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Scientific/Clinical Article

Relative active motion programs following extensor tendon repair: A pilot study using a prospective cohort and evaluating outcomes following orthotic interventions



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ABSTRACT

Study design: Prospective cohort.

Introduction: The Immediate Controlled Active Motion program, used to manage extensor tendon repairs in the hand, immobilizes the wrist in an orthosis with the affected finger(s) placed in a separate yoke orthosis allowing controlled flexion.

Purpose: To compare our outcomes using similar programs in patients with simple extensor tendon lacerations to those previously reported. To compare our 4-week orthotic intervention to our 6-week orthotic intervention.

Methods: 18 subjects received a 4-week orthotic intervention, 45 subjects received a 6-week orthotic intervention. Range of motion was measured 4, 6 and 8 weeks post-repair, grip strength at 6 and 8 weeks, and patient-rated outcomes at baseline, 6 and 12 weeks post-repair.

Results: Significant improvements in all outcomes were seen over time ($p < 0.0001$), with no significant differences between programs.

Conclusion: Outcomes were comparable with those previously published and similar between the 4-week and 6-week orthotic interventions.

Level of evidence: III

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Introduction

Over the last two decades, controlled mobilization after extensor tendon repair has become normal practice in preference to immobilization as it avoids the need for prolonged rehabilitation and facilitates earlier activity and return to function. The first published description of an early postoperative motion program after extensor tendon repair was by Frere et al.¹ Evans and Burkhalter² popularized a controlled motion program to improve the

functional outcome following extensor tendon repairs, which they based on knowledge of the tensile strength of the repair, the biomechanics of extensor tendon function and research on flexor tendon healing. Many different mobilization programs for use after extensor tendon repair have since been reported, varying with respect to the amount of movement allowed in protective orthoses and the duration of orthotic intervention.^{3–21}

The postoperative programs after extensor tendon repair can be broadly categorized as immobilization, early controlled passive motion and early controlled active motion programs. Passive and active motion programs have become the preferred programs for the postoperative treatment of simple extensor tendon repairs in zones IV to VIII, due to an earlier return of finger motion than that seen following immobilization.^{22,23}

In 2005, Howell et al.²⁴ reported a novel approach to active motion after extensor tendon repair, called the immediate controlled active motion (ICAM) program. This program was used

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IRAM program	Modified IRAM program	
Extensor tendon repairs in zones IV, V and VI	Extensor tendon repairs distal to juncturae tendinum (zones IV, V)	Extensor tendon repairs proximal to juncturae tendinum (zone VI and if EDM repaired in zones IV, V or VI)
<p>Day 1-21</p> <ul style="list-style-type: none"> • Wrist orthosis (20–25° E) and yoke orthosis (MCP joint of injured finger[s] 15–20° E in relation to uninjured finger[s]). • Orthoses worn at all times. • Education about tendon healing and strength of repair. • Active composite finger F and E. • 5–10 repetitions every waking hour. • Avoid use of injured hand in ADL. 	<p>Day 1-21</p> <ul style="list-style-type: none"> • Yoke orthosis only. • Orthoses worn at all times. • Education about tendon healing and strength of repair. • Active composite finger F and E. • 5–10 repetitions every waking hour. • Commence light ADL as able in orthoses. • Return to light duties at work in orthoses. 	<p>Day 1-21</p> <ul style="list-style-type: none"> • Wrist orthosis (20–25° E) and yoke orthosis (MCP joint of injured finger[s] 15–20° E in relation to uninjured finger[s]). • Orthoses worn at all times. • Education about tendon healing and strength of repair. • Active composite finger F and E. • 5–10 repetitions every waking hour. • Commence light ADL as able in orthoses. • Return to light duties at work in orthoses.
<p>Day 22-35</p> <ul style="list-style-type: none"> • <u>Wean from wrist orthosis over a period of 7 days.</u> • Continue to wear yoke orthosis at all times. • Initially wrist exercises performed with fingers relaxed. When no active E lag, composite wrist and finger F, and wrist and finger E. • During active use of injured hand both orthoses worn. • When wrist moves freely, light use of hand without wrist orthosis. 	<p>Day 22-28</p> <ul style="list-style-type: none"> • Continue to wear yoke orthosis at all times. • Initially wrist exercises performed with fingers relaxed. When no active E lag, composite wrist and finger F, and wrist and finger E. 	<p>Day 22-28</p> <ul style="list-style-type: none"> • <u>Wean from wrist orthosis over a period of 7 days.</u> • Continue to wear yoke orthosis at all times. • During active use of injured hand both orthoses worn. • When wrist moves freely, light use of hand without wrist orthosis. • Initially wrist exercises performed with fingers relaxed. When no active E lag, composite wrist and finger F, and wrist and finger E.

Fig. 1. Outline of IRAM and mIRAM programs. EDM = extensor digiti minimi; E = extension; F = flexion; MCP = metacarpophalangeal; ADL = activities of daily living.

when the tenorrhaphy was to extensor digitorum communis (EDC), extensor digiti minimi (EDM) or extensor indicis (EI) in zones IV to VII. The treatment program was the same for both simple and complex extensor tendon lacerations and for injuries proximal and distal to juncturae tendini. The program involved immobilization of the wrist (20–25° extension) in a wrist orthosis with the affected finger(s) placed in 15–20° extension relative to the neighboring fingers using a separate yoke orthosis. Full finger flexion was restricted by the yoke orthosis. Orthotic intervention was for 7 weeks. Using this approach, they reported no tendon ruptures or complications and good return of range of motion (ROM), grip strength, function and return to work. Similar positive outcomes were reported by Hirth et al.²⁵ for simple single digit extensor tendon injuries in zones V–VI where only a yoke orthosis was worn

during the day, and a night resting orthosis, for protection of the repaired tendon.

Following these favorable results, an ICAM program was introduced into clinical practice at one of our hospitals in 2007. A retrospective audit of our data for simple and complex extensor tendon repairs managed with a 7-week ICAM program revealed that patients exhibited good ROM and grip strength 4–10 weeks postrepair. However, this audit was limited by a small sample size ($n = 26$), the retrospective nature of the audit and the ad hoc nature in which patients had been selected to receive the ICAM program. In order to gain a clearer picture of our outcomes using an ICAM program, the current study evaluated outcomes using an ICAM program in a prospective cohort and compared the results to those reported by Howell et al.²⁴ We elected to involve another local

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