes beyond the limitations of a single local lesion and extends to a more complex and multidimensional level of neck posture dysfunction. Although the traditional anatomical perspective provides a basic framework for understanding this type of pain, its explanatory power and guiding value are limited when facing complex and ever-changing clinical realities. Therefore, with the deepening of medical research and the integration of interdisciplinary knowledge, the fascial theory and its derived fascial chain theory have emerged, providing us with a profound understanding of the relationship between the overall structure and function of the human body.

The fascial theory, rooted in the developmental process of fibrous tissue in embryology, especially the gradual construction of the inner fibrous network, and the subsequent proposal of the double bag theory (i.e. the double-layer structure of superficial fascia and deep fascia), has revealed to us that the fascial system is a continuous, dynamic, and highly integrated network structure within the human body. This network not only connects muscles and bones, but also penetrates deep into the internal organs and nervous system, collectively forming the "tensioned overall structure" of the human body. In this structure, mechanical balance becomes the core element for maintaining physiological homeostasis and functional activity, and any mechanical abnormality may trigger a chain reaction, leading to pain and functional impairment.

The fascial chain theory further elucidates the mechanical roots of neck pain in the case of cervical

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type neck pain. Pain, as a defensive response of the body to harmful stimuli, is centered around the activation and sensitization of nerve endings by inflammatory substances. However, from the perspective of fascial chains, the source of pain can often be traced back to imbalances and abnormal changes in the mechanical environment. This change may originate locally, but rapidly spreads throughout the body through the mechanical conduction of fascial chains, forming a complex pain network.

Based on the above theory, our treatment approach has also undergone fundamental changes. From the mechanical changes of "local systemic" to the treatment strategy of "systemic local systemic", we emphasize the importance of adhering to the concept of fascia holism in the treatment process, which not only focuses on the direct manifestation area of pain, but also traces the systemic mechanical imbalance behind it. Through overall evaluation and intervention, combined with local precision treatment, the aim is to restore the overall mechanical balance and functional coordination of patients, thereby achieving fundamental pain relief and comprehensive improvement of their health status.

Specifically, in clinical practice, we need to use advanced assessment techniques such as fascial tension testing, posture assessment, etc. to comprehensively analyze the patient's mechanical state and pain patterns. Subsequently, personalized treatment plans will be developed, including but not limited to manual therapy (such as fascial release, muscle stretching), exercise therapy (strengthening and stabilizing muscle groups, improving posture control), physical factor therapy (such as ultrasound, electrotherapy), etc., aiming to promote tension recovery and functional reconstruction of the tendon membrane chain through comprehensive means.

In summary, the overall concept of fascial chain theory provides a new perspective and approach for the clinical treatment of cervical pain, which not only deepens our understanding of pain mechanisms, but also provides strong theoretical support and practical guidance for achieving true "recovery" of patients.

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