INTERNAL WORK OF FLEXION FOR A NOVEL SUTURE REPAIR USED IN FLEXOR TENDON SURGERY

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INTRODUCTION

Lacerations of the flexor tendons are common hand injuries that, postoperatively, often result in adhesions and reduced digital function. While considerable research has been devoted to improving the tensile strength of various repair techniques, comparatively little research has investigated the effect of these techniques on the gliding resistance of the repair. High-friction repairs would increase the gliding resistance of the tendon and have been suggested to lead to abrasion of the tendon sheath and subsequent adhesion formation [1]. This study compared the internal work of flexion, a measure of a tendon's resistance to gliding [2], of the Pennington modification of a Kessler repair (MK) to a ventral locking modification of a Kessler repair (LMK) in porcine Flexor Digitorum Profundus (FDP) tendons.

METHODS

Forty-eight fresh porcine FDP tendons were transected in zone II and surgically repaired within the flexor sheath using either the MK or LMK 2 strand core repair. The locking loops were approximately 10mm from the laceration, while the epitendinous throws were in the order of 2mm from the lacerated tendon, with approximately 1mm between each loop of suture. In all cases, 3-0 prolene was used for the core suture and 5-0 prolene was employed for continuous epitendinous repair. All repairs were performed by the same investigator (EZ).

Following repair, the distal insertion of the FDP tendon was sharply divided and a small custom-made, lightweight, force transducer (aluminum ring configuration with full Wheatstone bridge) was inserted at the tendon-bone interface via a bone plate and flexible steel cable. The proximal phalanx was subsequently mounted within a test frame and the proximal end of the tendon secured to a 100N load cell of a uniaxial materials testing machine. Initial pretension was applied to the tendon by a 100g weight connected to the distal transducer, which also ensured full extension of the digit. The tendon was then pulled proximally, over a 30mm excursion, at a rate of 2mm/s and the force between the proximal and distal ends of the tendon recorded. Given that the applied loads were small (<10N), it was assumed that deformation of the repair was minimal. Thus the peak force differential and the internal work of flexion (differential-force-tendon-excursion integral) were calculated as measures of gliding resistance. Differences between repair techniques were evaluated using a one–way analysis of variance. Statistical significance was set at 0.05.

RESULTS AND DISCUSSION

A typical force–excursion curve for a repaired tendon is shown in Figure 1.

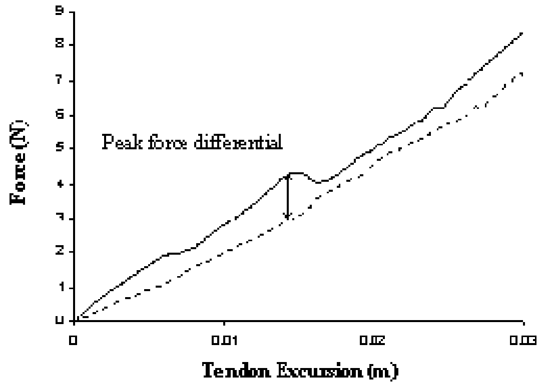

Figure 1: Typical proximal (solid line) and distal (dashed line) tendon forces during excursion of the repair. The area between the curves represents the internal work of flexion.

The internal work of flexion of the MK tendon repair was significantly greater (~25%) than that of tendons repaired via the LMK technique ($P<0.05$). Similarly, a significantly greater peak force differential ($P<0.05$) was noted for the MK repair compared to the LMK repair (Table 1).

Table 1: Internal work of flexion and peak force differential for MK and LMK tendon repairs.

	MK	LMK
N	25	23
Work of flexion (Nm)	0.033 ± 0.015	0.025 ± 0.010*
Peak force differential (N)	2.22 ± 1.47	1.54 ± 0.73*

* Statistically significant difference between repairs (P<0.05)

The internal work of flexion was significantly lower for FDP tendon repaired using the LMK method, suggesting the technique results in less energy loss and lower gliding resistance than the MK repair. Given that the two repair techniques have been shown to have similar tensile strength [3], the LMK repair may be clinically more beneficial than the traditional repair by minimising gliding resistance and potential adhesion formation.

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