Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2021 18(3): 2159-2163. **OPEN ACCESS**

Early active dynamic flexion versus place and hold protocol after Flexor Tendon repair

Eatmad Allam[1*], Amal M Abd El Baky[1], Mohamed Bayoumi Ibahim Bayoumi[1], Osama Abdel Raheem Alshahat[2] and Hatem El-Azizi[3]

[1]The Department of Physical Therapy For Surgery, Faculty of Physical Therapy Cairo University, **Egypt**
[2]Department of plastic Surgery, Faculty of Medicine Al Azhar University, **Egypt**
[3]Department of Radiology, Faculty of Medicine Cairo University, **Egypt**

***Correspondence:** eatmadashref5@yahoo.com **Received 13-03-2021, Revised: 01-07-2021, Accepted: 10-07-2021 e-Published: 27-07-2021**

: The main objective of the study is to determine the differences between the effect of early dynamic flexion protocol and place and hold on flexor tendon excursion and adhesion after repair.30 participants who underwent zone II flexor tendon primary modified Kessler repair. (23 males and 7 females with age ranged from 18 to 50). The participants were divided into two groups: group A (PAH) and group B (EAD) protocol. The participants were selected from Cairo university hospital (Egypt), Department of physical therapy. Group(A) composed of 15 patients who received place and hold protocol 3rd day post-operative and Group (B) who received early active dynamic protocol 3rd day post-surgical repair. Patients in each group received the treatments (3sessions /week) from 3rd day post-operative till 6th week post-operative. All patients were assessed by ultrasound to detect tendon excursion at 3rd and 6th week postsurgical repair. There was a significant increase in the tendon excursion at 6 weeks compared with 3 weeks post treatment in group A and B. There was no significant difference in adjusted mean of tendon excursion at 6 weeks between both groups. The present study demonstrated that both active protocols affected the excursion of the flexor tendon zone II after surgical repair

Keywords: (Early active dynamic flexion ,place and hold ,flexor tendon repair)

INTRODUCTION

Loss of digit flexion in some patients due to adhesions after flexor tendon injuries.The adhesions are part of the healing process which produces functional disability following the biological response of tendon injury (Khanna et al .2009).

Sapienza and Green, (2012) mentioned that adhesions may occur after zone II flexor tendon repair of both muscles, flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS). Early active protocols have been used to minimize adhesions by improving tendon excursion (Baskies et al. 2008).

One of the Active mobilization protocols is early place and hold which was developed by Strickland and cannon, (1993) who described this technique as early active gliding of tendon after 3 days of post-operative. The therapist moved the digits in tolerable unrestricted composite flexion then patient was asked to maintain the attainted digits flexion actively for 5 seconds then relax (Kisner and Colby, 2012).

Early active dynamic is a treatment protocol, which involved active flexion half of a fist in the first two weeks then patient did toward a full fist position (Amanda and Donald, 2016).

MATERIALS AND METHODS

Subjects:

30 participants who underwent zone II flexor tendon primary modified Kessler repair. (23 males and 7 females with age ranged from 18 to50). Participants were divided into two groups group A(PAH) and group B (EAD) protocol. The study was done in EL-Hussein University Hospital (Egypt), from the Department of Physical Therapy. The Exclusion criteria were Patients younger than 15 years because of incidence of tendon rupure , patients older than 50 years because of impairment of hand function and those with medical conditions such as diabetes affecting the tendon The participants read and signed a consent form .Ethical approval was presented by Cairo university.

Treatment procedures :

Place and hold protocol:

Patients are immobilized in dorsal block splint that positioned the wrist up to 0 degree extension, the MP joints in 70 to 90 degrees of flexion and IP joints in full extension. Patients were advised to passively flex the fingers using their other hand then hold the finger position actively, holding for three to five seconds ,then relax (from the 3rd day to 2nd week). The Patients started gliding tendon exercise and allowed to active flex their fingers at 3rd week post-surgical repair then blocking and resistive exercises were initiated at the 6th week .These exercises were done for 15 repetitions (Farzad et al. 2014)

Early active dynamic protocol:

Patients are immobilized in a dorsal block splint with wrist up to 45 degrees of extension, metacarpal phalangeal joint joints in 30 degrees of flexion and IP joints in full extension. the patient worked toward half fist position (from the 3rd day to 2nd week), then moved toward full active fist position and active tenodesis exercises at the 3rd week . short splint discontinued and the Patients can start blocking exercises and resistive exercises were initiated at the 6th week . These exercises were done for (10 repetitions) (Amanda and Donald, 2016).

