



BIOMECHANICS COMPARISON BETWEEN TRANSTIBIAL PULLOUT, SUTURE ANCHOR AND ALL-SUTURE ANCHOR TECHNIQUES FOR MEDIAL MENISCAL ROOT REPAIR

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Declaration of Interest

None of authors have any relevant disclosures for this research



BACKGROUND AND RATIONAL

- Posterior medial meniscal root (PMMR) repair can restore meniscal function and knee kinematic, resulting in significantly lower OA progression and TKA conversion rate.
- A novel all-suture anchor technique for meniscus root repair that combine the advantages of transtibial pullout and suture anchor techniques has been developed which can avoid the use of an additional posteromedial portal while allowed to get direct fixation at the same time.

However, the biomechanics comparison between a novel all-suture anchor repair to conventional technique including the transtibial pullout and suture anchor repair techniques for posterior medial meniscal root repair has not been established

Purpose of Study

- To compare the biomechanical properties in terms of cyclic displacement, load to 3 mm displacement, ultimate load to failure and stiffness between three different techniques for posterior medial meniscal root repair in porcine knee.



- Cyclic displacement
- Load to 3 mm displacement
- Ultimate load to failure
- Stiffness
- Mode of failure

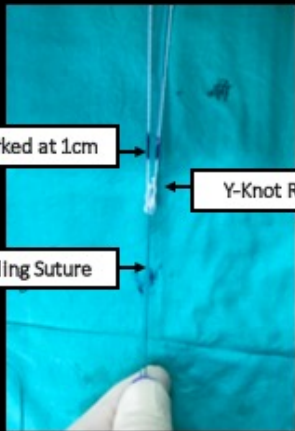
MATERIALS AND METHODS



- 33 fresh frozen porcine hind knee joints, age 24-30 weeks with intact medial
 - transtibial pullout
 - anchor suture
 - all-anchor suture
- Detach muscle and tissue around knee by preserving meniscus
- PMMR tear was created at medial edge of posterior medial meniscal root
- All repair techniques were conducted to mimic *in vivo* meniscal root repair in patient



A novel all-suture anchor technique



Marked at 1cm

Y-Knot RC 2.4mm

Pulling Suture



1. Create tunnel by using PIN 2.4mm drilled from anterior tibial cortex under aiming guide

2. Removed 2.4 Y-Knot from insertion instrument and hold with pulling suture

3. Pulled Y-knot all-suture anchor 2.4 mm into the tunnel

4. Retrograde deployed Y-knot all-suture anchor into 2.8 mm at footprint

5. Meniscus repair with FIRSTPASS mini suture passer using modified Mason-Allen stitch

RESULTS

Displacement During Cyclic Loading (mean, standard deviation and 95% CI)

	Displacement (mm)		
	100 Cycles	500 Cycles	1000 Cycles
Transtibial pullout	1.50 (0.17)*	2.12 (0.34)	2.89 (0.31)**
Suture anchor	1.19 (0.40)	1.86 (0.67)	2.21 (0.79)
All-suture	0.92 (0.49)*	1.34 (0/67)	1.75 (0.72)**

- All-suture anchor technique was significant superior to transtibial pullout technique at 100, 500, 1000 cycles (*, **)
- There were **no significant different** between suture anchor and transtibial pullout technique
- There were **no significant different** between all-suture anchor and suture anchor

RESULTS

Load to clinical failure, Ultimate load to failure, Stiffness (mean, standard deviation and 95% CI)

Parameter	Technique		
	Transtibial pullout	Suture anchor	All-suture
Load to clinical failure (N)	38.34 (9.44)	57.54 (9.65)*	61.29 (6.49)**
Ultimate load to failure (N)	101.96 (12.94)	143.26 (39.77)	152.98 (55.05)**
Stiffness (N/mm)	9.55 (1.54)	13.67 (3.29)*	13.28 (4.32)**

- An **all-suture anchor** was significant superior to transtibial pullout technique for **load to clinical failure, ultimate load to failure and stiffness (**)**
- The **suture anchor** was significant superior to transtibial pullout technique for **load to clinical failure and stiffness (*)**
- There is **no significant different** between all-suture anchor and suture anchor technique for all aspects

RESULTS

	Mode of failure		
	Suture Elongation	Meniscus Cut Out	Anchor Suture Pulling Out
Transtibial pullout	11	0	0
Suture anchor	5	6	0
All-suture anchor	2	9	0

- The **transtibial pullout** technique demonstrated **suture elongation** for all specimen (100%)
- In all-suture anchor technique demonstrated suture elongation for two specimens (18%) and meniscus cut out for nine specimens (82%)
- In suture anchor technique demonstrated suture elongation for five specimens (45%) and meniscus cut out for six specimens (55%)

DISCUSSION

- The most important finding was that all-suture anchor techniques can provide **superior biomechanical properties** compared with conventional technique for posterior medial meniscal root repair in terms of **load to clinical failure, ultimate load to failure and stiffness** at time zero.
- The drawback of transtibial pullout technique is **long construction** and indirect fixation that makes a significant **lower stiffness** which can compromised meniscal healing and high risk of failure by suture elongation in early postoperative period.



CONCLUSION

- This study proved that an all-suture anchor can be a promising alternative technique for posterior medial meniscal root repaired due to **high reproducibility** and **superior biomechanics** than conventional technique.

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