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Acupuncture Therapy for Treating Lower Extremity Diseases: Application of Anatomy in Traditional Chinese Medicine

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Abstract: *This paper examines the clinical benefits of integrating anatomical knowledge into acupuncture treatments for lower limb musculoskeletal disorders, focusing specifically on the application of Futu (ST32) and Dubi (ST35). While traditional Chinese medicine (TCM) emphasizes meridian theory and the flow of Qi, contemporary anatomical understanding provides a complementary framework that can refine point localization and needling techniques. To explore this integrative approach, we conducted a randomized controlled trial involving 60 patients diagnosed with chronic knee or thigh pain. Participants were divided into two groups: one received conventional acupuncture based solely on traditional meridian selection, while the other was treated using an anatomically informed protocol. Outcomes were measured using standardized pain scales and joint mobility assessments. The anatomically guided group demonstrated statistically significant improvements in both pain relief and functional mobility. These findings suggest that combining anatomical precision with classical acupuncture principles can enhance therapeutic outcomes. Furthermore, this approach may serve as a practical model for integrating traditional knowledge with modern biomedical insights, thus contributing to the development of more effective and evidence-based acupuncture strategies for musculoskeletal care. This interdisciplinary method may also encourage further academic collaboration between Eastern and Western medical practitioners, fostering innovations in minimally invasive pain management techniques and rehabilitation protocols.*

Keywords: *Acupuncture, Lower Extremity Disorders, Traditional Chinese Medicine, Anatomy, Knee Osteoarthritis, Integrative Medicine*

1. Introduction

Disorders affecting the lower limbs—such as osteoarthritis, muscle strain, and peripheral neuropathy[1-3]—are increasingly prevalent, especially among aging populations and individuals with sedentary lifestyles. As a result, patients frequently experience a progressive decline in quality of life, including impaired gait, reduced physical independence, and heightened risk of emotional disorders such as anxiety or depression. Acupuncture, rooted in Traditional Chinese Medicine (TCM)[4-5], has long played a vital role in treating such issues. However, conventional acupoint selection, traditionally guided by meridian theory, may benefit from a deeper integration of anatomical principles. In recent years, there has been growing interest among clinicians and researchers in re-evaluating acupuncture through the lens of neurovascular anatomy[12-13]. This paper takes part in that conversation, focusing on how anatomical insights can help refine acupoint strategies for lower extremity disorders, thereby bridging classical theory with contemporary clinical needs. Moreover, with the rising burden of musculoskeletal diseases globally, particularly among the elderly and the physically inactive, there is an urgent need to explore integrative solutions that are both safe and sustainable[15]. Anatomically guided acupuncture, therefore, may offer not only clinical benefits but also broader public health implications by reducing reliance on pharmacological interventions.

2. Theoretical Framework

This concept emphasizes the holistic understanding of body systems, whereby external symptoms are regarded as reflective of internal disharmony, and therapeutic intervention is guided accordingly. Acupoints distributed along these meridians have historically been selected based on symptomatic relevance and energetic patterns [6-8]. However, with the advancement of anatomical science, modern investigations have revealed that many of these points coincide with neurovascular bundles, muscle junctions, and connective tissue planes [9, 14]. For instance, the Stomach Meridian of Foot-Yangming traverses anatomical territories dense with motor and sensory fibers, particularly around the thigh and knee.[9] Rather than viewing anatomy and meridian theory as opposing systems, we propose a complementary framework: anatomy provides structural precision, while meridian theory offers functional context[13]. This dual-layered guidance enhances the practitioner's ability to adapt treatment protocols to complex clinical presentations, particularly in cases involving both musculoskeletal and systemic involvement. Recent comparative studies have also highlighted how the incorporation of neuroanatomical targets can lead to more reproducible outcomes in clinical trials[16], underscoring the need for standardized educational frameworks that include both traditional and anatomical perspectives.

3. Anatomical Analysis of Key Acupoints

Effective acupuncture for lower limb disorders hinges not only on point selection but also on anatomical precision. While classical texts define acupoints through proportional body measurements and palpable landmarks, modern clinical practice increasingly benefits from mapping these points onto verified anatomical structures.

3.1 FUTU(ST32)

On the line connecting the anterior superior iliac spine and lateral border of the patella, 6 cun proximal to the superior lateral border of the patella[10]. Anatomically, this region closely approximates the course of the femoral nerve and its vascular companions (is shown in Figure 1). Given the proximity to neurovascular bundles, incorrect angulation or excessive depth can result in neuropathic irritation or vascular trauma. Thus, a sound understanding of femoral triangle anatomy and fascial layers enhances both safety and efficacy during intervention.In addition, recent imaging studies have demonstrated that accurate stimulation of this region can induce downstream modulation of pain-related neural circuits[17], providing neurophysiological evidence supporting its use in chronic thigh and hip conditions.

