

Biomechanical Comparison Of The Double Opposing Locking Loop (DOLL), Lim/Tsai And Modified Kessler Flexor Tendon Repair Techniques

Anca Dogaroiu MS, David Cardenas BS, Muhammad Harirah MD, Andrew Y. Zhang MD, Douglas Sammer MD, Andrei Odobescu MD PhD

PURPOSE

We performed a biomechanical comparison of the double opposing locking loop (DOLL) 4-strand flexor tendon repair technique with the Lim/Tsai 6-strand (LS) and modified Kessler 4-strand repairs (MK), exploring differences in tensile strength, stiffness and gap resistance.

INTRODUCTION

- Controlled early active mobilization stimulates collagen deposition across the repair and reduces adhesions between tendon and tendon sheath.
- Excessive load can cause the repair to gap or rupture. Gap formation of 2-3 mm results in insufficient strength for early mobilization.
- The biomechanical properties of the DOLL technique have not been well characterized.

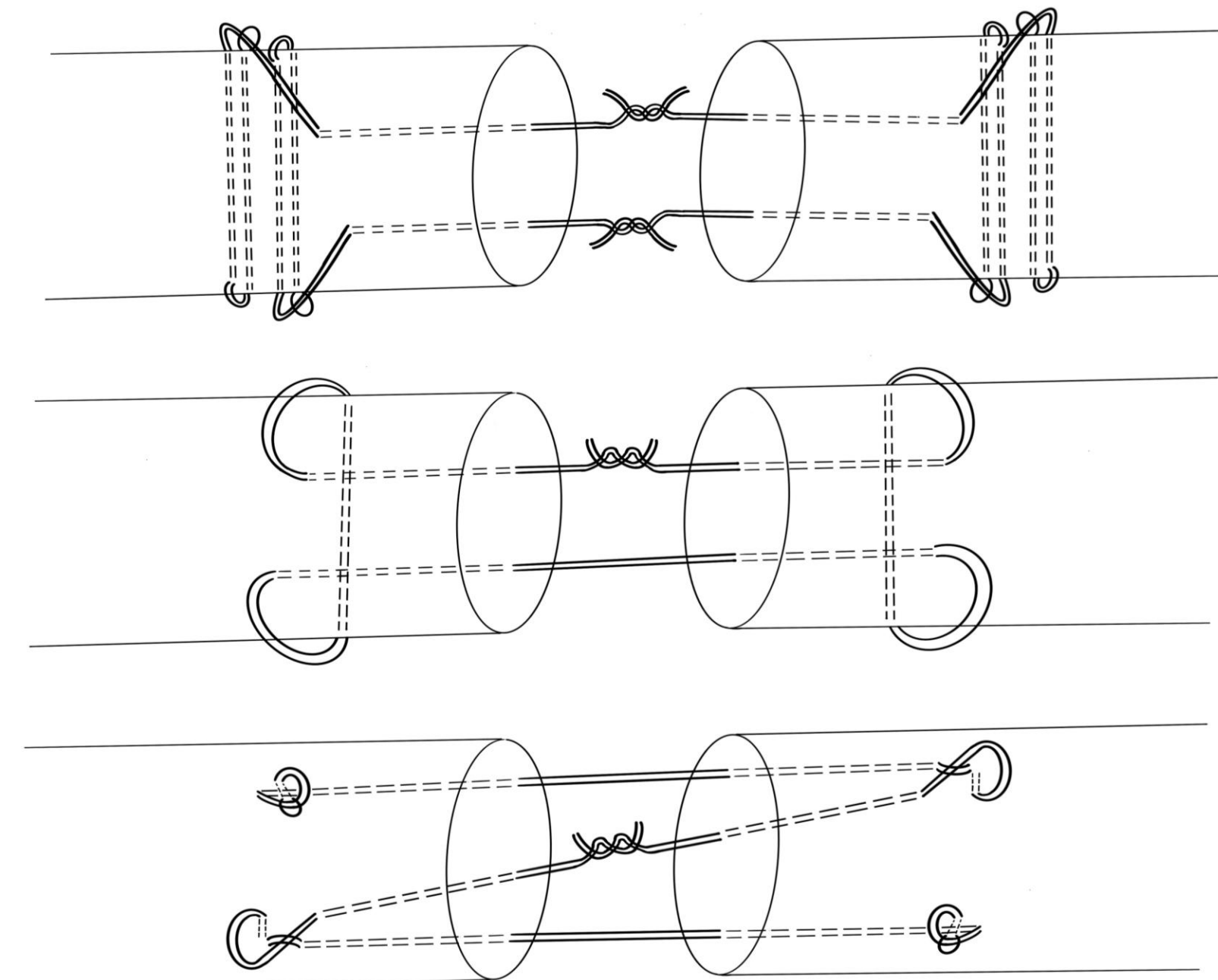


Figure 1. Tendon repair techniques utilized: DOLL (top), MK (middle), and LS (bottom).

METHODS

- Thirty FPL, FDP, and FDS cadaveric flexor tendons were harvested and transverse Zone 3 lacerations were created.
- Tendons were repaired using one of three techniques: DOLL, Lim/Tsai, and modified Kessler.



Figure 2. Tendon specimen with a DOLL repair in the Instron materials testing machine.

- Repair strength was tested to failure using an Instron materials testing machine.
- Maximum load, load at 2 mm gap, stiffness, and mechanism of failure were recorded.

RESULTS

- The LS and DOLL repairs had significantly greater maximum load than the MK repair
- LS showed the greatest average maximum load.
- The DOLL repair had significantly greater 2 mm gap force than both the LS and MK repairs.
- There was no significant difference in 2 mm gap force between LS and MK repairs or the stiffness of all three repairs.

