

Application of Traditional Chinese Medicine in Postoperative Rehabilitation for Anterior Talofibular Ligament Rupture

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Abstract. The anterior talofibular ligament (ATFL) plays a critical role in ankle stability, yet it is the most commonly injured ankle ligament. Thus, its postoperative rehabilitation has become a crucial clinical issue. With the development of Traditional Chinese Medicine (TCM), TCM-based rehabilitation, in its turn, has been receiving more and more attention. This paper is a systematic review of the research studies on the use of TCM interventions in the rehabilitation of postoperative ATFL rupture. Findings indicate that the combination of TCM and conventional Western medicine exerts a significant positive effect on improving ankle motor function, alleviating local pain and swelling, shortening the overall recovery period and delivering effective, cost-effective and high-quality clinical care. Yet, the existing studies have weaknesses such as small sample sizes, lack of high-quality evidence, as well as poor interventions standardization and low international awareness. There is also the lack of integration of Western medicine with TCM because of the lack of interdisciplinary cooperation. This paper helps to confirm the clinical value of TCM in ATFL rupture rehabilitation, promote the international acceptance and application of TCM-based rehabilitation, facilitate the integration of TCM and Western medicine, and lay a more robust theoretical foundation for the development of clinical practice in ankle injury rehabilitation.

Keywords: Anterior talofibular ligament, acute injury, rehabilitation.

1. Introduction

Ankle sprains are one of the most common musculoskeletal disorders in the general population, and the ATFL is the most susceptible lateral ligament within the ankle. The ATFL injuries usually cause various complications, such as synovitis, tendinitis, and muscle weakness [1,2]. Due to the emergence and propagation of TCM culture, the use of TCM treatment has increasingly become common in medical practice in the recovery of patients after surgery to reconstruct ATFL ruptures. In essence, the TCM treatment rests on the foundations of relaxing the tendons and unblocking the meridians, and TCM treatment enhances the circulation of qi and blood. Its effect has been clearly supported by sufficient literature. These investigations have clearly shown that TCM is an invaluable part of easing pain and swelling after the operation, improving joint range of motion, reducing the rehabilitation period, and avoiding permanent instability after ATFL rupture surgery. Moreover, combined TCM-Western medicine rehabilitation regimens are better than Western medicine-only rehabilitation models in terms of such indicators as the Visual Analogue Scale (VAS) pain score and the American Orthopaedic Foot & Ankle Society (AOFAS) score. Thus, since TCM treatment has been clinically proven to be effective and a variety of methods are available in it, TCM treatment has become a significant part of postoperative rehabilitation in China as a number of hospitals have standardized protocols for postoperative rehabilitation [3,4].

The study is expected to systematically verify the clinical effectiveness of TCM interventions used in the postoperative rehabilitation of ATFL rupture. The study will focus on the TCM theory of tendon and ligament injuries to review and combine the clinical uses and real results of TCM in the post-surgical rehabilitation of ATFL ruptures, thus distinguishing the benefits and peculiarities of TCM rehabilitation procedures. Through these results, the study aims to give clinicians the guidelines on how to design effective and cost-effective rehabilitation guidelines, and therefore enhance the outcomes and quality of rehabilitation provided to postoperative patients even further. Further, the paper will aim at offering theoretical and practical justification of standardized clinical promotion of unique TCM rehabilitation methods, exchange and dissemination of knowledge in the world of TCM

rehabilitation at the international level. The proposed research is based on the analysis of current research materials on the effectiveness of TCM, the assessment of its clinical usefulness in the post-ATFL rupture rehabilitation process, and explore the effectiveness of it. This research approach will be used to make the findings scientifically rigorous and pragmatic.

2. Theoretical Foundations of Research

2.1. Rehabilitation Mechanisms Following Anterior Talofibular Ligament Rupture Surgery

ATFL is located in the anterolateral area of the ankle joint. It prevents anterior dislocation of the talus and restrains the anterior translation and internal rotation of the ankle joint, as well as plantar flexion and inversion of the ankle. The post-ATFL rupture rehabilitation consists of four standardized clinical phases, which are practiced through ankle brace immobilization and stage-specific targeted rehabilitation exercises. Recovery of the patient's pre-injury weight-bearing and motor capacity is the major indicator of eventual rehabilitation outcome [5]. The validated secondary outcome measures are the Ankle Ligament Reconstruction Return to Sports Inventory (ALR-RSI), the Simple Foot and Ankle Score (SFAS), AOFAS Rearfoot Score, VAS scores for pain, Foot and Ankle Outcome Scores (FAOS) and the Tegner Activity Level.

