UKM Universitätsklinikum Münster

ISAKOS CONGRESS 2025

MUNICH GERMANY June 8–11

Universität Münster

Refixation Of Avulsion Fractures Of The Posterior Cruciate Ligament With Headless Compression Screws Provide Comparable Primary Biomechanical Properties

Briese T., Peez C., Albert A., Deichsel A., Herbst E., Hägerich L.M., Grunenberg O., Palma-Kries L.K., Raschke M.J., Kittl C.

Dr. med. Thorben Briese
Department of Trauma-, Hand- and Reconstructive Surgery
University Hospital Münster
(Director: Univ.-Prof. Dr. med. M. J. Raschke)

medizinische fakultät
Westfälische Wilhelms-Universität Münster

www.traumacentrum.de

ISAKOS CONGRESS 2025

Faculty Disclosure Information

- magnesium-based implants were provided by Medical Magnesium GmbH

- no further disclosures

Background

- Most posterior cruciate ligament (PCL) injuries are intrasubstance tears and avulsion fractures are relatively rare. Tibial avulsion fractures are more common than femoral.[1,2]
- Surgical refixation (open/arthroscopic) leads to satisfactory results[3]
- Techniques range from assissted arthroscopic techniques with sutures/anchors to direct open approaches with screws/plates depending on fracture morphology
- **Are Headless-Compression-Screws (HCS) a viable alternative in solid avulsion fractures?**

Hypotheses

- (1) biomechanical properties of HCS would be comparable to those of conventional fixation methods.

- (2) bioabsorbable magnesium-based HCS would provide comparable primary stability to titanium-based HCS

Methods

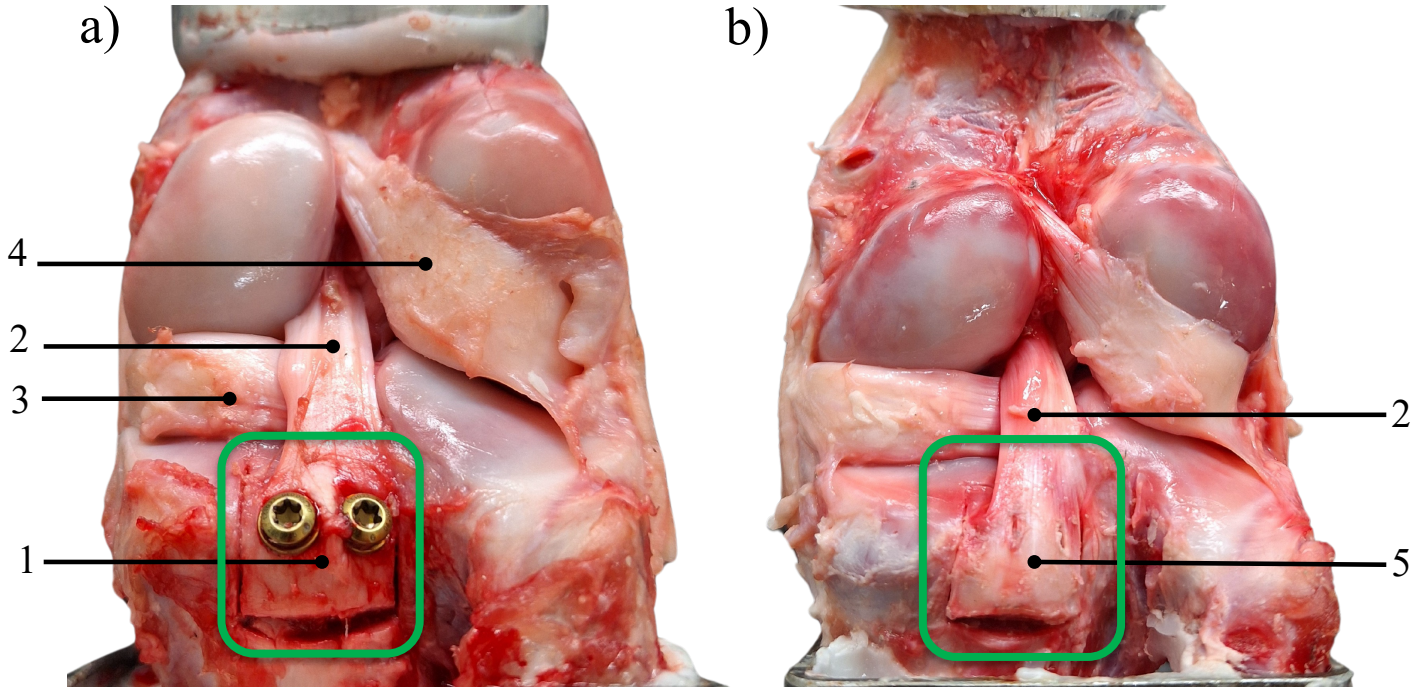
- **4 groups** (à n=10 porcine knee joints)
    1) native
    2) 2 x Titanium-based HCS (Ti-HCS) (3.5 mm) (Synthes)
    3) 2 x Magnesium-based HCS (Mg-HCS) (3.5 mm) (Medical Magnesium)
    4) 2 x cortical titanium screw + washer (Ti-CS) (3.5 mm) (Synthes)

