Tendon healing, oedema and flexor tendon gliding resistance

Educational article - English edition

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Source article: Wu YF, Tang JB. Tendon Healing, Edema, and Resistance to Flexor Tendon Gliding: Clinical Implications. Hand Clinics. 2013.

1. General introduction

Functional recovery after flexor tendon repair depends on more than suture strength. It results from a dynamic interaction between cell biology, inflammation, gliding biomechanics, postoperative oedema and mechanical loading during rehabilitation.

Wu and Tang's major contribution is showing that gliding resistance changes dynamically over the days and weeks after surgery. Understanding these mechanisms substantially changes modern flexor tendon rehabilitation strategies.

2. Chronobiology of tendon healing

Early phase, days 0-7: apoptosis predominates. The authors report that the proportion of apoptotic cells can exceed 40% between days 3 and 7, affecting inflammatory cells and tenocytes.

Proliferative phase, weeks 2-3: tenocyte proliferation peaks during the second and third weeks. Cells synthesise collagen and rebuild extracellular matrix. This corresponds to primary biological consolidation.

Remodelling phase: after week 4, proliferation declines sharply and apoptosis again becomes predominant. This phase appears essential to restoring gliding surfaces and remodelling adhesions.

3. Pathophysiology of adhesions

Adhesions should no longer be considered static structures. Wu and Tang's work shows changing biomechanical properties: stiff, resistant adhesions at four weeks; increased plasticity at six weeks; and substantially reduced mechanical resistance at eight weeks.

Movement generates shear forces that stimulate apoptosis at the tendon-adhesion interface. This gradually helps restore tendon gliding. This perspective explains how appropriate mobilisation provides biological stimulation of remodelling.

4. Oedema and gliding resistance

Postoperative oedema is a major contributor to gliding resistance. The authors show that oedema severity influences resistance more than its anatomical extent; resistance rises markedly between days 0 and 4; swelling reduces the space beneath the pulleys; and the repaired tendon becomes mechanically more vulnerable.

Clinically, oedema control therefore needs to be a priority treatment goal.

5. Biomechanical role of the A2 pulley

The A2 pulley is fundamental in preventing bowstringing. Postoperatively, however, it also becomes a highly constraining structure. The repaired tendon increases in volume, develops intratendinous oedema and has an irregular surface.

In this situation, A2 becomes a major mechanical obstacle. The authors report that partial venting of 50-66% of the pulley's length reduces resistance, improves gliding and reduces secondary ruptures.

6. Why extreme flexion is hazardous

Gliding resistance rises exponentially with finger flexion. Maximal flexion increases compression under the pulleys, tendon-pulley impingement, extensor tension, loading of the repair and the risk of secondary rupture.

The authors therefore recommend active mobilisation through an intermediate range in the early phases.

7. Implications for hand therapy

Major clinical applications include individualising protocols, intensive oedema management, limiting extreme ranges, gradually increasing loading, using passive mobilisation as a warm-up and understanding changing gliding resistance.

This article changes the traditional view of flexor tendon rehabilitation: mobilisation is not merely mechanical; it also acts as a biological stimulus directly influencing tissue remodelling.

