

# Efficacy of Isokinetic Muscle Strength Training Combined with Manual Release in Treating Postoperative Shoulder Joint Adhesion

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**Abstract:** This study investigates the clinical efficacy of isokinetic muscle strength training combined with manual release in the treatment of postoperative shoulder joint adhesion. The findings indicate that manual release can ameliorate structural adhesion of the shoulder joint, while isokinetic muscle strength training can restore the strength of the periarticular muscle groups and joint stability. The combined regimen exerts a synergistic effect by integrating structural release with functional reconstruction. The observation group demonstrated superior outcomes in active shoulder range of motion, muscle strength, pain relief, and comprehensive shoulder function recovery compared with the control group, with a higher overall clinical effectiveness rate and a reduced risk of adhesion recurrence.

**Keywords:** Postoperative shoulder joint adhesion; Manual release; Isokinetic muscle strength training; Joint function

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## 1. Introduction

At present, a variety of rehabilitation interventions are available for postoperative shoulder joint adhesion. Among them, manual release has become a mainstream rehabilitation approach due to its advantages of convenient operation, direct effect, and noninvasiveness. As an advanced precision rehabilitation technique, isokinetic muscle strength training—characterized by constant angular velocity, adaptive resistance, and quantifiable and controllable muscle force—can precisely target the core muscle groups around the shoulder, activate atrophied muscle fibers, improve peak torque and endurance, reestablish muscle balance and proprioception, effectively repair motor function, and enhance dynamic joint stability. Its application in functional reconstruction after orthopedic surgery is becoming increasingly widespread. On this basis, the present study adopted a comprehensive rehabilitation protocol combining isokinetic muscle strength training with manual release for patients with postoperative shoulder joint adhesion. Through a randomized controlled trial, we systematically analyzed the effects of the combined intervention on shoulder range of motion, muscle strength, pain intensity, and overall joint function, explored the synergistic mechanism and clinical

advantages of the combination, and summarized key implementation points and optimization strategies. The aim is to provide a more effective, safe, and comprehensive standardized rehabilitation program for these patients and to offer a reference for clinical postoperative rehabilitation practice.

## **2. Theoretical framework of the combined treatment protocol**

### **2.1. Integrated pathology-rehabilitation approach**

Isokinetic muscle strength testing and training is an advanced technique for muscle strength assessment and conditioning, which has been widely used by physicians and physical therapists in clinical practice with satisfactory outcomes<sup>[1]</sup>. The pathological mechanism of postoperative shoulder joint adhesion primarily involves two core dimensions—structural and functional—that mutually reinforce each other to worsen the condition. Postoperative trauma triggers local aseptic inflammation, and inflammatory cytokines stimulate abnormal proliferation of fibrous connective tissue, leading to adhesion and contracture of the joint capsule, rotator cuff tendons, and surrounding fascia, which structurally restrict joint mobility<sup>[2]</sup>. Simultaneously, prolonged immobilization and pain-induced stress after surgery result in disuse atrophy of the periarticular core muscles, decreased muscle strength and endurance, and impaired motor coordination among muscle groups, further aggravating joint movement limitation and forming a vicious cycle of adhesion and functional deterioration. The integrated pathology-rehabilitation model, grounded in this pathogenesis, overcomes the limitations of single rehabilitation modalities by addressing both structural repair and functional reconstruction<sup>[3]</sup>. Manual release specifically targets structural adhesions, using passive external force to separate adhered tissues and release contracted soft tissues, thereby relieving mechanical impingement and restoring passive joint mobility. In combination, isokinetic muscle strength training corrects functional impairments, activates atrophic muscle groups, enhances muscle strength and motor coordination, and strengthens dynamic joint stability<sup>[6]</sup>, thereby interrupting the pathological cycle at its root and achieving both symptomatic and fundamental postoperative rehabilitation outcomes.

### **2.2. Technical system of manual release**

A standardized manual release technique for shoulder joint adhesion was adopted in this study, following a four-step procedure: gentle relaxation, layer-by-layer release, passive mobilization, and concluding relaxation, with rigorous avoidance of forceful manipulation<sup>[4]</sup>. Superficial soft tissue relaxation (5 min): palmar kneading and rolling maneuvers were applied to the trapezius, deltoid, and upper pectoralis major to gently relax superficial muscles and improve local circulation. Deep adhesion release (10 min): thumb plucking and acupressure were used to release adhesions in the supraspinatus, infraspinatus, and teres minor tendons as well as the joint capsule; acupoints including Jianyu (LI15), Jianzhen (SI9), and Tianzong (SI11) were pressed with gradually increasing force, up to a level of mild soreness without sharp pain. Passive joint mobilization (10 min): passive stretching was performed sequentially in flexion, extension, abduction, adduction, internal rotation, and external rotation, with 10–15 repetitions for each direction, gradually expanding the range of motion<sup>[5]</sup>. Concluding relaxation (5 min): palm pushing and light stroking were applied to the surrounding soft tissues to reduce the risk of re-adhesion. The treatment was administered once daily, five times per week, concurrently with isokinetic muscle strength training, each session lasting 30 min, for a total of 8 consecutive weeks.