2.2. Theoretical Basis of Traditional Chinese Medicine

Sports related ligament rupture such as the ATFL rupture is classified as tendon injury (Jin Shang) in the principles of TCM. Meridian and Collateral Theory, qi stagnation and blood stasis are the essence of pathological processes of tendon injuries. Based on this, TCM therapeutic guidelines aim at opening meridians, clearing of blood stasis, inflammation, alleviation of muscle spasms, pain, and soft tissue repair and restoration of joint functions [6]. Huangdi Neijing (Inner Canon of the Yellow Emperor) Early approaches to tendon injuries treatment were established in the first in the TCM which laid a theoretical framework of systematic approaches to injuries treatment [6]. This ancient medical text gives a solid theoretical basis of application of TCM in musculoskeletal injury rehabilitation and it aids in the ongoing optimization and clinical advocacy of the TCM based rehabilitation protocols.

3. Traditional Chinese Medicine Treatment Techniques and Clinical Efficacy

Rehabilitation involves external treatments and internal drugs that are administered orally. The first-line clinical therapy is external and the internal herbal formulations, are provided as adjunct therapies to improve the overall efficacy. The main strength of TCM in comparison with standard Western approaches to the postoperative rehabilitation protocols is a individual approach to the syndrome and a flexible and adaptive treatment regimen. Depending on the severity of an injury, postoperative phase, physical constitution and clinical symptoms of the patient, clinicians may choose between the external therapy, internal medication, or the combination of both. The therapeutic treatment plan may be dynamically changed during the healing process, such as changing herbal formulas, changing the choice of acupuncture points, or changing manipulation skills, so as to be able to achieve maximum therapeutic results [7].

Moreover, TCM treatments majorly rely on natural herbal products, as well as on non-invasive physical therapies, in which the rate of adverse events is much lower than in certain Western drugs or invasive methods to rehabilitate [7]. All medical expenses incurred in TCM therapies such as herbal plasters, acupuncture, and manual therapy are also cheaper compared to Western medicine rehab drugs and specialized procedures. Such high-cost effectiveness enhances patient acceptability and treatment adherence, which forms a strong ground towards the course of progressing postoperative rehabilitation [7]. In general, TCM modalities that are commonly used in the clinical setting are herbal plasters, herbal preparations by oral administration, acupuncture, TCM manual therapy, and bone-setting manipulation. All modalities have different mechanisms, and they prevent certain pathological

processes, and when introduced together with traditional Western rehabilitation protocols, they achieve synergistic effects.

Table 1 demonstrates that TCM interventions have huge and consistent therapeutic effects in the rehabilitation of ATFL rupture postoperative. When the patients have equal conditions of the injury, the use of TCM modalities in combination with conventional Western postoperative care enhances faster healing of the tissues, reduces time to recover, and effects a better overall functional outcome. This hybrid method acts as a high-value rehabilitation solution to patients with surgery of the rupture of the ATFL to increase the efficiency of rehabilitation and the experience of recovery of a patient.

Table 1. Clinical Efficacy of Common TCM Interventions in Postoperative ATFL Rupture Rehabilitation [8-11]

