

*Research Article***Evaluation of the effects of platelet-rich plasma (PRP) therapy on the healing of flexor tendon injuries of the hand.****Abdou M. Abdullah Darwish, Khaled M. Hassan, Alaa M. Hassan El-Swefy, and Mohab M. Hassanin Sultan**

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Abstract

Introduction: Platelet rich plasma has been used to enhance healing after surgical tendon repair. **Aim of the work:** Evaluation of the effect of platelets rich plasma on the healing of flexor tendons of the hand. **Patients and methods:** The present randomized controlled study included 20 patients in hospital of Minia university during the period between December 2018 and December 2019 at age 5 - 50 years, Diagnosed as acute complete cut tendon. **Results:** Incidence of excellent healing was in PRP group. **Discussion:** Platelet rich plasma increase strength of repair with poor effect on complications of tendon repair. **We recommend:** More studies have to be done on individual growth factors of PRP to show effects of every factor on tendon healing.

Keywords: Flexor tendons – platelet rich plasma – healing – growth factors**Introduction**

Decades of research on tendon and ligament (T/L) injuries have yielded extensive knowledge of the mechanical and biological properties of these dense connective tissues, translating into advances in surgical and conservative therapies that can prevent major disability. However, T/L injuries remain a persistent clinical challenge. In the U.S. alone, tendon, ligament, and joint capsular injuries account for 45% of the 32 million musculoskeletal injuries each year⁽¹⁾

With rates rising due to increasing sports participation and an aging population.

Unfortunately, current treatment strategies fail to restore the functional, structural, and biochemical properties of repaired T/L to those of native tissue. Consequently, the principal elements of tissue engineering – cells, scaffolds, and bioactive molecules – have been explored in an effort to improve T/L healing.

Both in vitro and in vivo studies have expanded the understanding of T/L biology while demonstrating the utility of tissue engineering in enhancing the healing of musculoskeletal tissues. Nevertheless, no tissue engineered construct thus far has achieved complete regeneration of T/L. In response, tissue engineers

are looking to the emerging understanding of T/L development in an effort to recapitulate the embryonic events that establish the native structure⁽²⁾.

Aim of the work

Evaluation of the effect of platelets rich plasma on the healing of flexor tendons of the hand.

Patients and methods**Patients:**

The present randomized controlled study included 20 patients in hospital of Minia university during the period between December 2018 and December 2019.

Inclusion criteria:

- Age 5 - 50 years.
- Diagnosed as complete cut tendon.
- Acute cut tendon

Exclusion criteria:

- Age less than five years and over 50 years
- Chronic cut tendon
- Recurrent cut tendon
- Associated skeletal or nerve injuries

Pre-operative evaluation:

Physical examination.

Inspection:

Resting position of the hand was observed and assessment of the digital cascade was done .

- Range of motion:

Passive wrist flexion and extension were allowed for assessment of the tendon, active MCP, PIP and DIP flexion was tested .

- Neurological:

An assessment of light touch and static two point discrimination was performed, loss of sensation in a digital nerve dermatome after a sharp laceration represented a nerve transection until prove otherwise, assessment of ulnar, median nerve.

- Vascular:

Capillary refill of the volar digital pulp and the nail bed was assessed.

Diagnostic imaging:

Standard diagnostic radiographs including AP, lateral and oblique views of the hand were done

Methods**Preparation of PRP**

Blood was drawn from patient from the antecubital vein (10 ml for every cut tendon) with 10 ml syringe that contained 1ml sodium citrate then the blood was centrifuged for 15 minutes at 500 rpm and collect supernatant 2-3 ml (PRP) into 5ml syringe using desktop centrifuge

Procedure

Patients were placed in supine position under local intravenous anesthesia with application of tourniquet.

Incision

The traumatic incisions were extended to achieve surgical exposure, zigzags incision extending from the distal phalanx into the palm, cross the digital flexion creases at 45 degrees angles to create flaps with 90 degrees corner.

Surgical technique:**I. General Considerations**

A. Flexor tendons have a propensity to retract. Repair should be done in the OR.

B. Neurovascular injury is common with flexor tendon injuries, so a detailed examination is paramount prior to local anesthetic infiltration.

C. A flexor tendon laceration will cause the affected finger to be more extended, disrupting the resting cascade.

D. The skin laceration does not always correlate with the level of injury. Lacerations that occur with the finger in flexion will result in the tendons being cut more distally than the skin.

Suture techniques:

Modified Kessler repair with proline 3-0 non absorbable sutures with 6-0 prolene running locking sutures.

PRP augmentation:

Injection of 0.5 ml of PRP liquid form in each edge of the tendon and the remainder at the site of repair after closure of the wound.

