Journal of Pain Research

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REVIEW

Traditional Chinese Rehabilitation Exercise (TCRE) for Myofascial Pain: Current Evidence and Further Challenges

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Abstract: Myofascial as a holistic structure emphasizes a holistic approach to intervention and treatment of fascial-related disorders such as neck pain (NP), low back pain (LBP), and knee pain. There are currently adverse effects of medication for diseases related to myofascial. Traditional Chinese rehabilitation exercise (TCRE) is a practical approach to traditional Chinese medicine and is a valuable option for intervening in myofascial-related pain. This article found some research evidence for Baduanjin, Wuqinxi, and Yijinjing in clinical studies of myofascial chain-related pain. The article summarizes the current evidence and finds that TCRE can enhance limb movement function through breathing and slow movements, increase joint movement and flexibility, and reduce joint pathology and stress-induced pain. As for future directions, focus on TCRE in improving the health of older adults and treating long-COVID syndrome, and integrate robotic and TCRE training to frame safe and effective exercise models. Relevant studies have already been registered in the Clinical Trials Registry, and some clinical study protocols have been published. TCRE can be an alternative nonpharmacological rehabilitation therapy to alleviate chronic rheumatic pain symptoms and augment public health management.

Keywords: traditional Chinese rehabilitation exercise, pain, myofascial chain, rehabilitation

Introduction

The high prevalence of myofascial-related disorders, such as low back pain (LBP) with morbidity of approximately 40%, is a major cause of disability and healthcare financial burden.[1] In comparison, NP is the fourth disabling factor, with an annual standardized prevalence of 2.7% in 2019, with prevalence rates ranging from 5.9% to 38.7% in adults.[2,3] Regarding pharmacological treatment, the current conventional treatment for myofascial and skeletal muscle pain mainly uses oral non-steroidal anti-inflammatory drugs (NSAIDs) and local drug injections.[4–6] In addition, intravenous steroids and anti-phospholipase A2 inhibitors also play a role in relieving myofascial and skeletal muscle pain. Although NSAIDs can reduce symptoms to a certain extent, there are adverse effects like gastrointestinal risks and a high relapse rate after stopping the drugs. In contrast, long-term use of injectable NSAIDs medications often leads to endocrine disruption and immune system decline.[7,8] Among the non-pharmacological treatments for myofascial chain-related pain, manual rehabilitation and self-rehabilitation have emerged as significant research hot spots, with numerous studies[9–11] highlighting their potential efficacy and applications in managing and alleviating such pain. These treatments focus on therapeutic exercises, manual techniques, and self-care strategies aimed at addressing the underlying muscular and fascial dysfunctions contributing to the pain.

As a traditional medical exercise, TCRE can substantially improve the myofascial status, relieve stress on musculoskeletal joints, and provide overall organism regulation.[12,13] In March 2024, an evidence-based guide[14] for lumbar disc herniation recommended the combination of TCRE such as Baduanjin or Yijin Jing with Western medicine treatment to relieve pain and improve physical function for lumbar disc herniation patients. TCRE is feasible for clinical application as a low-cost, non-invasive treatment modality for myofascial chain-related disorders. Although limited high-quality

Received: 12 June 2024
Accepted: 23 August 2024
Published: 28 August 2024

evidence has been published, much evidence[15,16] supports that TCRE can help reduce different forms of motor and sensory abnormalities, such as chronic pain.[17] TCRE involves slow, controlled movements and deep breathing, which can induce mechanical stress on the fascia, stimulating its remodeling and regeneration. This process, known as fascial remodeling, involves the reorganization of collagen fibers and the improvement of fascial elasticity, which can enhance joint mobility and reduce pain.[18] Furthermore, TCRE promotes blood circulation and lymphatic flow, facilitating the removal of metabolic waste products and reducing inflammation in the fascia.[19] These physiological changes contribute to the overall efficacy of TCRE in alleviating myofascial-related pain and improving musculoskeletal health.[20] Understanding the underlying anatomical and physiological mechanisms of TCRE provides a comprehensive perspective on its potential as an alternative nonpharmacological rehabilitation therapy. This review screened three TCRE techniques, namely Baduanjin, Yijinjing, and Wuqixi, as references to explore TCRE for myofascial chain-related pain to summarize current high-quality evidence and future challenges.