Methods

- **solid tibial avulsion fracture** (15x10x20mm) was performed with a chisel
- **Refixation** was performed with 2 screws according to protocol

a) fixation with titanium-CS

b) fixation with HCS



1: tibial avulsion fixated with titanium-CS

2: PCL

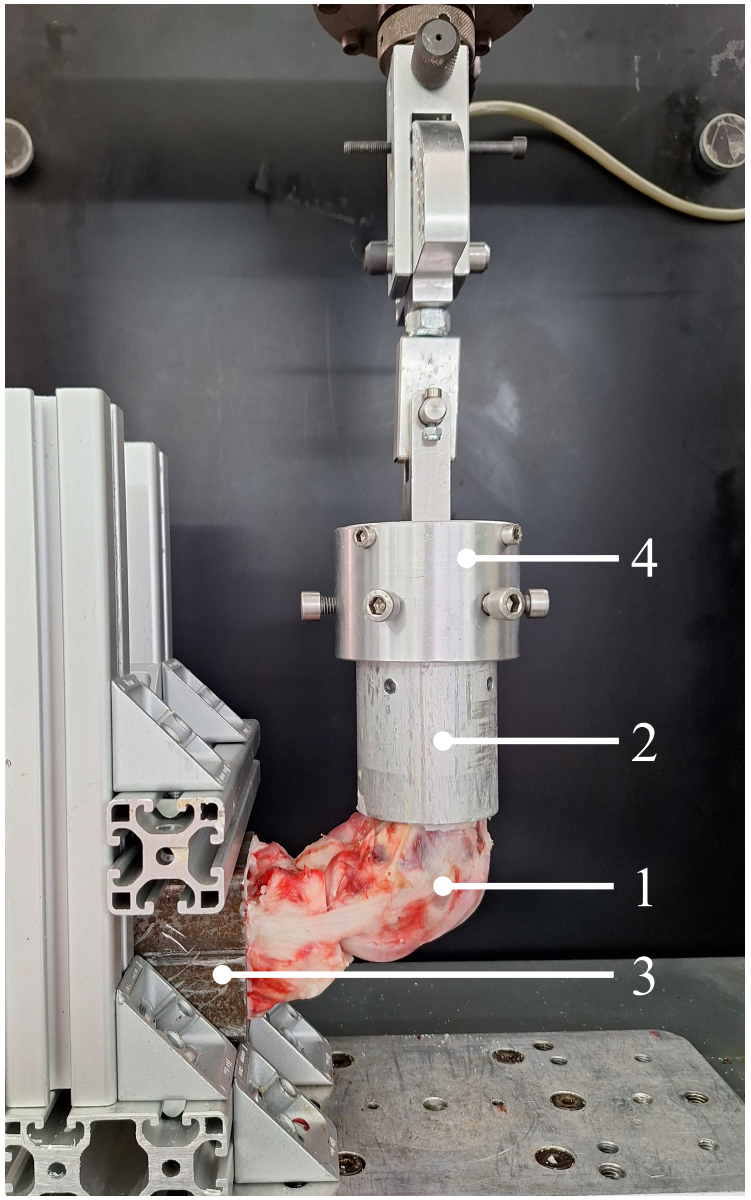
3: medial meniscus

4: lateral meniscus

5: tibial avulsion fixated with HCS

Methods

- **Simulated posterior drawer** testing was performed with a material testing machine
- **Preconditioning** was performed followed by
- **500 cycles** (200mm/min) with 10-100N
- subsequent **load-to-failure (LTF)**
- Statistical analysis was performed with one/two way ANOVA with post-hoc correction



