THE EFFECT OF SYNERGISTIC MOTION ON FDP EXCURSION AFTER TENDON REPAIR IN A CANINE MODEL IN VIVO

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Introduction: Early controlled motion performed after flexor tendon repair has been widely accepted as an efficient postoperative therapy (1). The key to this protocol is to maintain tendon gliding within the sheath to decrease adhesion formation and improve the tendon healing quality. Tendon gliding after repair depends on the range of motion of the affected joints and the force applied to the tendon. During passive motion, the joint motion is not always related to tendon excursion after tendon repair because of the buckling effect (2). Forces need to be applied to the tendon to overcome this resistance. The ideal postoperative therapy will achieve the largest tendon excursion gliding excursion with the least amount of force. The synergistic wrist motion protocol (SWM), which combines finger flexion with wrist extension and finger extension with wrist flexion, is considered to be a good postoperative therapy after tendon repair. The purpose of this study is to assess the effect of synergistic motion on the in vivo gliding excursion of the canine flexor digitorum profundus (FDP) tendon after tendon repair.

Material and Methods: Twelve mongrel were used for this study. The dogs were anesthetized with pentobarbital. A radial neuroectomy proximal to the tripeces intervation was performed to prevent weight bearing on the operated limb. Then the second or the fifth FDP tendon was exposed between the A2 and A4 pulley. The total excursion of the normal FDP tendon was measured as control data, and then the tendon was lacerated to 80% of its transverse section at the level of the proximal interphalangeal. Each tendon was then repaired with the Modified Kessler suture technique with a circumferential epitenon simple running suture. A small metal marker (4/D steel suture, Ethicon, Somerville, NJ) was put between the lacerated tendon ends and a single metal suture knot was placed at the distal edge of the A2 pulley at the attachment to the proximal phalanx in order to avoid interference with tendon gliding under the A2 pulley. In six dogs, the wrist was allowed to move flexion and extension freely. The paw and forearm were dressed with a dorsal aluminum splint to maintain 40 degrees wrist flexion and neutral position of the digit joints between therapy sessions. Rehabilitation began on postoperative day 3. For the wrist fixation group, passive motion of the operated digits from full flexion to extension was performed in ten repetitions twice daily. The SWM rehabilitation described above was performed in the non-fixation group.

A radiographic method was employed immediately after surgery to define tendon excursion by measuring the distance between two markers. The extension distance (ED) and flexion distance (FD) were measured with the digits in full extension and full flexion, respectively with the wrist under fixation or synergistic motion. If the tendon marker was distal to the A2 pulley at the attachment to the proximal phalanx in order to avoid interference with tendon gliding under the A2 pulley. With the wrist in extension in the SWM protocol, the suture site was able to glide past the distal edge of the A2 pulley (ED) was nearly the same between the fixation and SWM groups. This is to be expected, as in both protocols the digits are extended with the wrist flexed. Limitations to this study are that one week after surgery may not be long enough to reflect lasting changes in the excursion after tendon repair and that adhesion data needs to be documented.

In conclusion, passive motion of the digits with the wrist flexed may cause suture site blocking on the pulley edge due to the increase of gliding resistance after tendon repair. This effect worsens in the first week after surgery. Synergistic wrist motion, on the other hand, can overcome this gliding resistance and increase the gliding excursion after tendon repair and the effect persists for at least one week after surgery.

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References:

Fig 2. Normal tendon vs repaired tendon at 0 time and 1 week after surgery in total excursion

Fig 3. The wrist fixation vs SWM in FD and ED at 0 time and 1 week after surgery.