Intervention	Comparison	Primary outcomes measure	Conclusion
Xuehai Acupoint (SP10) Herbal Application	Standard interventions: rest, ice, compression, elevation (RICE)	Edema volume, Edema resolution time, Numeric Rating Scale (NRS) pain scores	Edema volume was significantly lower in the intervention group on Day 3 (2.00 ± 0.42 cm vs. 3.07 ± 0.51 cm; $P < 0.001$) and Day 5 (0.72 ± 0.29 cm vs. 1.37 ± 0.44 cm; $P < 0.001$); edema resolution time was shorter (80.23 ± 6.33 hours vs. 96.63 ± 4.78 hours); pain reduction trends were favorable, with no statistically significant between-group difference in initial NRS scores (6.01 ± 1.07 vs. 6.06 ± 1.06 , $P > 0.05$)
Dangguixu-san (DS) combined with Acupuncture	Placebo combined with Acupuncture	Pain VAS, FAOS, edema, EQ-5D-5L scores	From Week 1 to Week 5, improvements in VAS and FAOS scores were significantly better in the DS group; in Grade II injury patients, greater enhancements were observed in FAOS ache scores (Week 0 to Week 5) and VAS, total FAOS, and EQ-5D-5L scores (Week 1 to Week 5)
Traditional Chinese Manual Therapy	RICE, electromagnetic wave irradiation, herbal fumigation, oral analgesics, elastic bandage fixation, kinesiio taping	Total effective rate of manipulation, AOFAS ankle-hindfoot score, Baird-Jackson score, VAS score, and Takakura score	Total effective rate was significantly higher than control ($RR = 1.23$; 95% CI = 1.17-1.30; $P < 0.00001$); superior improvements in Baird-Jackson ($RR = 10.14$; 95% CI 5.57-14.70; $P < 0.0001$), VAS ($RR = 1.78$; 95% CI -3.14 to -0.43; $P = 0.01$), and AOFAS scores ($RR = 15.70$; 95% CI 12.72-18.68; $P < 0.00001$); rotating-traction-poking manipulation provided enhanced pain relief
TCM Bone Setting and Loosening Manipulation	Conventional rehabilitation therapy	Excellent-good response rate, clinical symptom score, SF-36 quality of life score	Excellent-good response rate was significantly higher (94.29% vs. 77.14%; $\chi^2 = 4.2000$, $P = 0.0404$); clinical symptom scores were lower at 6 months post-treatment (7.25 ± 0.74 vs. 15.25 ± 1.47 ; $t = 28.7580$, $P = 0.0000$); all SF-36 subscale scores were significantly higher, with marked improvements in physical and psychological function

4. Research Questions and Outlook

4.1. Existing Issues

Judging by the data and the explanation of the analytical results provided above, the effectiveness of TCM in the rehabilitation of ATFL ruptures, postoperative has been demonstrated to have strong and overwhelmingly considerable efficacy. Nevertheless, contemporary scholarly sources show that there has been limited scholarly work on specifically observing the therapeutic impact of TCM in the rehabilitation of ATFL rupture. Also, the size of most of the existing literature is small, which, to a certain degree, reduces the clinical persuasiveness of research conclusions. At the same time, the research on the use of TCM in ATFL rupture rehabilitation conducted in the clinical setting and the fundamental research potential in the given area are highly concentrated in China. The phenomenon shows that the methods of TCM of Chinese origin are yet to break the barrier in the global medical scholarly exchange and popularization of clinical practice. They still have not managed to emerge out of China, live in the international limelight, and escape the geographical restrictions completely. Therefore, the clinical distinctiveness of TCM is yet to receive popular acknowledgment and implementation among the world sports medicine and rehabilitation fraternity. It is desperately needed to intensify the academic cooperation on an international level and promote the spread of such therapeutic methods over the globe. In addition to this, there has been a lack of unifying system of the present integration of Chinese and Western medicine in postoperative rehabilitation of ATFL

ruptures. In most cases, a superficial combination of conventional Western rehabilitation regimens with a single TCM therapy, with no obvious correspondence to the pathophysiological scheme of ATFL recovery and the evolution of the tendon injury mechanisms as determined by TCM terminology. It leads to less than optimal coordination and a lack of timely and focused interventions. At the same time, the lack of mutual understanding of the diagnostic and treatment systems by each other between the TCM and the Western physicians causes the inability to coordinate treatment. It causes the autonomous efficacy assessments of each modality, in the sense that it is hard to reflect the real results of integrated rehabilitation in its entirety. This also limits the synergistic growth of the two systems.