1: porcine knee specimen

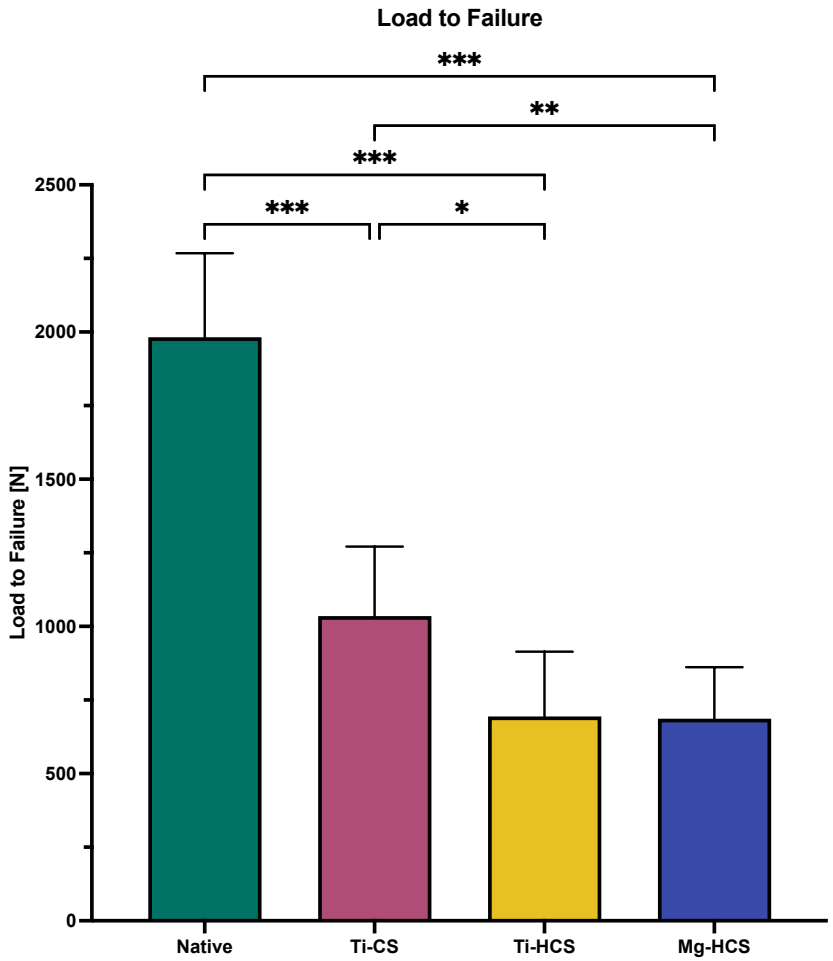
2: fixed femur

3: fixed tibia

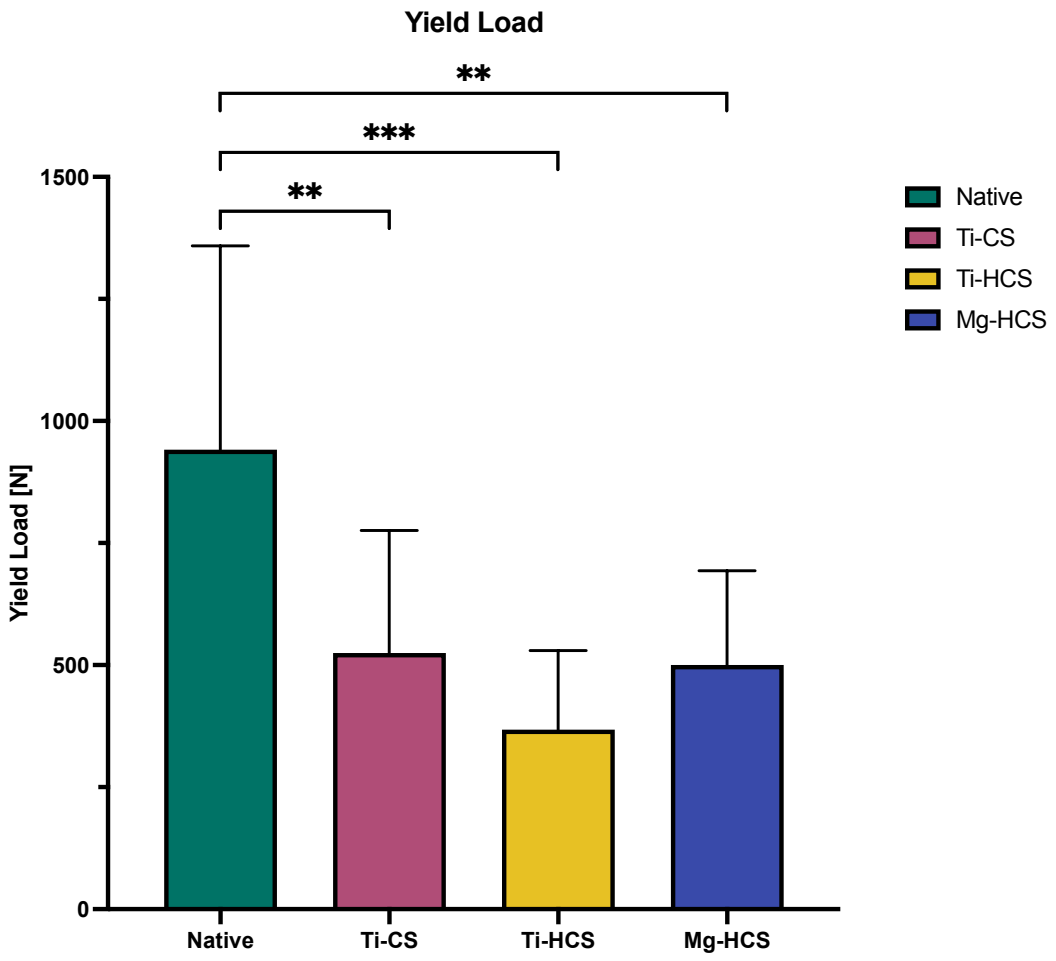
4: material testing machine

