

MUSCLE ACTIVATION PATTERNS AND STRENGTH GAINS AFTER REGENERATIVE TREATMENT FOR ROTATOR CUFF INJURIES

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Summary

This study investigates the effects of platelet-rich plasma (PRP) and prolotherapy on biomechanical changes in patients with rotator cuff tendinopathy. The trial involved 64 participants and assessed shoulder function over 24 weeks. Significant improvements in range of motion (ROM) were observed, with prolotherapy showing a notable increase in strength compared to baseline, while PRP showed no significant strength changes. Muscle activation patterns improved, with reduced EMG amplitudes in compensatory muscles during repetitive and overhead movements. Ultrasound imaging also revealed enhanced tendon structure, including increased thickness and improved fibrillar patterns. These findings highlight the potential of both treatments to improve recovery and rehabilitation outcomes.

Introduction

Rotator cuff injuries can alter biomechanics, disrupting muscle activation patterns and reducing strength. Regenerative treatments like platelet-rich plasma (PRP) and prolotherapy play pivotal roles in promoting tissue repair and restoring function [1]. This study investigates how these therapies influence biomechanical changes, focusing on improved muscle activation and strength gains, highlighting their potential to revolutionize recovery and rehabilitation outcomes.

Methods

This double-blind, randomized clinical trial, conducted at the University of Malaya Medical Centre, examined the effects of PRP and prolotherapy on supraspinatus tendinopathy. Sixty-four participants underwent detailed assessments and interventions between 2021 and 2023. Using standardized protocols, PRP and prolotherapy were delivered under ultrasound guidance to evaluate their clinical efficacy in improving shoulder pain and function.

This study evaluated biomechanical aspects, including range of motion, strength, muscle activity patterns, and tendon morphology changes at 6, 12, and 24 weeks. Range of motion (ROM) was assessed using a universal goniometer, while isometric strength testing employed a handheld dynamometer for shoulder elevation and rotation. Muscle activity patterns were analyzed via wireless EMG during two functional movements from the FIT-HaNSA [2] protocol on six periscapular muscles. Ultrasound imaging assessed tendon thickness, fibrillar disruption, neovascularization, and calcification.

Results and Discussion

Significant improvements in shoulder range of motion (ROM), including abduction, internal rotation (IR), external rotation (ER), and forward flexion, were observed over time, with most changes occurring by 3- or 6-month follow-up. Prolotherapy showed a significant strength increase at six months relative to baseline, while PRP did not demonstrate significant changes (Figure 1).

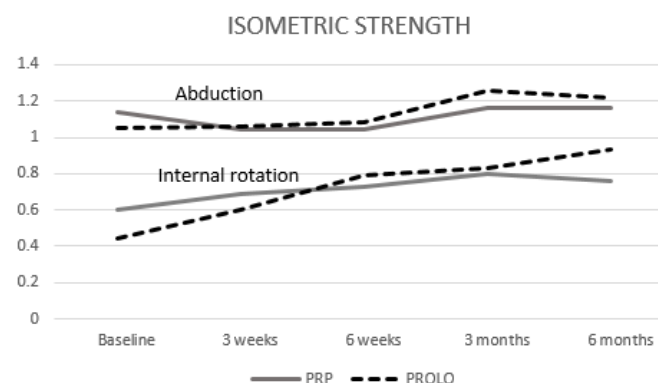


Figure 1: Isometric muscle strength

Muscle activation patterns revealed significant reductions in EMG amplitudes of the upper trapezius and latissimus dorsi during repetitive arm movements for both treatments. During sustained overhead activity, PRP notably decreased EMG amplitudes for the middle deltoid, biceps brachii, lower trapezius, and upper trapezius post-treatment.

Ultrasound findings corroborated these results, showing improved tendon fibrillar patterns and increased tendon thickness at 3 and 6 months, aligning with functional and biomechanical enhancements.

Conclusions

This study demonstrates that PRP and prolotherapy, significantly influence the biomechanics of rotator cuff injuries, with notable improvements in shoulder function and muscle activation patterns. Prolotherapy exhibited superior outcomes in strength enhancement, while PRP contributed to improved muscle activity during sustained overhead movements. Both treatments reduced compensatory muscle activation and enhanced tendon morphology, as evidenced by ultrasound findings.

References

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- [2] MacDermid, JC et al., (2009). Arthritis Res Ther 8:42