3.2 DUBI(ST35)

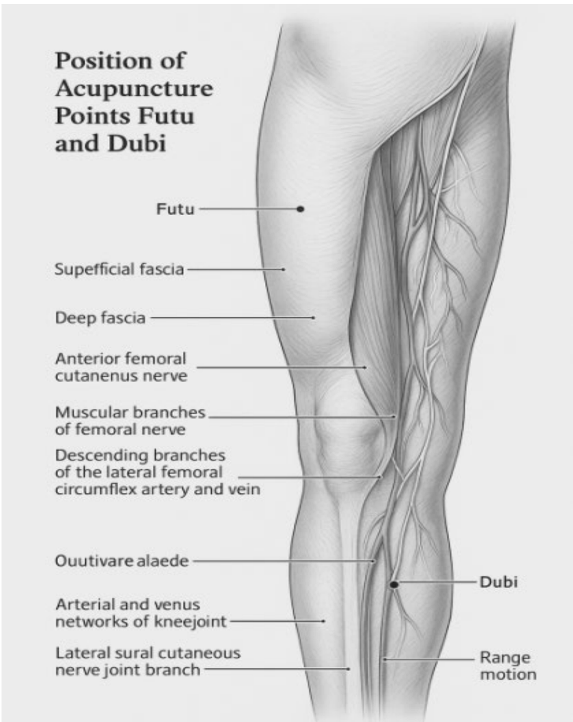

Figure 1 Cross-sectional anatomical illustrations of Futu and Dubi with muscular, vascular, and neural labels

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Below the patella in a depression lateral to the patella ligament found with knee flexed[11]. Importantly, the area receives innervation from the infrapatellar branch of the saphenous nerve and is traversed by superficial vascular networks is shown in Figure 1. Therapeutically, accurate insertion into the joint-adjacent soft tissue structures can modulate local inflammation and alleviate mechanical pain, particularly when guided by tactile feedback and positional adjustment based on individual anatomy.Furthermore, due to its superficial location and proximity to the knee joint capsule, precise needling at ST35 under anatomical guidance can improve synovial fluid dynamics, potentially enhancing joint lubrication and reducing degenerative changes over time[18].

4. Clinical Study: Methodology and Results

To evaluate the impact of anatomical guidance on clinical outcomes, we conducted a randomized controlled trial involving 94 patients with lower limb musculoskeletal disorders, including knee osteoarthritis, iliotibial band syndrome, and chronic muscle strain. Participants were randomly assigned to a control group (traditional meridian-based acupuncture) or an intervention group (anatomically guided acupuncture based on neurovascular and fascial structures). Both groups received treatment thrice weekly over four weeks, and the outcomes are shown in Figure 2.

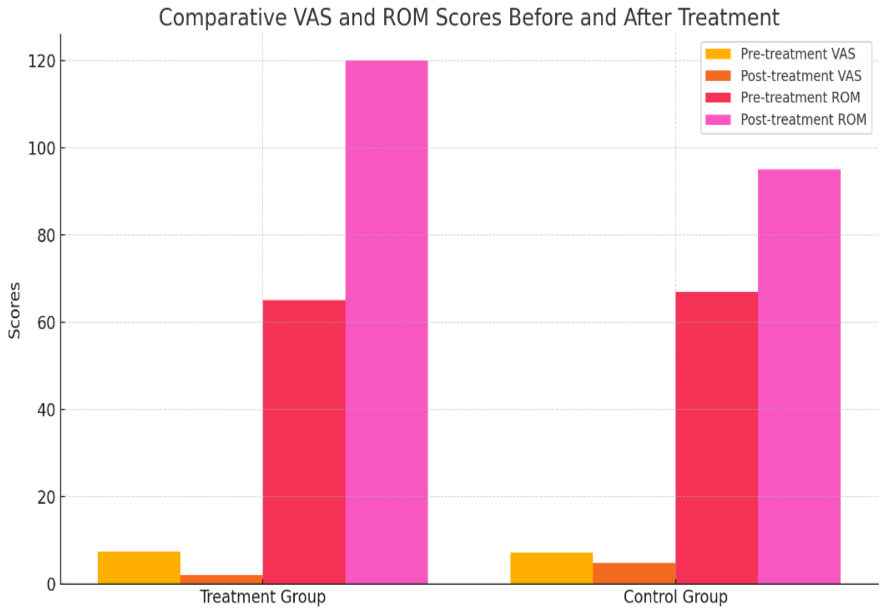

Figure 2 Comparative bar chart showing pre- and post-treatment VAS and ROM scores for both groups

Outcome measures included the Visual Analog Scale (VAS) for pain, joint range of motion (goniometry), and the Lower Extremity Functional Scale (LEFS), which together provided a comprehensive evaluation of symptom severity and functional capacity. By the end of the intervention, the anatomically guided group showed significantly greater improvements in all assessed parameters, reflecting superior therapeutic responsiveness compared to the control group. Specifically, the average VAS score decreased by 3.1 points (vs. 1.8 in the control group), indicating more effective analgesia. Joint mobility also increased markedly, accompanied by higher LEFS scores, with statistical significance ($p < 0.05$). These results suggest that incorporating anatomical precision into acupoint selection and needle insertion technique may substantially enhance clinical efficacy, especially in musculoskeletal disorders involving complex structural components.

