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A PROSPECTIVE COMPARATIVE STUDY OF CLINICAL AND FUNCTIONAL OUTCOME OF ZONE II FLEXOR TENDON REPAIR: TWO STRAND MODIFIED KESSLER (4-0 POLYPROPYLENE) VS SIX STRANDS MODIFIED KESSLER (6-0 POLYPROPYLENE) TECHNIQUE

Plastic Surgery

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ABSTRACT

Zone II flexor tendon injuries remained an ever challenging issue for hand surgeons. Since 1980s till date numerous techniques of repair and rehabilitation protocols have evolved to give the best outcome which was never possible. In search of modification of six strand repairs and to assess the outcome of this modification in comparison to two-strand repair, we did this study in our department on 30 injured digits. We found better results in tendons repaired with 6-0 polypropylene in six strand modification of modified Kessler technique.

Further study in larger number of patients comparing 6-0 polypropylene in six-strand modification of modified Kessler technique with four-strand techniques and other triple loop (six strands) technique followed by early active motion protocol is required to establish its efficacy and standardization.

KEYWORDS

INTRODUCTION

The hand is divided into 5 zones. Zone II (no man's land) is in between the limits of the flexor tendon sheath which is at the A1 pulley and the insertion of the flexor digitorum superficialis. Tendons can get injured either by lacerations such as those from knives or glass, from crush injuries and occasionally they can rupture from where they are joined to the bone. They heal by intrinsic or extrinsic mechanism. Flexor tendon lacerations remain a challenge for the hand surgeon and therapist with the ultimate aim to restore maximum function with expedience and safety in a range of clinical situations. To achieve this goal, suture techniques and their specific post-operative therapy protocols have evolved over the years from programmes of complete immobilization through early controlled motion- to the current interest in early active motion.

In tendon surgery many repair methods have been developed so as to cope with cohesiveness, gap formation and rupture in repair field. Furthermore, active or passive motion programs are modified to the repaired tendon in order to heal the post-surgery results.[1,2] However, as much weight is mounted on the repair field during the cyclic active embarkations, early motion protocols, proved to be efficient to avoid post-surgery tendon cohesiveness, shows the necessity of strong suture techniques. Many researchers stated that the more suture legs passing through the repair field increase the stretching strength of the repair field significantly.[3,4] But these type of suture techniques have difficulties in practice as the complexity increases and so much manipulation is required.[5,6] In addition to this information, although the modified Kessler suture technique combined with simple epitendinous suture used commonly in tendon surgery is easy and practical to apply, it is stated in various studies that it's not so strong as to permit active movement.

Since it was believed that healing occurred by extrinsic mechanism in the past, the necessity of immobilization for the development of adhesion was advocated.[7] But the narrowness in the finger movement was a frequently encountered result. In the following years, Gelberman and Manske, upon their studies, proved that flexor tendons have the power to heal intrinsically.[8] Furthermore, when it is understood that mobilized tendons healed more quickly and their final pace was stronger than immobilized tendons, some differences have been made in the suture techniques used in the operations and in rehabilitation programs used afterwards.[9]

Comparative study in cadaver model between 2, 4 & 6 strands zone 2 flexor tendon repair shows 2-strand repair had significantly greater gap formation after cyclic loading than either the 4-strand or 6-strand repair. The tensile strength of the 6-strand repair was significantly greater than either the 4-strand or 2-strand repair.[10]

Irrespective of the type of repair used, the ideal tenorrhaphy should be:

1. Biomechanically sound, to maintain integrity of the tenorrhaphy until healing is sufficiently advanced;
2. Biologically inert, to facilitate normal tendon healing processes , and
3. User friendly, to allow the repair to be performed by less experienced surgeons.

Currently, proposed multi-strand repairs appear to be able to withstand the tension required for postoperative active motion or combined active and passive motion. The six-strand Savage repair is a strong tenorrhaphy with excellent biomechanical characteristics.

MATERIALS AND METHODS

Study design: Prospective study.

Study set-up: In the Department of Surgery, Agartala Government Medical College and GB Hospital, Agartala, Tripura, India.

Study duration: 2 years (August 2016 – July 2018).

Study population: 17 patients presented with zone II flexor tendon injury in single or multiple digits in the Department of Surgery, GB Hospital, Agartala during the study period.

INCLUSION CRITERIA: Patients who sustained sharp and complete flexor digitorum profundus (FDP) lacerations in zone II, with or without concomitant flexor digitorum superficialis (FDS) lacerations or neurovascular damage. The inclusion criteria required treatment within 2 days and postoperative therapy for a minimum of 12 weeks.

Data collection:

1. 17 patients presenting with zone II flexor tendon injury in single or multiple digits were taken up for the study.
2. Informed written consent was taken.
3. 30 involved digits were divided into two groups of 15 each.
4. Group A (15) treated with 6 strands modification of Kessler technique using 6-0 polypropylene suture.
5. Group B(15) treated with 2 strand modified Kessler method using
4- 0 polypropylene suture.
5 patients with multiple zone II injuries treated with both the technique were considered for both cases as well as control group.