Myofascial and Myofascial Chain

Myofascial is solid and liquid, a loose, collagen-rich, dense fibrous connective tissue.[21,22] From a microscopic perspective, myofascial is an active substance secreted by connective tissue cells into the intercellular space, forming the extracellular matrix.[23,24] In addition, the myofascial chain is more clinically significant and widely used in rehabilitation medicine.[25] The myofascial chain links all muscle groups, ligaments, and other soft tissues through myofascial interpenetration, integrating muscles, joints, bones, and nerves into a dynamic, kinematic chain-activated chain-type overall structure.[26] A chain-type force line joint is formed, transmitting mechanical information through the tension mechanics structure (the tensegrity) and jointly maintaining the body's stability. Figure 1 shows the structure of the myofascial.[27]

Tension imbalance caused by abnormal function of the myofascial chains affects the distal functions in the direction of stress transmission, and since myofascial chains follow a tensional nature where pressure is mechanically transmitted along the shortest distance.[28] The part of tensegrity is often located where the body can best withstand the pressure to maintain the maximum structural stability of the body.[29] Therefore, the points that end up in a pathological state are often weak points of the body (including previous injury or overwork points).[30] Based on the functional integrity of the myofascial chain, when the body has localized functional abnormalities, the symptoms of the body can be substantially improved by finding the fascial tissues, muscles, and ligaments associated with the abnormal site and intervening in the distal-related weak points to restore the original mechanical balance of the body from the overall movement pattern.[28] Hence, the principle of myofascial chain treatment emphasizes restoring the tension force of muscles, fascia, and other tissues as a whole, adjusting the force lines, and achieving the original balance of the body.[31]

Furthermore, since 2022 Foundation of Osteopathic Research and Clinical Endorsement (FORCE) added holography fascia[32] as an element of fascia in its definition. It emphasized that each structure is a communication interface that can form different energy forms. This update has focused on the similarities between myofascial chain-related disorders and TCRE, which is why we conducted this review.

The Relationship Between the Fascial Structure and Disease

Current research has shown that myofascial chain-related disorders' characteristics include myofascitis, joint function limitation, pain, or fatigue.[33] During constant movement and friction, muscle-tendon junction and tendon attachment points are easily damaged, including myofascial trigger points (MTrP).[34,35] Due to the integral nature of mechanical changes with tension structures, when MTrPs are out of treatment for a long time and repeatedly activated often produce a disease characterized by spasms, nodular points, and pain.[36,37] In addition, the fascia is rich in nerve endings and autonomic nerves, which intensely perceive the force acting on the muscle fibers. Therefore, after the fascia injury, the mechanical effects on the muscle also affect the body's nerve signals transport. As illustrated in Figure 2, the myofascial continuity among components of the musculoskeletal system demonstrates that any aberration at one point can spread to influence others, resulting in pain or dysfunction. The clinical manifestations are (i) Pain: sudden onset of muscle overuse and subsequent short-term pain, chronic pain, and accompanying increased sympathetic activity. (ii) Nodules: pressure pain can be felt in the affected muscle area with tension bands and spastic nodules that trigger local spasms on touch or