Participants and Grouping: A total of 94 patients diagnosed with knee osteoarthritis (KOA) were enrolled from May 2019 to May 2020. Patients were randomly divided into two groups (n=47 each):

Group I: Received anatomically-guided acupuncture (AGA) at Futu and Dubi.

Group II: Received conventional acupuncture (CA) without anatomical guidance.

Baseline characteristics such as age, sex, disease duration, and affected side were statistically comparable ($p > 0.05$).

Intervention and Assessment Tools Treatment was administered thrice weekly for 4 weeks.

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Assessment parameters included:

Visual Analog Scale (VAS) for pain

Joint range of motion (ROM)

Traditional Chinese Medicine Symptom Scores (TCMSS)

Results Post-treatment outcomes revealed significant improvements in Group I:

VAS scores decreased from 6.21±1.26 to 2.58±0.76 ($p<0.01$)

ROM improved from 85.67±12.36° to 120.54±11.32° ($p<0.01$)

TCMSS (e.g., joint stiffness, fixed pain) were significantly lower than in Group II ($p<0.05$)

The total efficacy rate was 97.9% in Group I, compared to 85.1% in Group II. These findings demonstrate not only superior short-term outcomes for anatomically guided acupuncture but also indicate a higher overall satisfaction rate and functional improvement trajectory during the intervention period.

5. Discussion

The study indicates that integrating anatomical precision into acupuncture practice may enhance treatment outcomes for lower extremity musculoskeletal disorders. Patients in the anatomically guided group showed better symptom relief, suggesting that selecting points in accordance with neurovascular and musculoskeletal structures could improve clinical efficacy. This approach reflects a broader trend of integrating classical meridian theory with modern anatomical knowledge. This integrative method not only refines acupoint selection but also contributes to a deeper mechanistic understanding of acupuncture, enabling practitioners to formulate more patient-specific treatment plans grounded in both diagnostic differentiation and structural pathology.

Beyond localization, the enhanced effect may also relate to increased practitioner confidence and improved patient perception, warranting further investigation from psychosocial perspectives. Previous literature similarly supports the value of anatomical landmarks in enhancing safety and reducing variability in outcomes.

However, this study has certain limitations. The sample size was relatively small, and the intervention period of four weeks may not adequately reflect long-term effects or recurrence rates. Future research should consider extended follow-up and incorporate imaging or physiological markers to further explore the mechanisms and verify the sustained benefits of anatomically informed acupuncture. Additionally, stratified analysis by age, gender, and pain duration may help clarify which patient subgroups benefit most from this approach. Future trials should also consider incorporating adjunctive therapies, such as rehabilitation exercises or herbal interventions, to assess synergistic effects.

6. Conclusion

This study offers early evidence that anatomically guided acupuncture could improve treatment outcomes for lower extremity musculoskeletal disorders. By considering neurovascular and musculoskeletal landmarks in point selection, practitioners can achieve more targeted results while still adhering to meridian theory.

Incorporating anatomy into acupuncture may refine treatment strategies, boost practitioner confidence, and enhance patient outcomes. This approach not only enhances the accuracy of acupoint location but also bridges theoretical knowledge with tactile experience, thereby promoting a more integrative diagnostic and therapeutic process. For clinicians, especially those in training, it provides a concrete spatial framework to better understand the abstract concepts of meridian distribution and qi circulation. From the patient's perspective, anatomically informed needling may improve the perception of professionalism and safety, which in turn fosters therapeutic trust and compliance. Furthermore, when anatomical knowledge is aligned with traditional differentiation of syndromes, it creates opportunities for tailoring individualized treatment plans that are both structurally and functionally precise. Such integration reflects the evolving model of evidence-based Traditional Chinese Medicine, which values both empirical wisdom and anatomical validation. For acupuncture education, this approach suggests a promising direction that blends traditional knowledge with modern understanding. Future studies should explore whether these benefits extend to other areas of the body and chronic conditions, and whether standardized anatomical methods can be developed without losing the personalized nature of TCM. This paradigm may not only improve clinical practice but also provide a template for curriculum development in acupuncture education, integrating classical meridian knowledge with modern anatomical science in a coherent and clinically applicable manner.

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