



Complex tibial plateau fracture

Circular external fixation

Message

- Circular frames and plates are not competing methods, but complementary tools
- Select on the basis of fracture patterns and soft tissue status

When **not** to use plates

- Certain open fractures
 - Gross contamination
 - Extended zone of injury



When not to use plates

- Certain open fractures
 - Most Gustillo 3 open



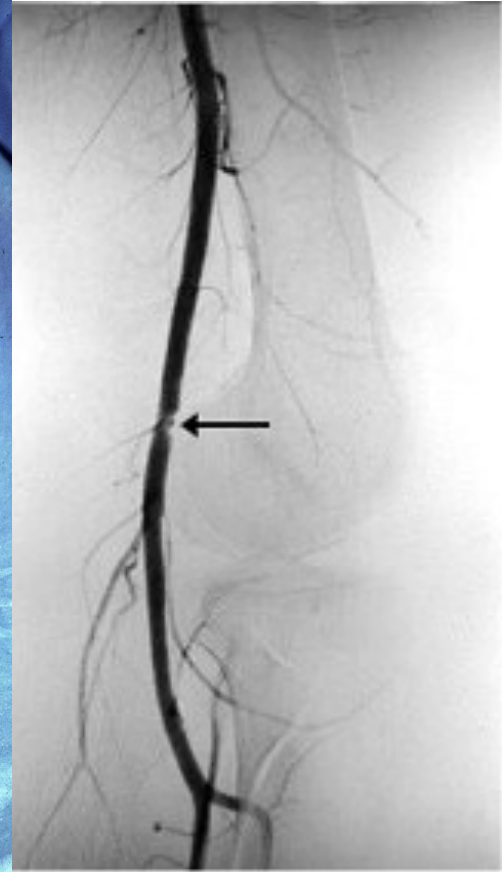
When not to use plates

- Decollement (Morel-Lavallée lesion)



Bløddele

- Tyndt bløddelslag
- Høj/lav energi
- Neurovaskulære forhold
- Compartment syndrom



AIM

- Respecting the soft tissues
- Reducing the fracture
- Stabilizing the fracture with the appropriate method

When i ring fixation an option?



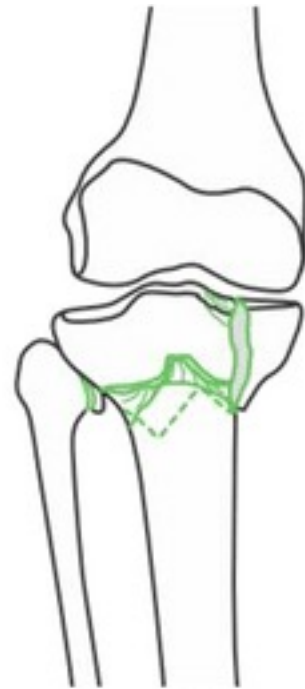
B1
n=8 (9,6%)



B2
n=15 (18,1%)



B3
n=36 (43,4%)



C1
n=3 (3,6%)

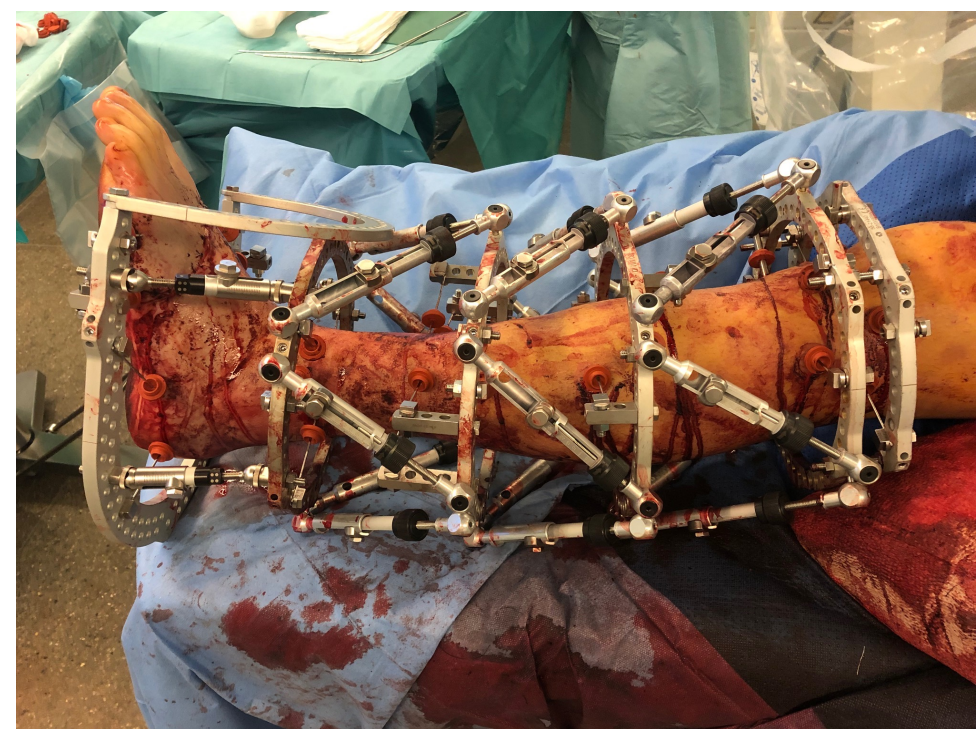


C2
n=8 (9,6%)



C3
n=13 (15,7%)