Procedures:

a) Modification of Kessler technique: six-strands(6-0)

After extending the original wound by zigzag or midlateral incisions, cut end of the tendons were explored and retracted ends retrieved from underneath the annular & cruciate pulleys. If required, cruciate pulley was sacrificed and annular pulley divided and repaired later on with 6-

0 polypropylene suture. Using 6-0 polypropylene core suture in a modified Kessler manner, with purchase length of 1cm, in three different sites 120˚ apart, taken and tied so that the knots remain buried once all the sutures are tied. A simple running epitendinous stitch with polypropylene (6-0) completed the repair.

b) Modified Kessler Group: two-strand technique (4-0)

After extending the original laceration by Bruner's zigzag or midlateral incisions, a modified two-strand Kessler core suture with polypropylene (4-0) and a simple running epitendinous stitch with polypropylene (6-0) were used for tendon repair (figure 2). Mobilization was commenced on the fourth day postoperatively according to the modified Duran regimen only.

Range of Motion (ROM) measurement:-

Active range of motion was measured by using goniometer at

- 3 ½ weeks
- 6 weeks
- 8 weeks
- 12 weeks post-op

Parameters :-Degree of flexion &extension deficit at metacarpopha langeal, proximal & distal interphalangeal joints

EVALUATION:-

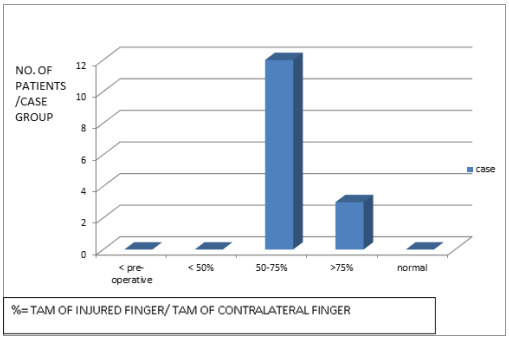
Evaluation of recovery was done by using TAM evaluation system of the ASSH(American Society for Surgery of the Hand)

score	%
excellent	Normal
Good	>75
Fair	50-75
Poor	<50
Worse	<pre-operative

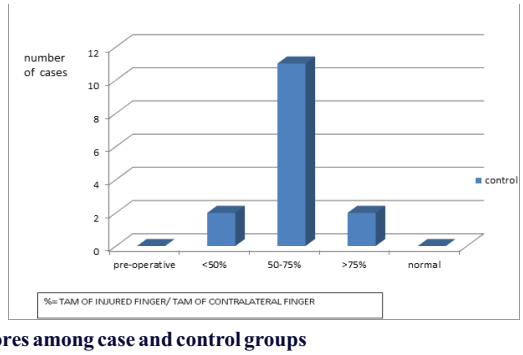
TAM = total active flexion – total extension deficit (MCP, PIP, DIP)
% = TAM of the injured finger / TAM of the contralateral finger.
Score evaluated in two groups and compared.

RESULTS AND OBSERVATION

Scores in case group



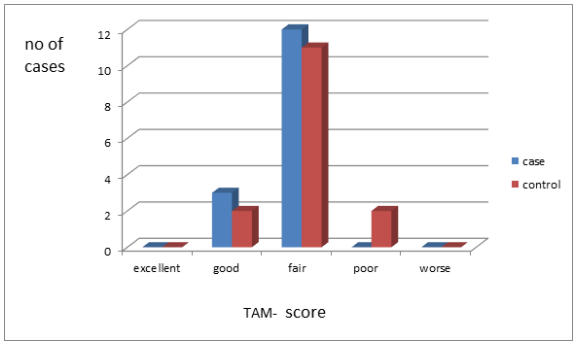
Scores in control group



Scores among case and control groups

Scores	Case	Control	P- value Chi-square test
Excellent	0	0	0.326
Good	3	2	
Fair	12	11	
Poor	0	2	
Worse	0	0	

Scores among case and control groups



DISCUSSION

This study was conducted in the Department of Surgery, Agartala Government Medical College and GB Hospital, Agartala for a period of 2 years (August 2016 - July 2018).

Intraoperatively, after exploration, retrieval of tendons ends were done and flexor digitorum profundus tendons were repaired with 6-0 polypropylene six strand modification technique. Out of 30 digits, 24 had concomitant flexor digitorum superficialis tendon injury which was repaired with 4-0 polypropylene two strand method. M.M. Al-Qatan et al in their study of six strand figure of eight suture technique for zone II injuries committed to only flexor digitorum profundus repair.

As a six strand modification of modified Kessler, following tying of all sutures the knot was hidden in the core; hence our technique does not increase the bulk and no adjunct procedure is required. In contrary M.M. Al-Qattan et al in their study of six strand figure of eight suture did venting of the proximal pulley due to increased bulk of the repair for outside knots.

Passage of 6-0 suture in 120 degree apart in six strands took average time period of 20+/- 5 minutes initially which gradually reduce to 12+/- 3 minutes at the end of the study. Whereas in control group it was in an average 5+/-2 minutes .

