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Case Report
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EXTENSOR TENDON REPAIR BY MODIFIED KESSLER'S TECHNIQUE: A CASE REPORT

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ABSTRACT
A 16 years old male child came at Rajiv Gandhi Govt. Ayurvedic college and Hospital paprola with history of trauma over right hand with sharp edged teen while playing and complained of pain and bleeding from the dorsum of right hand i.e. the dominant hand of the patient. On examination there was a lacerated wound approximately 7×4 cm over dorsum of right hand. Bleeding was active and profuse with flexion deformity of affected hand. The child was unable to extend his fingers of affected hand. Extensor tendons were not intact. Distal Neurovascular Status was normal and Radial Pulse was present. After clinical and radiological evaluation, the case was diagnosed with extensor tendon injury of extensor digitorum tendon of 2^{nd} 3^{rd} 4^{th} phalanges right hand with open fracture of 3^{rd} 4^{th} Metacarpal head of Right hand. Extensor tendon repair was done by modified Kessler technique and cockup slab was applied for 4 weeks and the wound was healed and the slab was removed after 4 weeks with 80% functional disability of the affected hand. Then the patient recovered with 90% of range of motion of affected hand within 6 months and with no functional disability within 1 year.

KEYWORDS: Kessler technique, tendon repair, extensor injury, extensor digitorum, hand.

INTRODUCTION
Tendons are fibrous tissues that connect muscles to bones, enabling movement and stability. Tendons play primarily a mechanical role at the junction of muscle and bone, directly transmitting contractile forces and dissolving stress that would otherwise concentrate if muscle and bone were in direct contact.[1] They store, release, and dissipate energy to efficiently maintain the joint-loading cycle while protecting adjacent tissues. A variety of damage processes can lead to tendinopathy or tendon rupture. Tears can form in healthy tendons that have been abruptly overworked (for example, during a high-speed or high-impact incident) or lacerated.[2] Tendinitis or tendinosis can develop in tendons subjected to overuse (e.g., an elite swimmer's training routine) or intrinsic tissue degeneration (e.g., age-related degeneration). The healing capacity of a torn or diseased tendon differs based on its anatomic position (e.g., Achilles vs. Rotator cuff) and local environment (intrasynovial vs. extrasynovial).[2] Although healing varies, in general, repaired tendons recover in the same way as wounds do, with an early inflammatory phase followed by proliferative and remodeling stages.[3]

Nonetheless, tendinous injuries are exceedingly common, with 50% of musculoskeletal injuries recorded in the United States involving tendinous or ligamentous injury and 10% of people (50% of runners) experiencing Achilles tendinopathy by age of 45.

MATERIALS AND METHODS
AIM AND OBJECTIVE
1. The main aim of the study was to evaluate the functional recovery of affected hand after tendon repair.
2. To review the current understanding of tendon repair and regeneration.
3. To discuss the implication of tendon repair on patient outcomes and quality of life.

CASE REPORT
• A 16 years old male child came at Rajiv Gandhi Govt. Ayurvedic college and Hospital paprola with history of trauma over right hand with sharp edged teen while playing and complained of pain and bleeding from the dorsum of right hand. on examination there was a lacerated wound approximately 7×4 cm over dorsum of right hand . Bleeding was active and profuse with flexion deformity of affected hand. The child was unable to

extend his fingers of affected hand. extensor tendons were not intact. Distal Neurovascular Status was normal and Radial Pulse was present. After clinical and radiological evaluation, the case was diagnosed with extensor tendon injury of extensor digitorum tendon of 2^{nd} 3^{rd} 4^{th} phalanges rt. hand with open fracture of 3^{rd} 4^{th} Metacarpal head of Right hand. Extensor tendon repair was done by modified kessler technique and cockup slab was applied.