Measurement procedures :

Transducer:

Tendon excursions were measured by ultrasonography using a Philips iU22 ((Kutsumi et al .2005)

Participant position and technique:

The wrist was positioned in 30 flexion, with the metacarpophalangeal joints in 60 flexion and the interphalangeal joints fully extended to localize the FDP and FDS with ultrasound, when both tendons were visualized, The examiner carried out the technique for both groups.

Statistical analysis:

Descriptive statistics and unpaired t-test were conducted for comparison of age, number of injured fingers and repaired tendons between groups. Chi-Squared test was conducted for comparison of sex and affected hand distribution between groups. Paired t test was conducted for comparison of tendon excursion between 3 and 6 weeks in each group.

Analyses of covariance (ANCOVA) were conducted for comparison of tendon excursion at 8 weeks post treatment between groups with 3 weeks assessment as a covariate. The level of significance for all statistical tests was set at $p < 0.05$. All statistical measures were performed through the statistical package for social studies (SPSS) version 22 for windows.

RESULTS

Subject characteristics:

Table (1) showed the subject characteristics of group A and B. There were no significant differences between groups in age, number of injured fingers and repaired tendons and no significant difference in sex and affected hand distribution ($p > 0.05$)

Effect of treatment on tendon excursion:

Within group comparison:

There was a significant increase in the tendon excursion at 6 weeks compared with 3 weeks post treatment in group A and B ($p < 0.001$). The percent of increase in tendon excursion in the group A was 89.25% while that for group B was 58.11%. (Table 2).

Between groups comparison*:*

There was no significant difference in adjusted mean of tendon excursion at 6 weeks between group A and B ($p > 0.05$). (Table 3)

Table 1: Basic characteristics of participants.

	Group A	Group B	p-value
	Mean ± SD	Mean ± SD	
Age (years)	26.13 ± 5.84	26.86 ± 6.83	0.75
Injured fingers	2.06 ± 0.7	2.13 ± 0.64	0.78
Repaired tendons	4.53 ± 0.91	4.4 ± 0.82	0.67
Sex, n (%)			
Females	3 (20%)	4 (27%)	0.66
Males	12 (80%)	11 (73%)	
Affected hand, n (%)			
Dominant hand	10 (67%)	8 (53%)	0.45
Non dominant hand	5 (33%)	7 (47%)	

SD, standard deviation; p-value, level of significance

Table 2: Mean tendon excursion at 3 and 6 weeks post treatment of the group A and B.

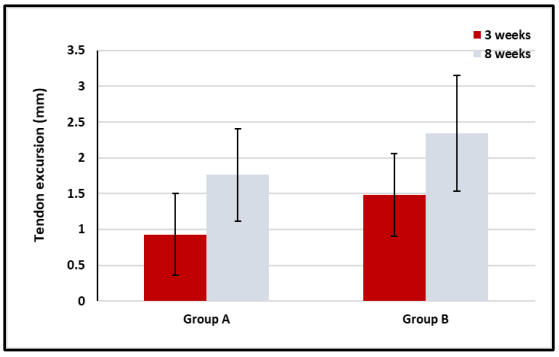
	Group A	Group B
	Mean ± SD	Mean ± SD
Tendon excursion (mm)		
3 weeks	0.93 ± 0.57	1.48 ± 0.58
6 weeks	1.76 ± 0.65	2.34 ± 0.81
MD	-0.83	-0.86
% of change	89.25	58.11
t- value	-6.77	-6.65
	p = 0.001	*p = 0.001*

SD, standard deviation; MD, mean difference; p-value, probability value

Table3: Adjusted mean of tendon excursion at 6 weeks post treatment for 3 weeks value of the group A and B:

	Tendon excursion (mm)	MD	F- value	p-value
	Mean ± SE			
Group A	2.02 ± 0.13	-0.06	0.07	0.79
Group B	2.08 ± 0.13			

SE, standard error; MD, mean difference; p-value, probability value



DISCUSSION

The study was designed to investigate the effect of early PAH and EAD mobilization on flexor tendon excursion post-surgical repair. The results of this study showed that There was no significant difference in the adjusted mean of tendon excursion at 6 weeks between group of PAH and the group of EAD.

No literature could be found on a previous study comparing both active protocols. However, Finger FDP tendon excursions were measured during different rehabilitation protocols by Korstanje et al. (2012). Their study showed FDP tendon excursions were 23.4, 17.8, 10.0, 13.9, and 7.6 mm for the active four-finger mobilization protocol, the passive four-finger mobilization protocol and the modified Kleinert mobilization protocol and the active protocol had the greatest excursion.