8. Conclusion

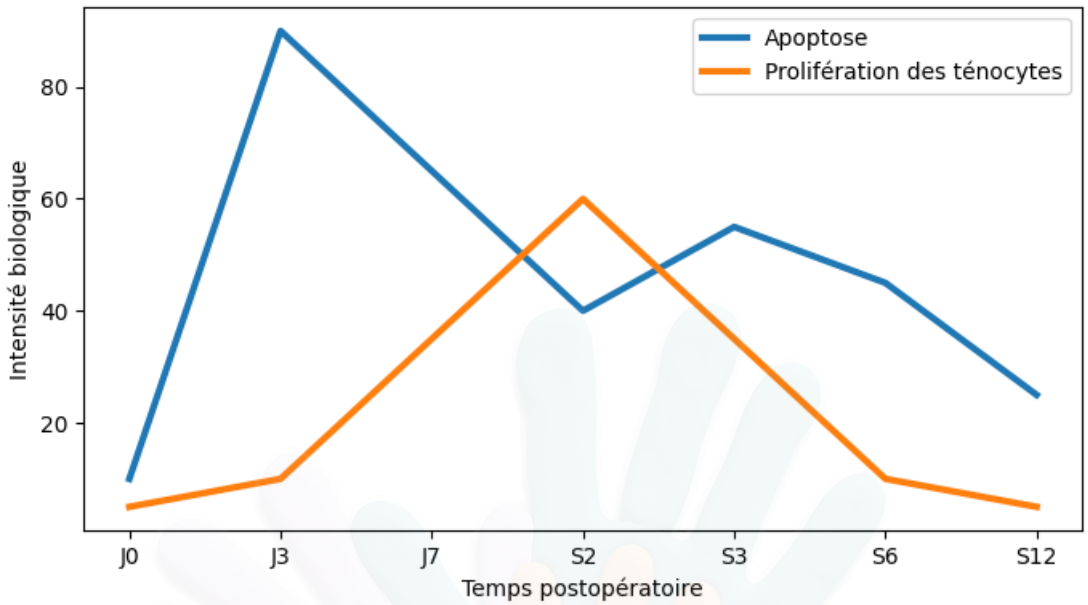
Recovery of a repaired flexor tendon depends on the balance between biological healing, oedema control, tendon gliding and the biomechanical loading applied during rehabilitation.

Wu and Tang's article is an important reference for understanding the mechanics of the repaired tendon and developing modern hand therapy protocols grounded in biology and biomechanics.

Level 2-3: expert narrative review based on experimental and biomechanical data and substantive studies.

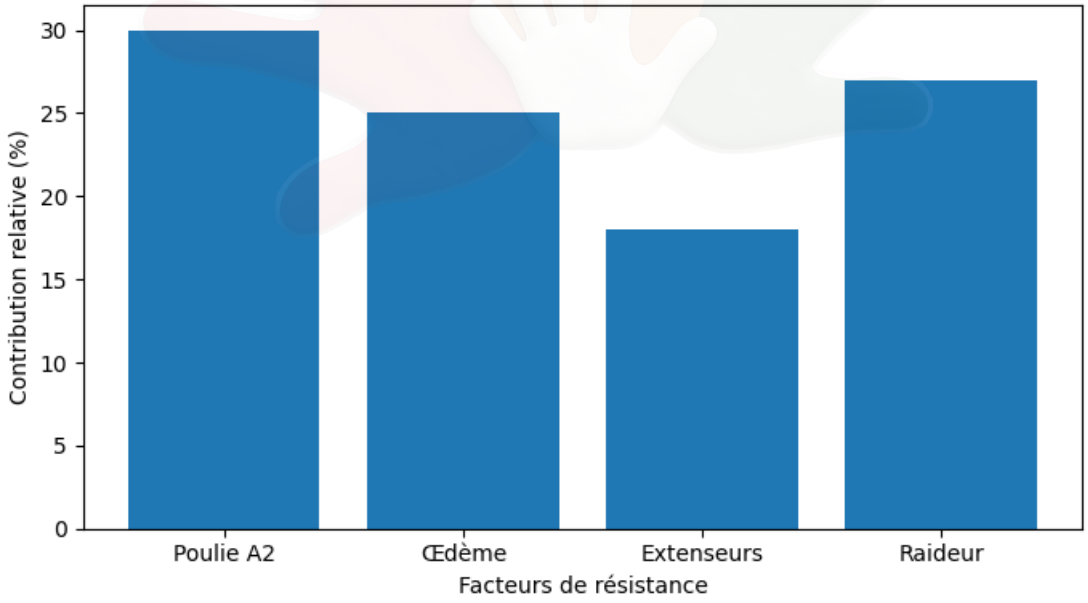
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Figure 1



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