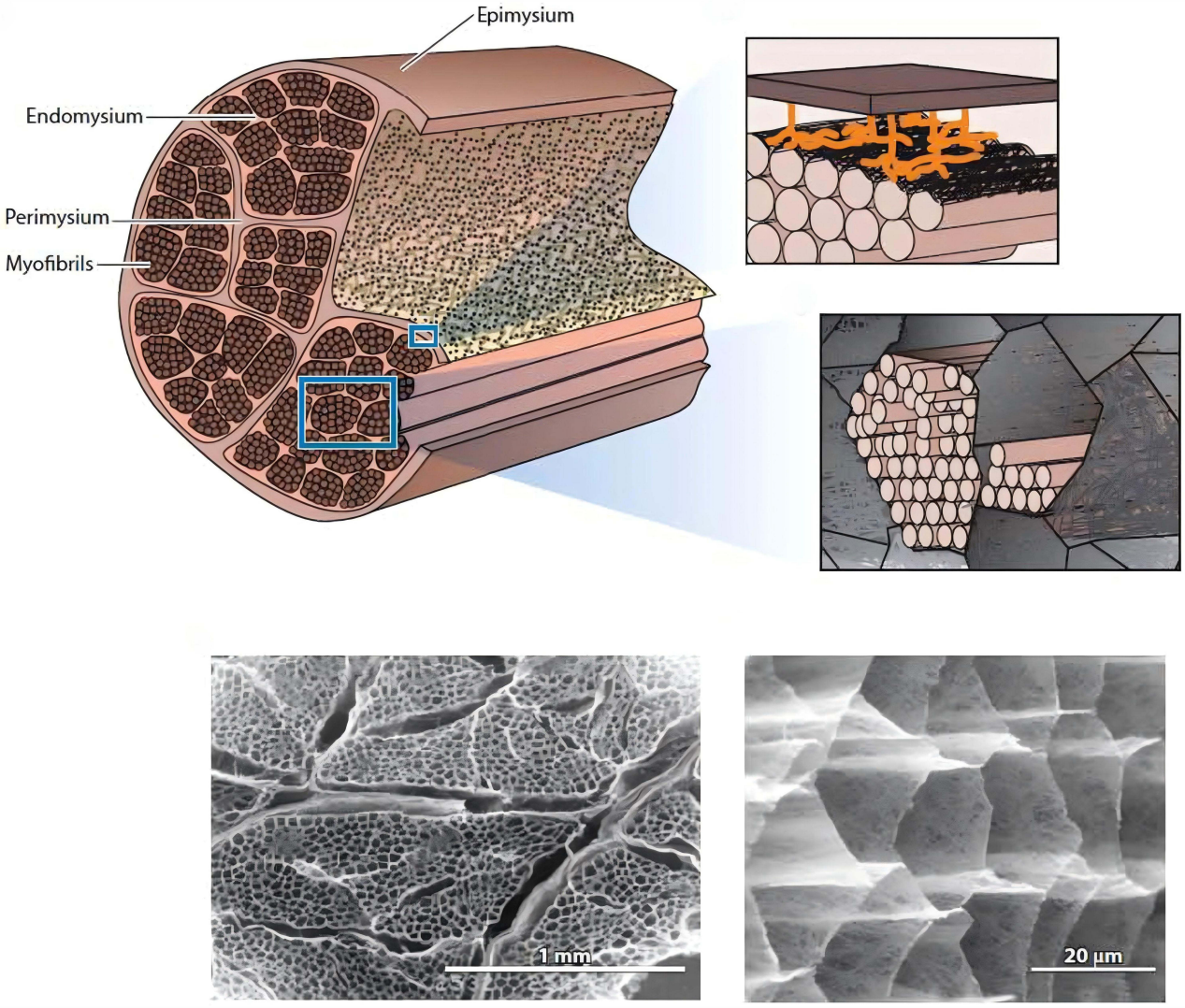

Figure 1 The structure of the myofascial. The structure of intramuscular connective tissue, including the arrangement of epimysium, perimysium, and endomysium in muscle, sparse junction zones between perimysium and endomysium, myofibrils of muscle cells, and IMCT structures in muscle after treatment with NaOH to remove myofibrillar proteins and proteoglycans. Note: Reprinted from Purslow PP. The Structure and Role of Intramuscular Connective Tissue in Muscle Function. *Frontiers in physiology.* 2020;11:495. Creative Commons.[27]

tingling. (iii) Movement restriction: The affected muscles have a restricted range of motion, retraction, and decreased muscle strength. In addition, the symptoms are aggravated by exertion and sleep deprivation.

Analyze the frequent points of myofascial chain-related pain and find that they occur in three motor joints: cervical, lumbar, and knee. Figure 2 shows the symptoms and the main locations of myofascial-related diseases.