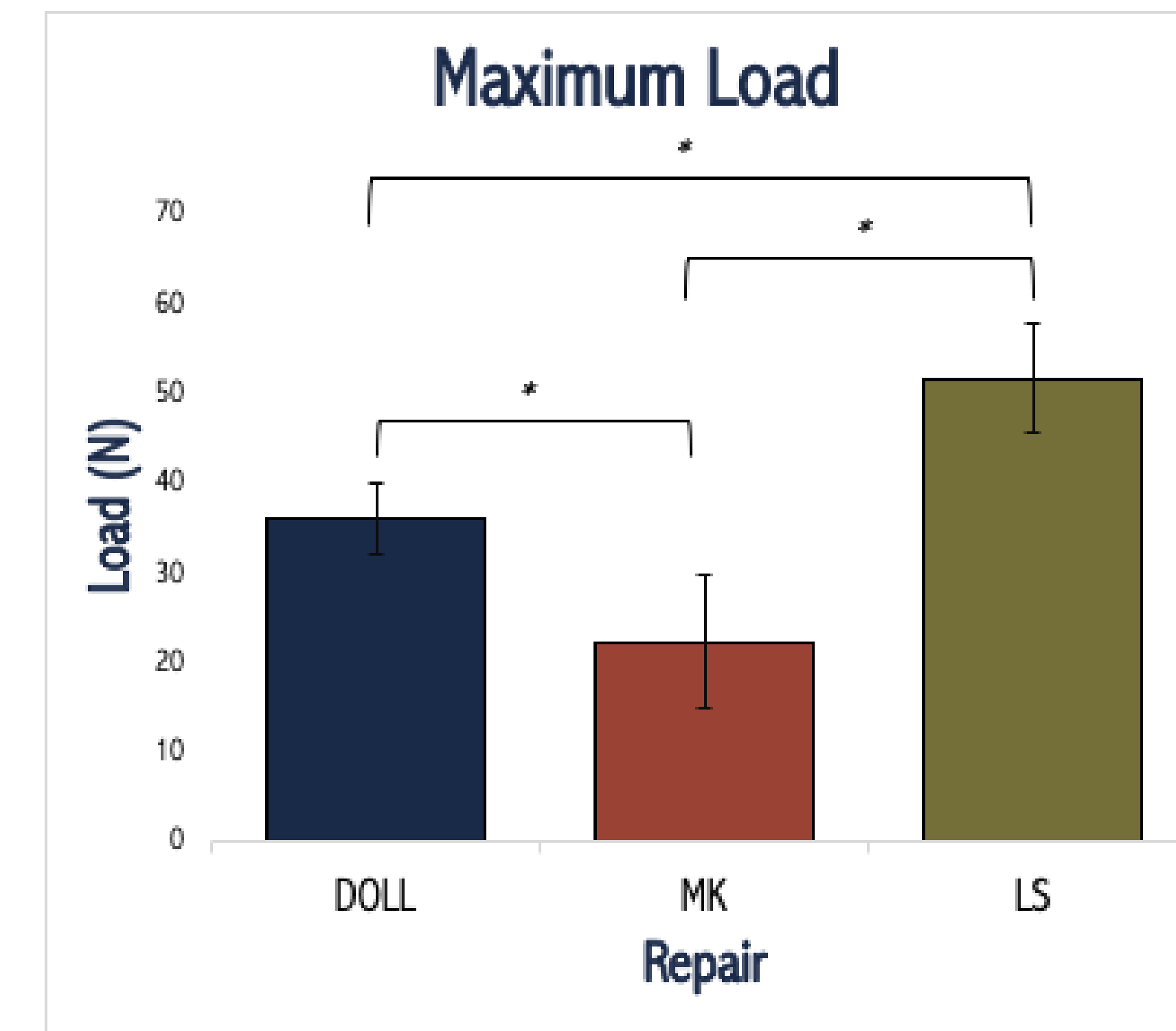


Figure 3. Maximum load (N) of each repair. “*” indicates p < 0.001.