### 3. Discussion

#### 3.1. Analysis of the synergistic mechanism of combination therapy

The combined application of isokinetic strength training and manual release exerts a significant synergistic effect, as the two modalities complement each other from the dual dimensions of structural repair and functional reconstruction, jointly improving joint function in patients with postoperative shoulder joint adhesions <sup>[7]</sup>. Manual release is a passive physical intervention that directly separates the fibrous connective tissue adhering around the shoulder joint through mechanical external force, releases the contracted joint capsule and fascia, rapidly relieves mechanical compression, and expands the passive range of motion; at the same time, it promotes local blood circulation, accelerates the absorption of inflammatory metabolites, alleviates pain and muscle spasm, and thereby lays the anatomical foundation for strength training <sup>[8]</sup>. Isokinetic strength training, in contrast, is an active dynamic rehabilitation approach. Relying on the equipment's characteristics of constant angular velocity and adaptive resistance, it precisely stimulates the core muscle groups throughout the entire range of shoulder motion, activates disused atrophic muscle fibers, increases peak torque and muscular endurance, and re-establishes muscular balance among muscle groups. The rhythmic contraction and relaxation of muscles during training produce gentle and sustained traction on the adhered soft tissues, further releasing micro-adhesions and consolidating the release effect; simultaneously, it improves muscle coordination and proprioception, enhances dynamic joint stability, restores biomechanical balance, and fundamentally prevents adhesion recurrence. The combination of the two achieves a synergistic effect of passive release for adhesion resolution and active training for functional consolidation, comprehensively overcoming the limitations of monotherapy.

#### 3.2. Core advantages compared with manual release alone

Compared with manual release alone, the core advantages of the combination therapy are primarily reflected in three dimensions—rehabilitation efficacy, long-term outcomes, and quality of functional recovery—with a more prominent comprehensive rehabilitation value <sup>[9]</sup>. Manual release alone can only relieve pain and improve passive joint mobility, addressing only the superficial joint adhesion problem without repairing the disuse muscle strength impairment resulting from prolonged immobilization of the affected limb. Therefore, most patients after such treatment still experience muscle weakness and insufficient joint stability, often accompanied by limb fatigue and joint instability, revealing obvious shortcomings in rehabilitation outcomes.

In terms of longterm efficacy, manual release alone can only separate existing adhesive tissues but cannot correct the functional deficits of muscle groups. Due to insufficient muscle strength and poor stability, the shoulder joint is prone to soft tissue load imbalance, which easily induces secondary adhesion, leading to a high recurrence rate and compromising long-term therapeutic effects. In contrast, combination therapy can rebuild the biomechanical balance of the shoulder joint through targeted strength training, strengthen the joint's autonomous stabilizing capacity, and fundamentally reduce the risk of adhesion recurrence, thereby achieving more durable and stable efficacy.

In terms of functional recovery, normal shoulder joint activity requires both unobstructed structural integrity and muscular power. Manual release alone only optimizes joint structure, with limited improvement in patients' active motor ability, exercise endurance, and limb coordination. Combination intervention simultaneously improves joint structure and muscle function, substantially enhancing patients' active movement capacity and facilitating a rapid return to daily work and motor functions, with significantly

higher rehabilitation quality. The present study data also confirm that the observation group receiving combination therapy demonstrated notably superior outcomes in all functional indicators and overall efficacy rate compared with the control group receiving manual release alone.

### **3.3. Key issues and countermeasures in clinical implementation**

In the clinical implementation of the combination therapy protocol, three key issues—individualized intervention, training safety, and course adaptation—should be carefully addressed to ensure rehabilitation efficacy and treatment safety. Individualized parameter adjustment: patients show significant inter-individual variation in surgical trauma extent, postoperative recovery speed, and pain tolerance; thus, uniform treatment parameters cannot be applied to all patients. Clinically, a comprehensive assessment of shoulder joint function, muscle strength, and pain level should be conducted prior to intervention, based on which the isokinetic training angular velocity, load, and range of motion, as well as the intensity of manual release, should be fine-tuned to formulate a tailored intervention plan, effectively avoiding undertraining or overtraining<sup>[10]</sup>. Training safety prevention: postoperative shoulder joint soft tissues are not yet fully healed and stabilized; high-intensity training or forceful release can easily cause secondary injury to tendons and joint capsules. Throughout the intervention, the principles of gradual progression and pain-free training should be followed: manual release should proceed from superficial to deep with gentle manipulation, and isokinetic training should be incrementally increased from low speed and low load, while real-time monitoring of the patient's pain feedback and muscle status is essential for dynamic adjustment of intervention intensity. Patient compliance management: long-term rehabilitation therapy tends to induce patient fatigue and resistance, leading to treatment interruption and compromised efficacy. Clinically, health education should be provided to explain the therapeutic principles and value, helping patients understand the importance of adherence; simultaneously, regular documentation of rehabilitation progress and positive reinforcement should be given, along with optimization of the intervention procedures and training experience, to effectively enhance patient compliance and ensure completion of the full treatment course.

## **4. Conclusion**

Postoperative shoulder joint adhesion is characterized by the coexistence of structural adhesive contracture and functional muscle strength degeneration. Monotherapy has obvious therapeutic limitations and fails to achieve comprehensive restoration of joint function. The results of this study confirm that the combined intervention of manual release and isokinetic strength training offers significant clinical synergistic advantages. Standardized manual release can rapidly relieve soft tissue adhesion around the shoulder joint, eliminate mechanical movement obstacles, and alleviate postoperative pain, thereby creating an anatomical foundation for the recovery of joint mobility. The adjunctive isokinetic strength training effectively activates atrophied muscle groups, enhances the strength and endurance of shoulder muscles, improves limb motor coordination, and re-establishes biomechanical balance and dynamic stability of the shoulder joint, fundamentally preventing the risk of secondary postoperative adhesion. The combined intervention perfectly compensates for the shortcomings of manual release alone, which only improves passive mobility without restoring muscle function. It simultaneously achieves structural repair and functional reconstruction of the shoulder joint, significantly enhancing overall rehabilitation efficacy and long-term outcomes.

## Disclosure statement

The author declares no conflict of interest.

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