The cervical spine maintains posture and limb movement with its seven flexible segments and myofascial chains. Poor neck habits can lead to tension and degenerative pathologies like cervical spondylosis and disc herniation due to the disruption of the cervical power balance system.[38,39] The lumbar spine, composed of five vertebrae, relies on balancing myofascial chains for stability. Trunk muscle dysfunction can cause instability, leading to LBP. Long-term poor posture or excessive force can result in degenerative changes and potential nerve compression. The lumbar intervertebral disc fibrous ring, cartilage plate, and nucleus pulposus will have different degrees of degenerative changes, resulting in straightening of the physiological curvature of the lumbar spine, decreasing elasticity and reducing the pressure that the lumbar intervertebral disc can withstand.[40] The nucleus pulposus will protrude from the rupture and compress the surrounding nerves, causing back and leg pain, numbness, and other symptoms.[41] The knee joint, the largest and most complex hinge joint, maintains stability during movement. Imbalances in its stability structures can lead to chronic pain,

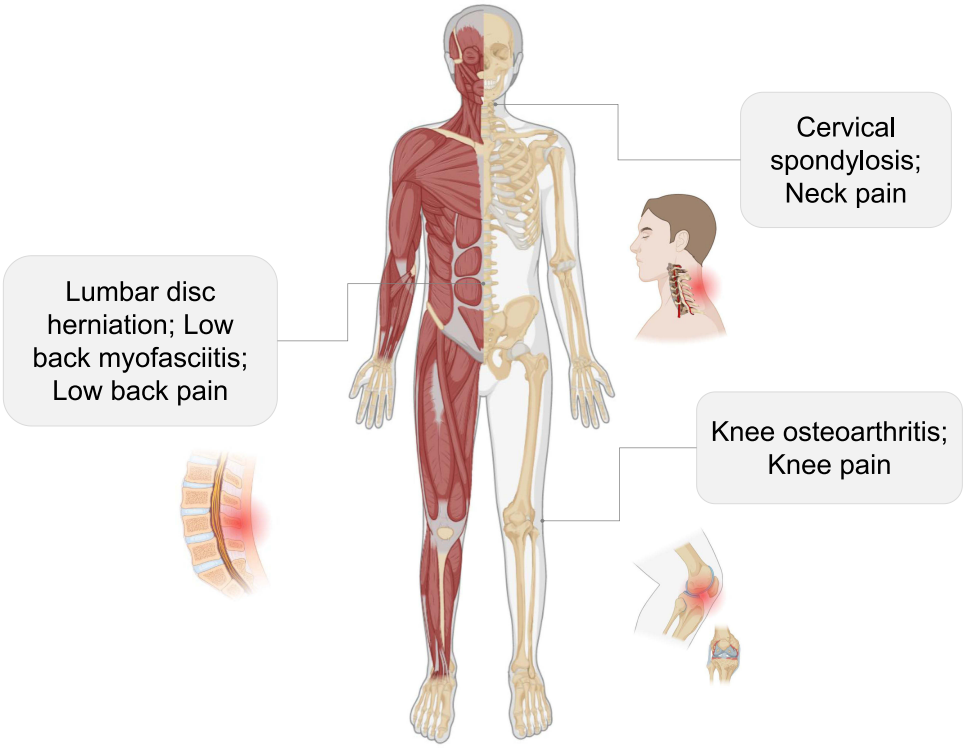

Figure 2 Myofascial chain-related diseases and primary symptom.

swelling, and impaired mobility, often characterized by degeneration of knee cartilage and osteophytes, resulting in abnormal mechanical conduction and joint stress imbalance.

The Therapeutic Status of TCRE

Traditional Chinese rehabilitation exercise, which originated in traditional Chinese medicine, is a slow physical exercise performed in breathing regulation and requires the participation of the whole body.[42] Current clinical evidence[43–45] suggests that TCRE can benefit a variety of disorders, such as cardiovascular, psychiatric, and respiratory diseases, and helps to reduce different levels of chronic pain. Furthermore, TCRE, such as qigong movement route stretching, involves multiple myofascial chains, which can effectively adjust the automatic extension of myofascial and neuromodulation, thus improving the over-tensioned contraction of skeletal muscles.[46]

In 2002, the General Administration of Sport of China organized the creation of the fitness qigong's new methods, which belong to TCRE. The definition of new fitness qigong is: "fitness qigong that people can strengthen their bodies and recover by participating in exercise". TCRE aims to improve patients' pathological state, promote pain recovery and improve the subhealth state.[47] We searched the current clinical research evidence of TCRE through the Web of Science and PubMed. The following search terms were used: 'traditional Chinese exercise' 'traditional Chinese rehabilitation' 'Qigong', 'Baduanjin', 'Eight brocade', 'Yijinjing', 'Five Animals Exercise', 'Wuqinxi', 'Daoyin yangsheng gong', 'Shierduanjin'. The publication is available in English until March 25th, 2024. Supplementary Material 1 provides details such as the relevant search strategy.