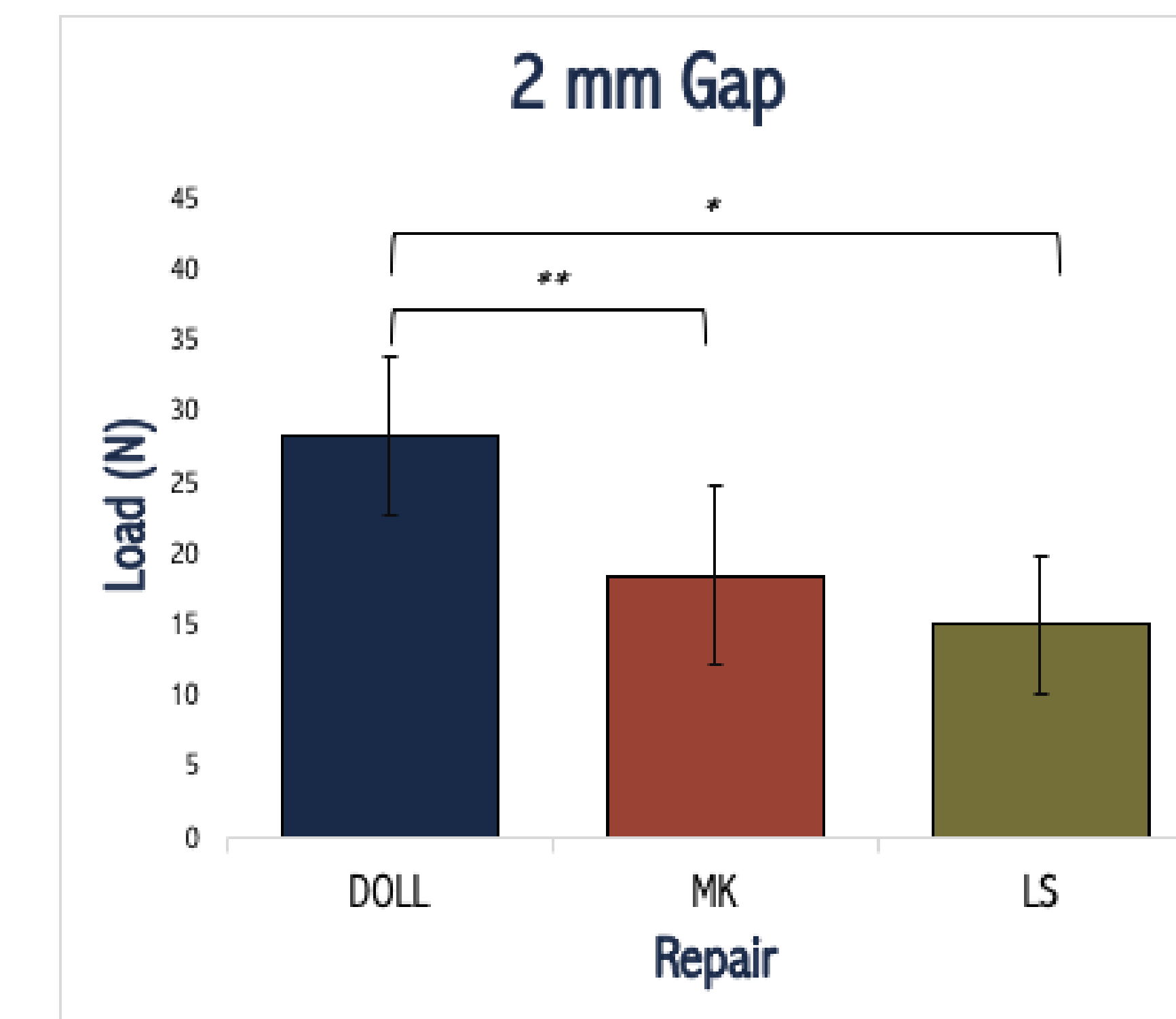


Figure 4. Load (N) at 2 mm repair gap. “*” indicates p < 0.001. “**” indicates p < 0.01.