Loupe magnification was not used in any of the cases.

Postoperatively we followed modified Duran passive motion protocol from the 4th postoperative day within the limit of dorsal blocking splintage, in contrast other studies with six strands repair wherein early active motion protocol began from 2nd postoperative day.

Active range of motion was measured by using goniometer at 3 ½, 6, 8, and 12 weeks post-op.

We followed ASSH (American Society for Surgery of the Hand) score of TAM(Total Active Motion). Whereas in other studies like M.M. Al-Qattan et al in their study followed Strickland and Glogovac grading system.

At the end of 3 months follow up and physiotherapy, range of motion was measured and TAM was calculated and scoring done. Among case group 3(20%) belongs to good and 12 (80%) belonged to fair category ,whereas among control group, 2(13%) belonged to good and poor category and 11(73%) belonged to fair category.

Hence, 50-75% of functional recovery by 3 months was obtained in 80% of case and 73% of control group.

CONCLUSION

Zone II flexor tendon injuries remain a challenge for the hand surgeons to give final outcome in a promising way. In the past decades, it has been proved that popularly performed two strand techniques lacked mechanical strength and do not tolerate early motion activity. Four strand repair was found to have improved tensile strength. Six or eight strand repair would provide greater safety margin to tolerate early motion activity.

As the number of core sutures increased, passage of suture technically became difficult with proper purchase length. In the past decade different techniques of four and six strand repairs were described; but

many of them were loop suture and knot tied outside the tendon which may hamper easy gliding of repaired tendon through the pulley system. Hence, most of these technique required adjunct sacrifice of one or both sleeves of flexor digitorum superficialis and venting of annular pulley.

In our study, we aimed to observed the clinical outcome of zone II flexor digitorum profundus tendon repair with 6-0 polypropylene in six strand modification of modified Kessler technique.

Average time of repair with 6-0 suture in six strand manner was longer, (12+/- 3 minutes Vs 5+/-2 minutes).

80% of the study group had fair and 20% had good recovery, whereas among control group 73% had fair recovery and (13%) belonged to good and poor category.

Although we did not have excellent scoring among both the case and control groups, in larger group study with longer duration our technique may produce better results.

We did not encounter any rupture. Technical improvement, easy handling of finer suture, reduction of repair time are subjective and there is always a learning curve .We found it easy to follow modified Kessler technique with 6-0 suture as it is regularly practised in our institute to repair tendon with 4-0 /3-0 suture .

It was not difficult to take purchase length of 10 mm with 13 mm (3/8 circle) size 6-0 needle.

The same 6-0 polypropylene was used for core and peripheral suture; hence no wastage of 6-0 suture happened as it occurs in two strand 4-0 technique where 6-0 suture is used only for epitendinous suture (70mm length of both 4-0 and 6-0 polyproplene cost almost the same price 295 Vs 306 rupees).

As a new technique, we believe that further study in larger group patients will come up with more information and acceptance.

REFERENCES

1. Kleinert HE, Kutz E, Ashbell TS, Martinez E. Primary repair of lacerated flexor tendon in no man's land. J Bone Joint Surg [Am] 1967;49:577.
2. Lee H. Double loop locking suture: a technique of tendon repair for early active mobilization. Part II: Clinical experience. J Hand Surg [Am] 1990;15:953-8.
3. Kubota H, Aoki M, Pruitt DL, Manske PR. Mechanical properties of various circumferential tendon suture techniques. J Hand Surg [Br] 1996;21:474-80.
4. Winters SC, Gelberman RH, Woo SL, Chan SS, Grewal R, Seiler JG. The effects of multiple-strand suture methods on the strength and excursion of repaired intrasynovial flexor tendons: a biomechanical study in dogs. J Hand Surg [Am] 1998; 23: 97- 104.
5. Wagner WF, Carroll C, Strickland JW, Heck DA, Toombs JP. A biomechanical comparison of techniques of flexor tendon repair. J Hand Surg [Am] 1994;19:979-83.
6. Strickland JW. Flexor tendon injuries: Foundations of treatment. J Am Acad Orthop Surg 1995;3:44-54.
7. Potenza AD. Critical evaluation of flexor-tendon healing and adhesion formation within artificial digital sheaths. J Bone Joint Surg [Am] 1963;45:1217-33.
8. Gelberman RH, Manske PR. Factors influencing flexor tendon adhesions. Hand Clin 1985;1:35-42.
9. Singer G, Ebramzadeh E, Jones NF, Meals R. Use of the Taguchi method for biomechanical comparison of flexor tendon repair techniques to allow immediate active flexion. A new method of analysis and optimization of technique to improve the quality of the repair. J Bone Joint Surg [Am] 1998;80:1498-506.
10. Thurman RT,Antonio S, Thomas ET,Douglas PH, Allan FT,Patty K. Two, Four and Six-Strand Zone II Flexor Tendon Repairs: An In Situ Biomechanical Comparison Using a Cadaver Model. J Hand Surg 1998;23A:261-265.