The current clinical evidence focuses on three TCRE methods, namely "Baduanjin", "Yijinjing", and "Wuqinxi", and we have compiled currently published randomized controlled trials (RCTs). A total of seven RCTs (Table 1) were related to myofascial chain-related diseases. Because these included studies were not homogeneous, we categorized the papers for a narrative review. The operational key points for the three TCRE are provided in Supplementary Material 2.

Table 1 Characteristics of the Included Seven Trials

Disease	Sample (I/C)	Age (I/C)	Intervention	Control	Period	Outcome	Trial Registry	JCR
Fibromyalgia[48]	31/31	48.9±10.2/53.5 ±10.6	Baduanjin	Blank control	Twice a week (each session 60 min) for 12 weeks	VAS, Fibromyalgia Impact Questionnaire (FIQ), Multidimensional Assessment of Fatigue (MAF), Pittsburgh Sleep Quality Index (PSQI), BDI, PSS, and Tender Point Count (TPC)	ClinicalTrials.gov identifier: NCT02401386	Q2
Knee Osteoarthritis[49]	25/25	64.48±7.81/63.08 ±3.65	Baduanjin	Blank control	Three sessions a week (each session 40 min) for 12 weeks	Proprioception, postural stability, and functional ability, WOMAC	ChiCTR-IOR -16010042	Q2
Nonspecific chronic neck pain[50]	51/51	36.8±5.1/36.2±4.8	Yijinjing and Tuina therapy	Tuina therapy	Three times a week for eight weeks	VAS, Neck Disability Index scores, Self-rating Anxiety Scale scores, tissue hardness, and active range of motion	ChiCTR2000036805	Q1
Knee Osteoarthritis[51]	25/25	55.76±8.37/53.40 ±10.66	Yijinjing	Stretching training exercise	Twice a week (each session 40 min) for 12 weeks	WOMAC, VAS, Mental Component Summary (MCS), Physical Component Summary (PCS), BDI, PSS, BBS	ChiCTR2000037256	Q2
Low back pain[52]	36/36	53±16/ 54±14	Wuqinxi	General exercise	Four times a week (each session 60 min) for 24 weeks	Short-Form McGill Pain Questionnaire (SF-MPQ), including the VAS and Present Pain Intensity (PPI)	ChiCTR-INR -16009038	Q3
Knee osteoarthritis[53]	34/34	70.7±9.36/70.2 ±10.35	Wuqinxi	Physical therapy	Four times a week (each session 60 min) for 12 weeks	WOMAC and BBS, Timed Up and Go Test, 6-min Walk Test, 30-s chair stand test, isokinetic muscle strength testing of knee flexion and extension	NA	Q1
Knee osteoarthritis[54]	132/134	71±2.92/69±3.72	Wuqinxi	Blank control	Six times a week (each session 60 min) for 24 weeks	Limits of stability (LOS) tests, Static Posture Stability (SPS) tests, Dynamic Fall Index (DFI) tests, WOMAC	NA	Q3

Notes: ClinicalTrials.gov, https://clinicaltrials.gov/; ChiCTR, Chinese Clinical Trial Registry (https://www.chictr.org.cn/abouten.aspx). All journal citation reports are from the latest 2021 partitions reported by Clarivate.
Abbreviations: I/C, Intervention/Control; VAS, Visual Analogue Scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index; PSS, Perceived Stress Scale; BBS, Berg balance scale; BDI, Beck depression inventory; JCR, Journal Citation Report; NA, not applicable.