The values obtained in the present study at 6 weeks (group A= 1.76mm, group B=2.34) and at 3weeks (group A= 0.93, group B=1.48) are slightly different compared for tendon excursion reported by Korstanje et al. (2012). The tendon excursion of post treatment group A was 2.02, while group B was 2.08. The protocols in their studies were passive and active but in the present study, we have compared two early active protocols and their effects on tendon excursion. It can be anticipated that if the tendon excursion will be different in both protocols, the resulting tendon excursion will depend on the amount of joint movement.

Hundozi et al. (2013), reported the benefits of early mobilization in comparison with immobilization, the healing process of immobilization 2 weeks after repair was maintained and the unstressed tendons needed to tenolysis after 6 weeks. The rate of tenolysis after primary repair was 2- 6 in case of immobilization and joints stiffness which leads to reduce Range of motion.

Moreover, it is crucial that the force of FDP was 1N during passive movement and was 19 N during active movement (Schuind et al. 1992). The blocking exercises of PIP and DIP gave the highest tendon forces but low excursions, another study reported that hook fist straight fist and full fist achieve maximum gliding of FDS and FDP (Wehbé & Hunter, 1985).

In the present study, the adhesion after zone II flexor tendon repair may occur between FDP and FDS and these adhesions lead to increase gliding resistance of the tendon.

Tang and Lalonde (2020), mentioned that the blocking exercises of FDS and FDP create high force on the tendon but low excursion. FDS had low force during EAD protocol in comparison with PAH protocol. The excursion measurement of the repaired tendon in zone III was explained by Horibes et al. (1990) who said that zone II had a high prevalence of adhesion formation.

CONCLUSION

The present study demonstrated that both active protocol, EAD and PAD affected the excursion of the flexor tendon zone II after surgical repair. The excursion of the PAD protocol at 6 weeks after treatment is statistically significantly larger than the excursion at 3 weeks, the excursion of the EAD protocol at 6weeks is statistically significantly larger than the excursion at 3 weeks. Moreover, there is no significant difference between both protocols at 6 weeks. Also, further research is needed with a larger number of participants and samples of patients with flexor tendon repair.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

Thanks Dr. Samar Nabil and Dr .Radwa mahmoud for their help in our study.

AUTHOR CONTRIBUTIONS

EA designed and conducted the research, data collection, data analysis and also manuscript writing .Prof. Dr AMA assisted in reviewing the manuscript .Dr. MBI helped in data collection, Prof. Dr. OA aided in manuscript writing and Prof. Dr HA measured the data by ultrasound system.

REFERENCES

Baskies, M. A., Tuckman, D. V., & Paksima, N.

(2008). Management of flexor tendon injuries following surgical repair. Bulletin-Hospital For Joint Diseases New York, 66(1), 35.

Farzad, M., Layeghi, F., Asgari, A., Ring, D. C., Karimlou, M., & Hosseini, S. A. (2014). A prospective randomized controlled trial of controlled passive mobilization vs. place and active hold exercises after zone 2 flexor tendon repair. Hand Surgery, 19(01), 53-59

Khanna, A., Friel, M., Gougoulias, N., Longo, U. G., & Maffulli, N. (2009). Prevention of adhesions in surgery of the flexor tendons of the hand: what is the evidence?. British medical bulletin, 90(1), 85-109.

Kisner, C. A. & Colby, L. A. (2012). Range of motion. Therapeutic exercise foundations and Techniques, 61-73.

Kutsumi, K., Amadio, P. C., Zhao, C., Zobitz, M. E., & An, K. N. (2005). Gliding resistance of the extensor pollicis brevis tendon and abductor pollicis longus tendon within the first dorsal compartment in fixed wrist positions. Journal of orthopaedic research, 23(2), 243-248.

Sapienza, A., & Green, S. (2012). Correction of the claw hand. Hand clinics, 28(1), 53-66.

Schuind, F., Garcia-Elias, M., Cooney III, W. P., & An, K. N. (1992). Flexor tendon forces: in vivo measurements. The Journal of hand surgery, 17(2), 291-298.

Strickland, J. W., & Cannon, N. M. (1993). Flexor tendon repair: Indiana method. Indiana Hand Center Newsletter, 1, 1-19.

Wehbé, M. A., & Hunter, J. M. (1985). Flexor tendon gliding in the hand. Part I. In vivo excursions. The Journal of hand surgery, 10(4), 570-574.