ISAKOS CONGRESS 2025

Results



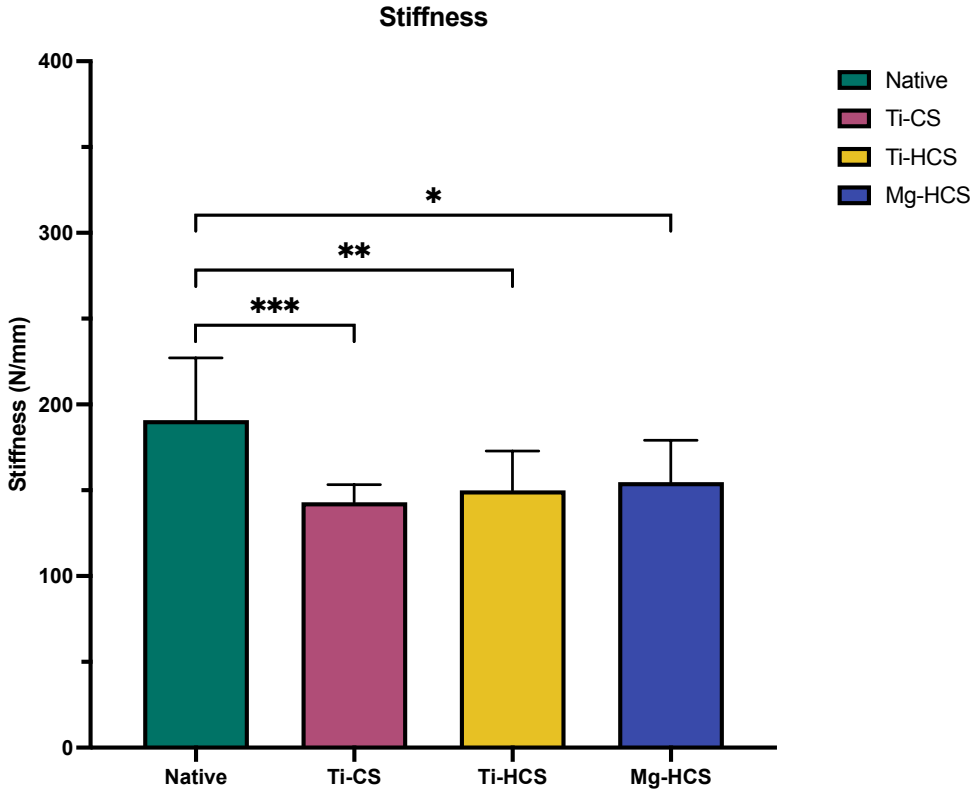
Ti-CS (1034.8 ± 236.1 N)
Ti-HCS (693.9 ± 220.5 N)
Mg-HCS (686.7 ± 174.6 N)