https://doi.org/10.2147/JPR.S482424

Baduanjin

Baduanjin is a well-known TCRE exercise composed of eight movements, each targeting specific body parts, providing a low-intensity aerobic exercise.[55] Compared with walking and jogging, Baduanjin requires less space. This rehabilitation exercise uses the lumbar spine as the axis to drive the limbs, alternating between muscle tension and relaxation. It can help patients improve their postural stability, strengthen core muscles, apply pressure to weight-bearing joints, enhance synergistic muscle contraction of active and antagonistic muscles, and facilitate the recovery of motor function.[56] Available clinical evidence suggests that baduanjin improves LBP and osteoarthritis. Baduanjin exercises can reduce anxiety-induced lower back pain and decrease the prevalence of LBP.[57]

A clinical study showed[48] that patients with fibromyalgia who practiced bajuanjin twice a week for one hour each time for 12 weeks of rehabilitation exercise showed significant changes in the primary outcome of the visual analog scale (VAS) at the fourth week and after the end of treatment ($P < 0.004$). In a clinical study of knee osteoarthritis,[49] baduanjin had positive effects on postural stability, proprioception, and symptoms, and 12 weeks of relatively regular baduanjin helped improve knee proprioception and postural stability to reduce pain, stiffness, and dysfunction. And another study for knee osteoarthritis[58] found that baduanjin rehabilitation training for one year resulted in significant improvements in WOMAC, stiffness, and SF-36, and patients' functional status of the knee extensor and flexor muscles improved significantly. Several meta-analyses have shown that baduanjin rehabilitation helps improve musculoskeletal pain. In a systematic evaluation of baduanjin for LBP,[59] a meta-analysis of 519 patients found that baduanjin had an improved effect on pain relief compared to general rehabilitation exercise. A recent meta-analysis[60] found positive benefits of baduanjin in treating NP in middle-aged and older adults, with lower VAS scores for NP after baduanjin rehabilitation.

Yijinjing

Yijinjing is a TCRE health practice that combines dynamic and static exercises. "Jin" refers to medicine's tendons, ligaments, fascia, tendon sheaths, bursae, and joint capsules. Yijinjing can promote blood circulation by regulating muscle groups, ligaments, and other connective tissues, activating stiff muscles and joints, thereby improving skeletal muscle contraction and ligament strength, and the balance of the upper and lower extremities of the joint.[61] A recent neuroimaging study[62] has shown that yijinjing can modulate brain neural network connections, which may be one of its analgesic mechanisms. Clinical studies have found that yijinjing is useful in improving NP and intervening in the symptoms of knee osteoarthritis.

Evidence from a recent high-quality study found[50] that yijinjing combined with tuina was efficacious for non-specific chronic neck pain (NCNP) and was more effective than tuina alone in VAS scores at week eight and recovery of cervical spine function. Although evidence for this research is limited, suggesting the potential promise of yijinjing. Furthermore, although there was no significant change in WOMAC scores compared to stretching for knee osteoarthritis with yijinjing[51] ($P > 0.05$), yijinjing was more effective than stretching in reducing stress, anxiety, depression, and mood disorders. An RCT[62] also found that yijinjing enhanced brain network activity improved the efficiency of information exchange/integration between different brain regions, and alleviated negative emotions, which also had beneficial effects on pain relief.

Wuqinxi

Wuqinxi is a TCRE treatment method to strengthen the body and prevent pain through bionic exercises. Wuqinxi creatively imitates the posture and actions of five animals by imitating different animals, such as tigers, bears, deer, apes, and birds, thus regulating yin and yang, qi and blood, and functional status.[63] It facilitates the coordination of nerve-muscle joints and the improvement of functional status, and is widely used in life conditioning, health care, rehabilitation and various other fields. During the practice of wuqinxi, emphasis is placed on matching the breathing, relaxing the muscles and spirit, and keeping the movements soft and consistent. Although there are many styles of wuqinxi, in 2003, the General Administration of Sport of China introduced the standardized style of wuqinxi as one of the "Fitness Qigong" programs nationwide. Some of the movements include the opening and closing of the thorax, the large swinging

of the upper limbs, and the swaying of the body from side to side, which can have a squeezing and massaging effect on the thorax, all of which are beneficial to the regulation of the circulatory, respiratory and digestive systems.[64–66]