INSPECTION

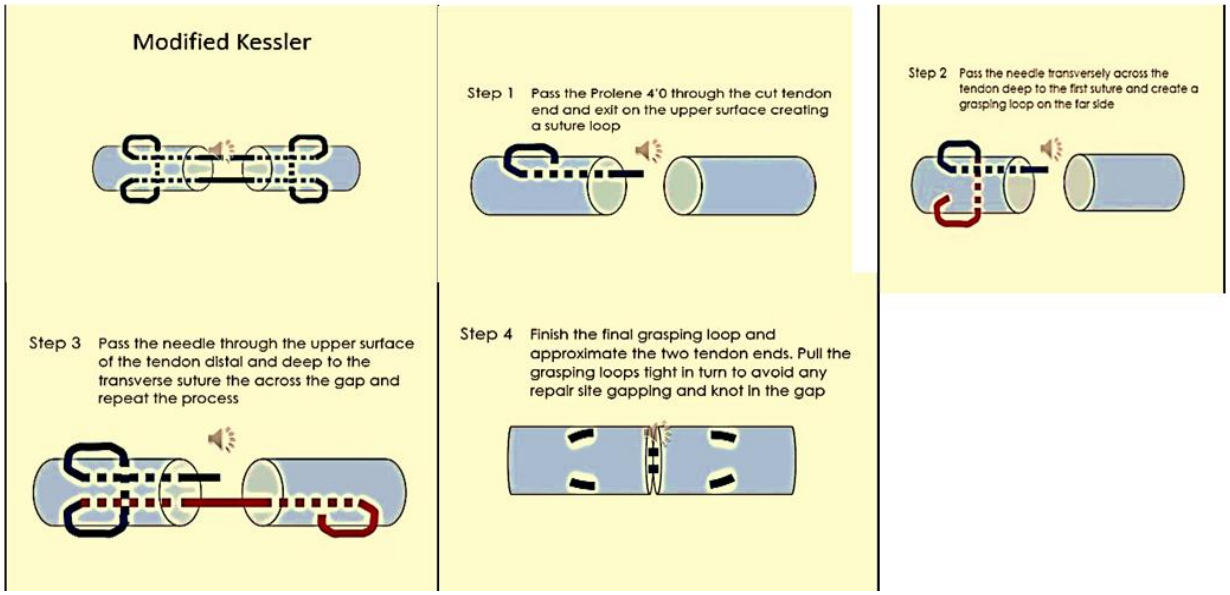
- SKIN: lacerated wound 7×4 cm present over dorsum of rt. Hand
- SWELLING : present mild
- BLEEDING : active
- DEFORMITY : present flexion deformity
- R.O.M. : unable to extend fingers of affected hand

DNV STATUS

- DISCOLOURATION: not present
- NUMBNESS : not present
- TINGLING SENSATION : not present
- CRT : <2sec
- RADIAL PULSE : present

Modified Kessler Technique[4]

- **Steps of Procedure**



The only common theme among these "modified Kessler techniques" is the use of intratendinous longitudinal and transverse components that are connected by an extratendinous arc/loop link component with the transverse component passed between the divided end of the tendon and the far end of the longitudinal component.[5]

Fig 1: Before Repair (Ruptured tendons) Exposed bones with open # 3^{rd} 4^{th} MC Head.

Fig 2: During Tendon Repair

Fig. 3: Tendon. Repair by Modified of Kesseler technique wound.

Fig. 4: After Tendon repair with closure of wound

Fig. 5 After 1 month.

Fig 6. After 1 year with full functional recovery.

DISCUSSION AND RESULT

After the Extensor tendon repair done by modified kessler technique, the cockup slab was applied for 4 weeks. Eventually the wound was healed and the slab was removed after 4 weeks with 80% functional disbality of the affected hand. With the help of physiotherapy, the patient recovered 90% of range of motion of affected hand within 6 months and got full functional recovery within 1 year.