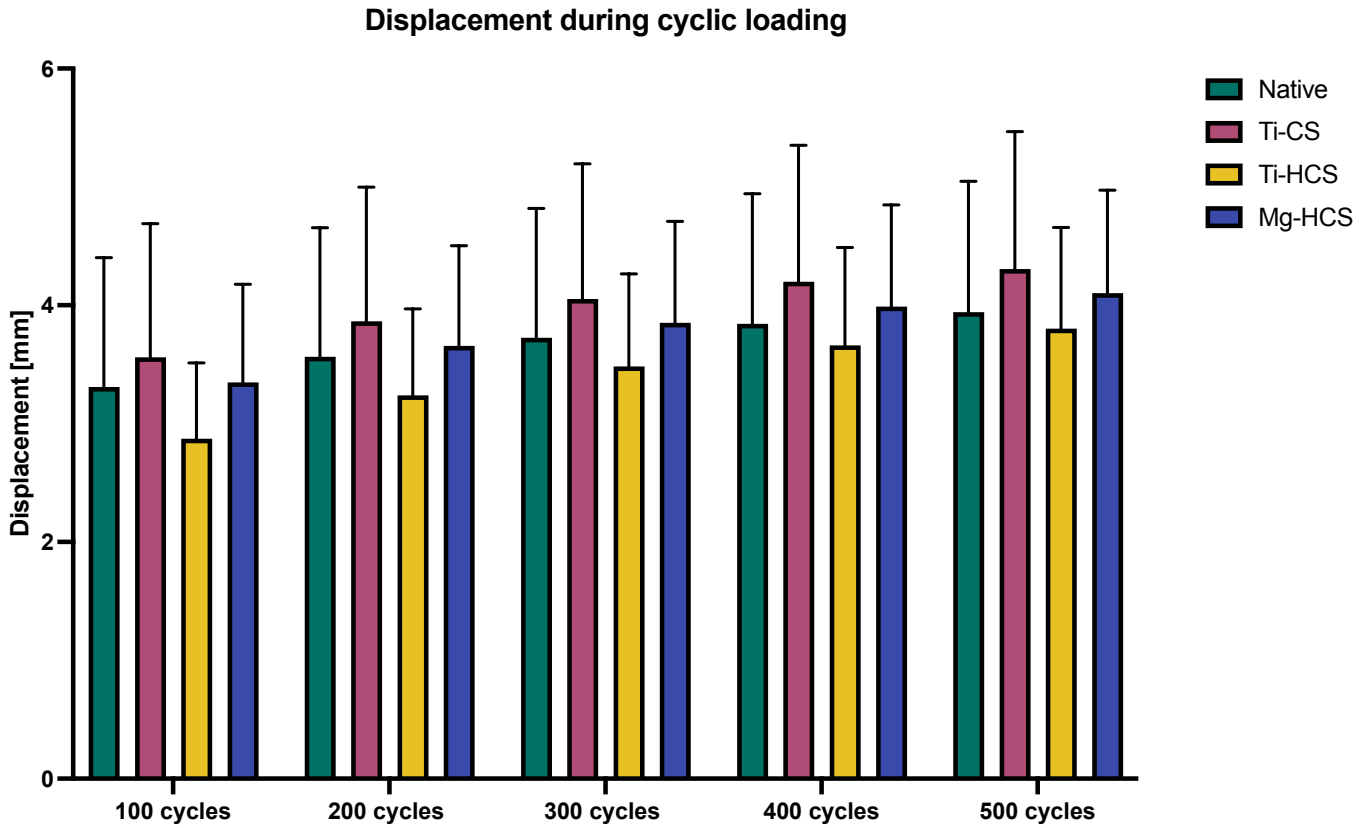


Ti-CS (524.6 ± 251.1 N)
Ti-CCHS (367.7 ± 162.1 N)
Mg-HCS (500.4 ± 193.1 N)

ISAKOS CONGRESS 2025

Results





Ti-CS (144.0 ± 15.4 N/mm)
Ti-HCS (150.0 ± 22.9 N/mm)
Mg-HCS (170.0 ± 20.9 N/mm)

ISAKOS CONGRESS 2025

Failure modes

Group	n	Failure mode
Native	10	2x PCL intrasubstance tear (20%), 8x avulsion fracture of tibial insertion (80%)
Ti-CS	10	9x PCL Rupture at screw insertion site (90%), 1x screw dislocation (10%)
Ti-HCS	10	10x Avulsion of fragment over screw head (100%)
Mg-HCS	10	10x Avulsion of fragment over screw head (100%)

Conclusion

- Non of the testes techniques was able to restore the native primary stability of the intact PCL
- Conventional screw osteosynthesis displayed the highest primary stability regarding load-to-failure
- There was no significant difference regarding titanium- or magnesium-based HCS
- Refixation with HCS can be an alternative approach to conventional screw osteosynthesis with the advantage beeing available bioabsorbable

References

- 1. Gopinatth V et al. Systematic review and meta-analysis of clinical outcomes after management of posterior cruciate ligament tibial avulsion fractures. Orthop J Sports Med. 2023
- 2. Katsman A et al. Posterior cruciate ligament avulsion fractures. Curr Rev Musculoskelet Med. 2018
- 3. Hooper PO et al. Management of posterior cruciate ligament tibial avulsion injuries: a systematic review. Am J Sports Med. 2018