In a 24-week clinical study,[52] Wuqinxi had a better result on long-term chronic LBP, improving VAS and Present Pain Intensity (PPI) than routine muscle training. Wuqinxi should be considered a possible stand-alone treatment and self-management skill for chronic LBP. For elderly patients with knee osteoarthritis, wuqinxi improves patients' pain and functional knee flexion and extension activities[53] and enhances balance function and lower limb muscle strength.[54] Evidence from Systematic Review found[64,67] that the wuqinxi improved lumbar spine bone density, reduced back pain, and improved knee function, dynamic balance, and static balance. However, due to the low methodology quality of most included literature, high-quality RCTs need to confirm further credibility of the results to investigate the effects of wuqinxi on human health precisely.

Future Prospects

Aging is a physiological process that affects cellular and structural changes and is closely linked to myofascial chain-related pain.[68] TCRE is one of the important tools for elderly health care, which can improve joint mobility by combining breathing, and strength training to ensure accuracy through tactile feedback formed by the movement design of exoskeleton robots and rehabilitation robots. In addition, long-COVID symptoms have the problem of muscular and skeletal loading. TCRE can restore physical and mental health by strengthening sensory and motor functions and improving microcirculation.

Application of TCRE in Aging and Neuroscience

As the metabolic rate slows down, the fascial renewal capacity decreases and the fascial layer becomes thinner and looser, leading to reduced fascial elasticity and weakened joint function.[69] Previous studies have shown that TCRE significantly delays aging and improves cognitive function.[63,70] With the accelerated progress of population aging, China is one of the fastest-aging countries in the world, and the proportion of China's population over 65 years old is expected to reach 16.9% in 2030.[71] The purpose and original intention of developing TCRE is to provide health care for older adults. It improves joint movements, and fascial tension through breathing combined with slow movements, thus strengthening limb movement function. It also enhances joint flexibility and reduces joint pathology and strain pain. Importantly, multicomponent interventions,[72] including TCRE, physical exercise, cognitive behavioral therapy, and occupational therapy, are crucial in managing health in older people. These combined approaches are pivotal in addressing the complex needs of older adults and optimizing their overall health outcomes.

TCRE for Exoskeletal and Rehabilitation Robotics

In recent years, exoskeleton and rehabilitation robotics have been used in rehabilitation therapy,[73] and studies have shown[74–77] that robotic training can improve gait speed, balance, and coordination with the help of robot-driven gait orthoses. Therefore, the exoskeleton robot motion equipment will be integrated with TCRE theory and applied to the design of rehabilitation robot motion to achieve safe and effective motion. TCRE functions are simulated through specific designs of mechanical properties. The robot can also provide precise feedback through haptic sensory technology, thus ensuring the accuracy and effectiveness of the rehabilitation exercise.

Long-COVID Syndrome Intervention of TCRE

According to recent studies, muscle and bone pain is the common symptom of the long-COVID syndrome.[78] Pain occurs in different parts of the body, including headache, joint and muscle pain.[79] It may be confined to a specific area or may be more widespread. In some cases, the pain may be severe enough to interfere with activities of daily living. TCRE can contribute to rehabilitating patients with long-COVID syndrome, targeting the respiratory system and more importantly, improving fascia, bones, joints, and pain.[43,80] We learn that relevant studies had been registered in the Chinese Clinical Trial Registry (Identifier: ChiCTR2300067568, ChiCTR2000030933, ChiCTR2000029994) and ClinicalTrials.gov (Identifier: NCT05675995, NCT05289154). Similar clinical study protocols have been published.[81,82]

Conclusion

Current evidence suggests that TCRE exercises such as Baduanjin, Yijinjing, and Wuqinxi can be recommended to improve functional status in myofascial chain disorders. Despite the limited quality of the current evidence, constructing an acceptable evidence-based guideline for treating myofascial disorders is essential for improving the treatment of myofascial-related diseases such as pain and dysfunction. To this end, researchers need to develop explicit TCRE models, continue conducting high-quality basic and clinical research, and enhance the level of evidence.

Data Sharing Statement

The original contributions presented in the study are included in the article and its Supplementary Materials. Further inquiries can be directed to the corresponding author.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no competing interests in this work.

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