Results

Case	Sex	Age	Zone	Fingers					Tendons			complication	TAM
				Index	middle	ring	little	thumb	FDP	FDS	FPL		
control 1	male	18	5	*	*	*	*		*	*		Adhesion	Very good
control 2	male	40	5			*	*		*	*		-----	Excellent
control 3	male	25	2			*	*		*	*		-----	Very good
control 4	male	20	2			*			*			-----	Very good
control 5	male	30	2	*					*			-----	Very good
control 6	male	50	2				*		*	*		Adhesion	Good
control 7	male	31	2	*					*			-----	Excellent
control 8	male	40	2			*			*			-----	Good
control 9	male	18	2	*					*	*		Infection	Good
control 10	male	31	2			*	*		*			Adhesion	Poor

study 1	male	30	5	*	*	*			*	*		Tourniquet pulsy	Excellent after 6 months
study 2	female	22	2	*					*			-----	Excellent
study 3	male	43	2		*				*			Rupture (after 2 months)	Poor
study 4	male	38	2		*				*	*		Adhesion	Very good
study 5	female	5	2					*			*	-----	Excellent
study 6	male	25	5	*	*	*	*		*	*		-----	Excellent
study 7	male	22	2		*				*			Adhesion	Very good
study 8	female	34	2	*					*			Adhesion	Good
study 9	Male	44	5		*	*			*	*		-----	Excellent
study 10	male	17	2			*			*			-----	Excellent

Excellent (85-100 %) – Very good (75-85 %) – Good (50-75 %) - Poor (0-50 %) – FDP (flexor digitorum profundus) – FDS (flexor digitorum superficialis) – FPL (flexor pollicis longus)

Discussion

Tendon and ligament injuries (TLIs) are among the most common health problems affecting the adult population⁽³⁾.

About 16.4 million tendon and ligament injuries occur in the United States every year⁽⁴⁾.

In recent years, a promising new treatment option using platelet-rich plasma (PRP) has been widely used in clinics to treat TLIs⁽⁵⁾.

PRP is the plasma fraction of autologous blood containing high concentration of platelets and

growth factors. After activation, PRP delivers various types of growth factors to injury sites, including platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), vascular endothelial growth factor (VEGF), epidermal growth factor (EGF), insulin-like growth factor-I (IGF-I), fibroblastic

growth factor (FGF), and hepatocyte growth factor (HGF) ⁽⁶⁾.

Because most of these factors are involved in the repair of tendon and ligament injuries high concentrations of these growth factors are considered to accelerate TLI healing ⁽⁷⁾.

During healing, tendons are responsive to circulation-derived or locally produced growth factors, most of which are found within PRP ⁽⁸⁾.

This randomized controlled study on 20 patients from 5-50 years with recent sharp clean cut tendons in zones 2,5 with no associated skeletal or nerve injuries.

At 12 weeks the fingers full active flexion and extension are assessed using the Goniometer and the readings were written in the evaluation sheet and the results were calculated with TAM scores.

The incidence of excellence was greater in the PRP group (6 cases) in relative to control group (2 cases) .

The incidence of rupture was greater in the PRP group (1 case) in relative to control group (0 cases) with no statistical significance.

The incidence of complications was greater in the PRP group (5 cases) in relative to control group (4 cases) with no statistical significance.

The incidence of adhesion was equal in the PRP group (3 cases) in relative to control group (3 cases) with no statistical significance.

We recommend

More studies have to be done on individual growth factors of PRP to show effects of every factor on tendon healing.

References

- 1- Butler DL, Juncosa N, Dressler MR. Functional efficacy of tendon repair processes. Annual review of biomedical engineering. 2004; 6:303–329.
- 2- Thomopoulos S, Genin GM, Galatz LM. The development and morphogenesis of the tendon-to-bone insertion - What development can teach us about healing. J Musculoskelet Neuronal Interact. 2010;10 (1):35–45.
- 3- James R, Kesturu G, Balian G, Chhabra AB. Tendon:biology, biomechanics, repair, growth factors, and evolving treatment options. J Hand Surg Am.2008;33:102–112
- 4- Wang JH, Guo Q, Li B. Tendon biomechanics and mechanobiology-a minireview of basic concepts and recent advancements. J Hand Ther. 2012; 25:133–140. quiz 141.
- 5- Finn off JT, Fowler SP, Lai JK, Santrach PJ, Willis EA, et al., Treatment of chronic tendinopathy with ultrasound-guided needle tenotomy and platelet-rich plasma injection. PM R. 2011;3:900–911.
- 6- Yuan T, Guo SC, Han P, Zhang CQ, Zeng BF. Applications of leukocyte-and platelet-rich plasma(L-PRP)in trauma surgery. Curr Pharm Biotechnol.2012;13:1173-1184
- 7- Taylor DW, Petrera M, Hendry M, Theodoropoulos JS. A systematic review of the use of platelet-rich plasma in sports medicine as a new treatment for tendon and ligament injuries. Clin J Sport Med. 2011;21:344–352.
- 8- Yoshikawa Y, Abrahamsson SO. Dose-related cellular effects of platelet-derived growth factor-BB differ in various types of rabbit tendons in vitro. Acta Orthop Scand. 2001;72:287–292.