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Optimizing Repair of Irreparable Rotator Cuff Tears: Arthroscopic Muscle Release, Suprascapular Nerve Decompression, and Advanced Pulley-Based Fixation Techniques

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Introduction and Background

Management of irreparable rotator cuff tears (IRCTs) remains one of the most challenging problems in shoulder surgery. This study presents a comparative analysis of multiple innovative arthroscopic and reconstructive techniques—including suprascapular nerve release, double-pulley-triple-row (DPTR) fixation, double-double-pulley-triple-row (DDPTR) configuration, and novel tendon transfer aids such as "Alligator's Jaw" and "Moruises Hammer" techniques—to optimize tendon mobilization, fixation strength, and healing potential in massive cuff tears.

Material and Method

A retrospective and technical review was conducted involving patients who underwent arthroscopic-guided supraspinatus and infraspinatus muscle release with suprascapular nerve decompression for mobilization of retracted tendons. Comparative evaluation was made across three fixation strategies—DPTR, DDPTR, and conventional suture-bridge techniques—along with adjunctive use of novel tendon transfer instruments ("Alligator's Jaw" for secure footprint anchoring and "Moruises Hammer" for controlled tendon advancement). Functional and radiological outcomes were assessed using Constant–Murley and ASES scores, tendon integrity (MRI), and footprint healing rates.

Results

The DDPTR construct demonstrated superior tendon compression, footprint coverage, and early healing response compared to standard DPTR and suture-bridge repairs. Arthroscopic-guided muscle release with suprascapular nerve decompression improved tendon mobility and reduced repair tension. Novel adjunctive techniques enhanced intraoperative handling, reduced slippage, and provided improved fixation during tendon transfer procedures. Postoperative assessments revealed improved range of motion and functional outcomes, with lower retear rates in the DDPTR and combined techniques group.

Conclusions

A multi-technique approach integrating arthroscopic muscle release, nerve decompression, advanced pulley-based fixation systems, and ergonomic tendon transfer tools offers a promising strategy for achieving anatomical repair and durable outcomes in irreparable rotator cuff tears. These evolving methods represent a paradigm shift toward precision-based, mechanically optimized shoulder reconstruction.