The Kessler technique (1917): It was developed by Kirchmayer in 1917 which involves a simple, end to end suture technique with knot buried in the tendon outside the suture line. A two stranded core suture with knots. The tendons are repaired by using continuous sutures with locking suture pattern.[6]

Modified Kessler Technique (1970): It is introduced in 1970s to address limitations of the original Kessler technique. The tendons are repaired by using figure of eight suture pattern and it uses a combination of epitendinous and endotendinous sutures. It enhances the strength of repaired tendon and provides the resistance to gap formation. This is the one or two sutures with intratendinous knots.[6]

Advantages[3]

1. It improves tensile strength
2. Reduces gap formation.
3. Enhances resistence to tendon rupture.
4. It has better functional outcomes.

Indications

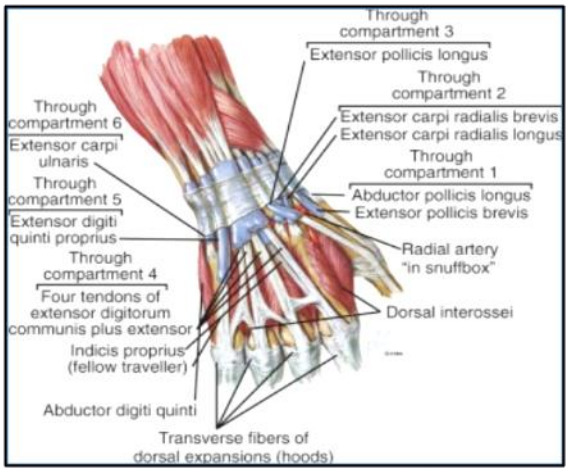
1. Partial or complete tendon lacerations
2. Tendon avulsions
3. Flexor tendon injuries (Zone II)

Contraindications

1. Tendon injuries with significant tissue loss
2. Inadequate tendon quality
3. Active infection

Table 1[5]

Year	Tendon Repair Name	Type of Repair
1917	Kirchmayr repair	2-strand, 1-knot, sliding repair
1940	Bunnell repair	1-strand, 1-knot, sliding repair
1941	Mason–Allen repair	4-strand, 2-knot, anchored repair
1969	Kessler "grasping" repair	2-strand, 2-knot, anchored repair
1972	Urbaniak variant of Kessler	2-strand, 2-knot, sliding repair
1975	Tsuge repair	2-strand, 1-knot, anchored repair
1979	Pennington "locking" repair	2-strand, 1-knot, sliding repair
1994	Massachusetts General Hospital repair	4-strand, 2-knot, anchored repair
1995	Strickland repair	4 strand, 2-knot, sliding repair
1996	Lim-Tsai repair	6-strand, 2-knot, anchored repair
1998	Winters-Gelberman repair	8-strand, 2-knot, sliding repair



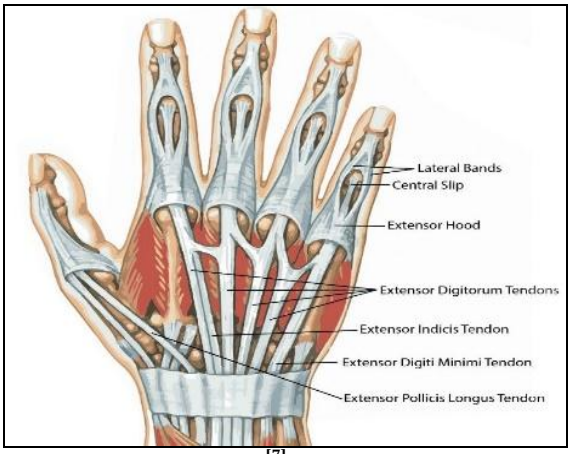


Fig 7 & 8: Anatomy of extensor tendons of Hand.[7]

CONCLUSION

Modified kessler technique is one of most effective technique for tendon repair with 90 -100% functional recovery along with the immobilization of the affected part for atleast 1 month. This is a surgical technique used for tendon repair, particularly in the hand. It's an advancement of the original kessler technique.

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