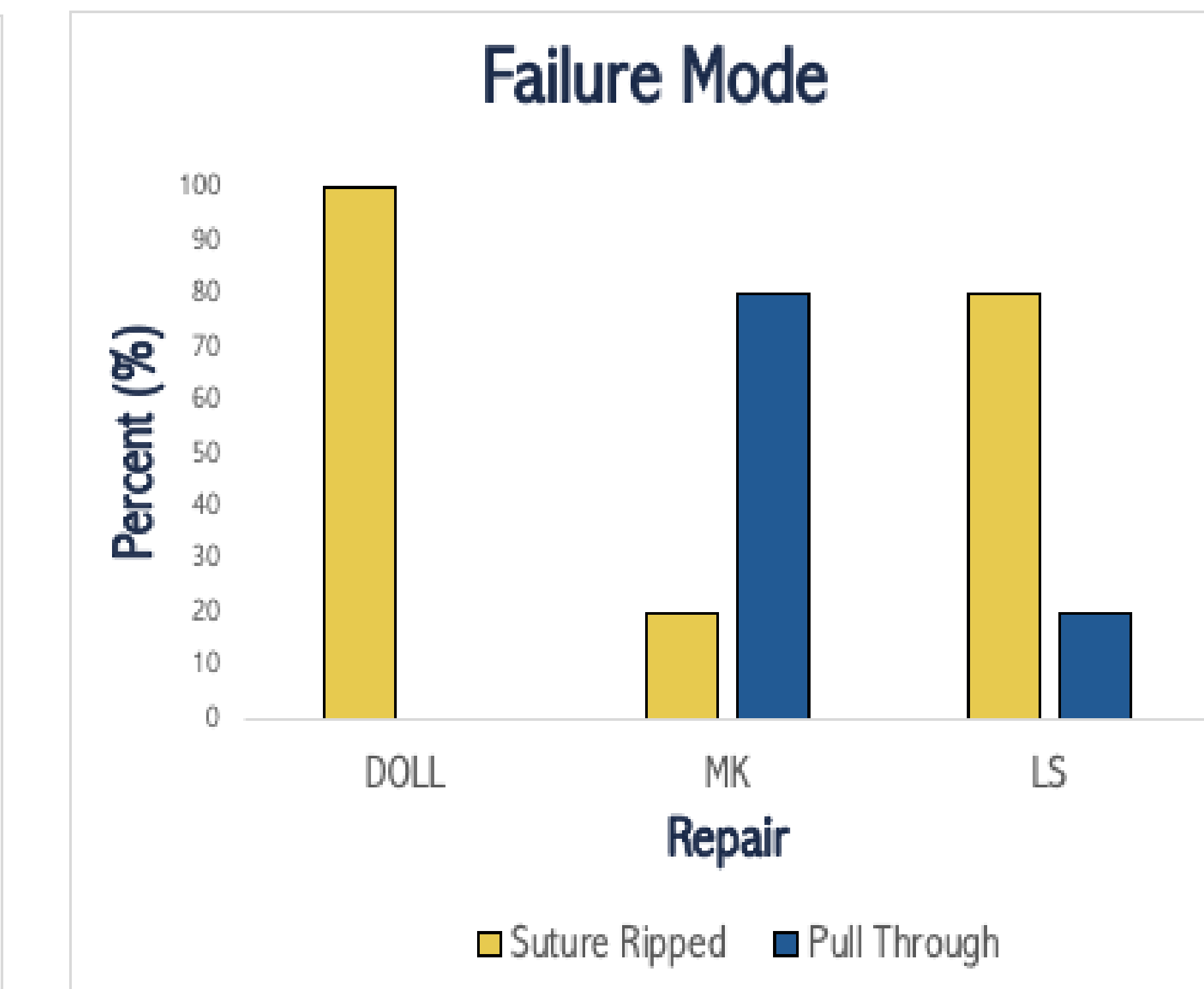


Figure 5. Failure mode of repairs.

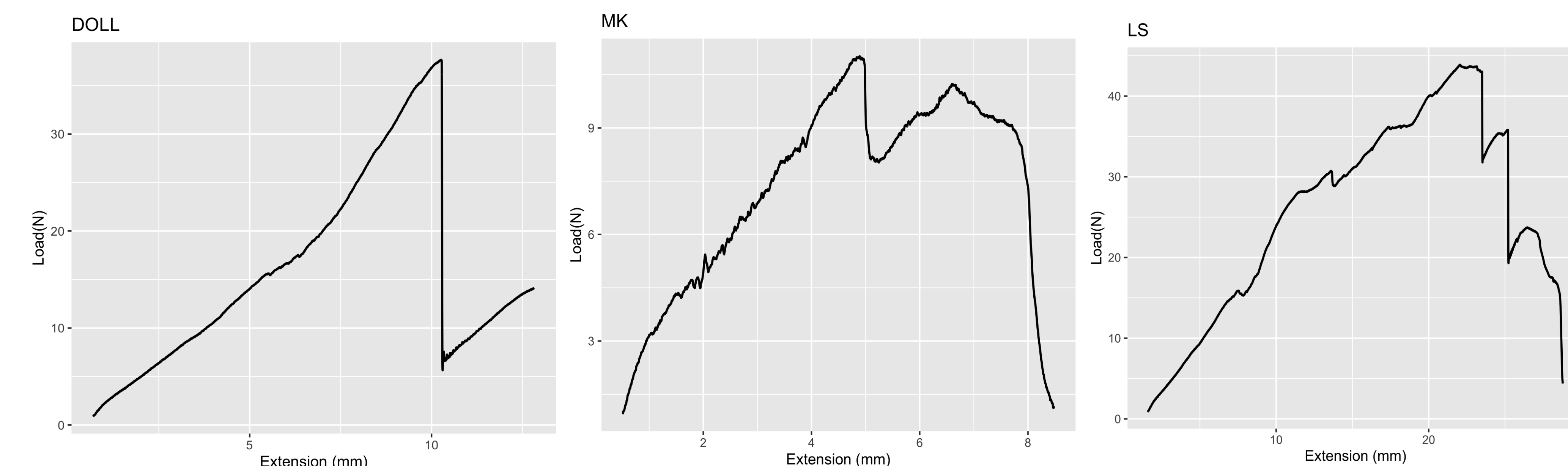


Figure 6. Sample Load-Extension curves of specimens repaired with the DOLL (left), MK (middle) and LS (right) techniques.

CONCLUSION

Although the biomechanical strength of the Lim/Tsai 6-strand repair was greatest, it is less stiff and less resistant to gap formation than the DOLL 4-strand repair.

CLINICAL RELEVANCE

Gap formation is associated with decreased repair strength, increased adhesion formation and increased gliding resistance. The DOLL repair demonstrated both adequate strength for early active motion as well as high gap resistance, making it an ideal flexor tendon repair technique.

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