4.2. Development Outlook

As the TCM treatment methods are utilized in the postoperative rehabilitation of ATFL tears, its peculiar ideas and treatments slowly become known. The effectiveness and mechanisms of TCM treatment in the postoperative rehabilitation of ATFL tears will be methodically confirmed in the future with an increase in the number of qualitative and large-scale clinical studies. At the same time, promotion and worldwide distribution of TCM methods will become more intensive, which will augment the world acknowledgment and tolerance of TCM. Through the integration of the modern medicine and the special traditional Chinese medical therapy, the rehabilitation treatment of ATFL rupture has developed into more than just a superficial integration between Western and traditional Chinese medicine, but rather a substantive one. Focusing on postoperative pathophysiological patterns of repair and TCM processes that occur during tendon injury, multidisciplinary professionals work on the standardization, progression, and syndrome differentiation of the rehabilitation plan. Such protocols explain combinations of intervention and operational standards of each step. Enhancement of the interdisciplinary talent cultivation and the collaborative diagnosis efforts helps to dismantle the information barriers in discipline so that accurate synthesis of Chinese and Western therapy practices can be achieved. At the same time, the combination of quantitative Western measurements and TCM syndrome differentiation measurements provides an all-in-one system of assessing efficacy. The scientific validation of the employed integrated protocol through the use of modern technology to study the molecular mechanisms of the occurrence of synergistic effects, where complementary abilities of both the systems are fully utilized to create a scientifically standardized framework of rehabilitation, is the metric to rehabilitation as a scientifically recognized phenomenon. Broad integration of Chinese and Western medicine would grant the patients with ATFL ruptures with more holistic and individual approach to rehabilitation, which will push the clinical work and theoretical studies of the given area to a new level.

5. Conclusion

The paper critically examines and supports the clinical worthiness and effectiveness of the TCM therapies in postoperative management of ATFL tear and serves as an informational and practical source to TCM therapy in postoperative management of such sporting injury. Chinese Traditional Medicine divides ATFL rupture into tendon tears, the overall principles of their treatment include relaxation of tendons and meridians activation, blood circulation and stasis. It has resulted in the emergence of an individualized intervention system that puts more emphasis on external interventions that are augmented by internal medication. This system is compatible with the pathological features of repair of the soft tissues and recovery of the joint functions after ATFL surgery and has the benefits over the traditional Western techniques of rehabilitation which imply the reduction of the adverse reactions and minimization of the costs of the treatment. Widely-known clinical TCM interventions which are medicated poultices on the Xuehai acupoint, the use of Danggui Xuduan Powder with acupuncture points, TCM massage, and bone-setting and mobilization have been found to be significant to reduce the volume of postoperative edema, shortening the duration of edema resolution, alleviating pain, increasing the scores of joint function (as well as AOFAS and FAOS), increasing

the percentage of excellent rehabilitation outcomes, and improving the quality of life of patients. These interventions in certain measures perform better than the traditional Western medical rehabilitation interventions on their own.

Moreover, the Traditional Chinese integrated with Western medicine rehabilitation model is superior to the Western medicine-only rehabilitation model in all the clinical indicators a complete manifestation of the rehabilitative worth of synergistic treatment. This study reviews the theoretical basis of TCM and clinical evidence on the subject of TCM in postoperative rehabilitation of ATFL tear systematically to offer a theoretical background within which a clinician can design effective, practical, and cost-effective rehabilitation regimens. It also provides the much-needed theoretical framework and practical platform on standardization of promotion of TCM-specific rehabilitation techniques and international academic exchange of the same. Relevant research that exists today is still limited in some ways. Special literature on the TCM measures in the healing of ATFL tears after surgery is relatively limited, and the results of existing research are usually of small samples, which makes it less clinical to persuade with the scientific conclusions of the research. In parallel, the practice and studies of TCM-related approaches are still at the high concentration in the country, and few people learn about them worldwide.

The adoption of TCM-Western medicine rehabilitation has not developed a unified system of fusion, leading to such problems as the inability to harmonize the effectiveness assessment systems and the absence of certain uniformities in the diagnostics and treatment systems. Conducting extensive, high-quality clinical studies to further substantiate the effectiveness and action mechanisms of the TCM interventions should be given the priority in the future. Encouragement of internationalization of academic exchange and promotion of TCM later forms of rehabilitation should be intensified to increase their popularity in the international sports medicine and rehabilitated arena. With the combination of the pathology repair pattern after ATFL surgery with the pathogenesis of TCM tendon and muscle injuries, multidisciplinary specialists are expected to produce the standard stage-based and the syndrome-differentiation-oriented integrated TCM-Western medicine rehabilitation programs. At the same time, the necessity to educate interdisciplinary professionals in the clinic, dismantle information barriers between Western medicine and TCM and create a single system of efficacy evaluation that should combine Western quantitative measurements with TCM syndrome differentiation measurements are great. Also, it is possible to go to deeper integration and stronger integration through application of modern technologies to investigate molecular processes of synergistic TCM-Western medical intervention to offer more personalized and scientifically based rehabilitation assistance to the patients after an ATFL rupture surgery.

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