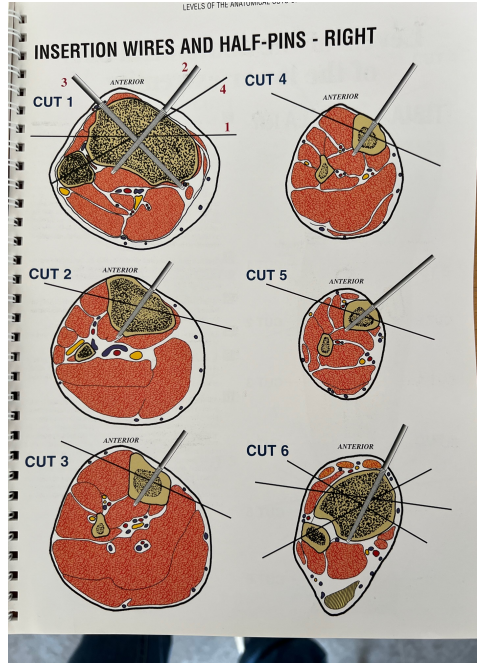
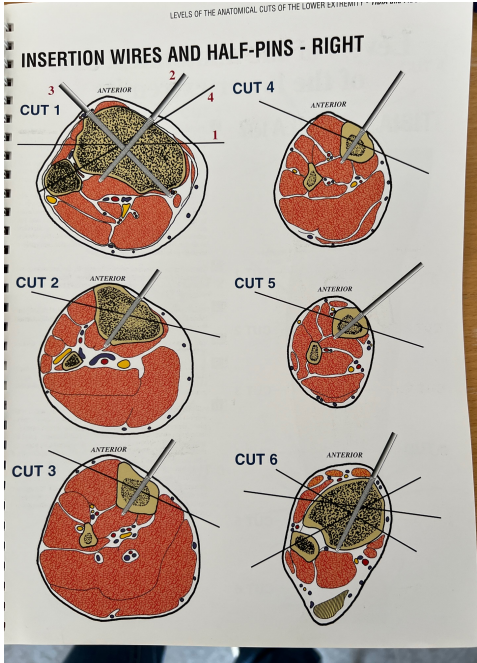
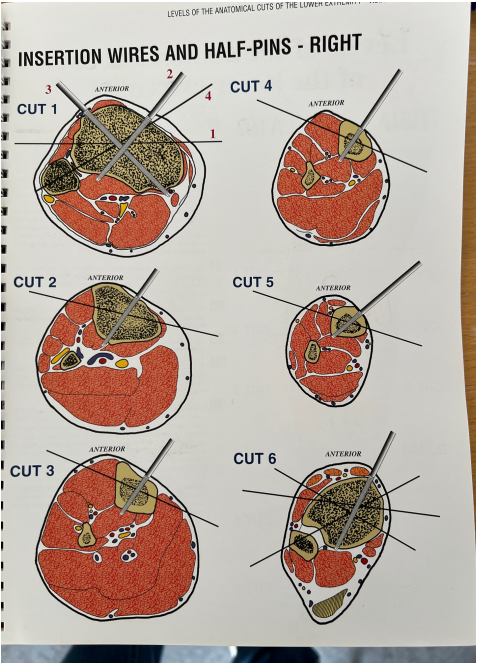
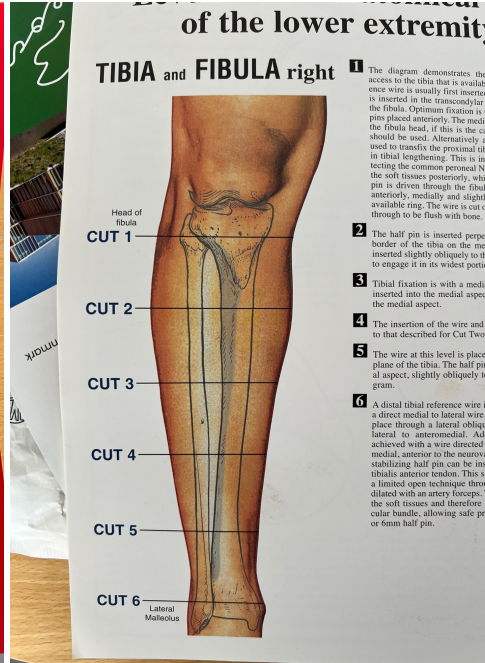
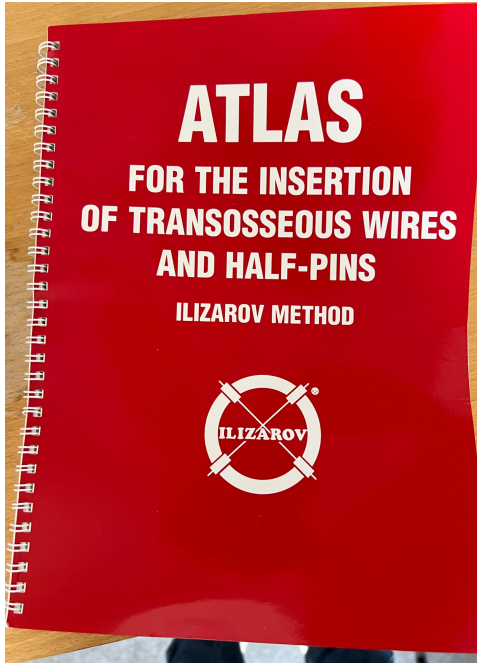
What is a ring fixator?



What is the problem with a ring fixator?

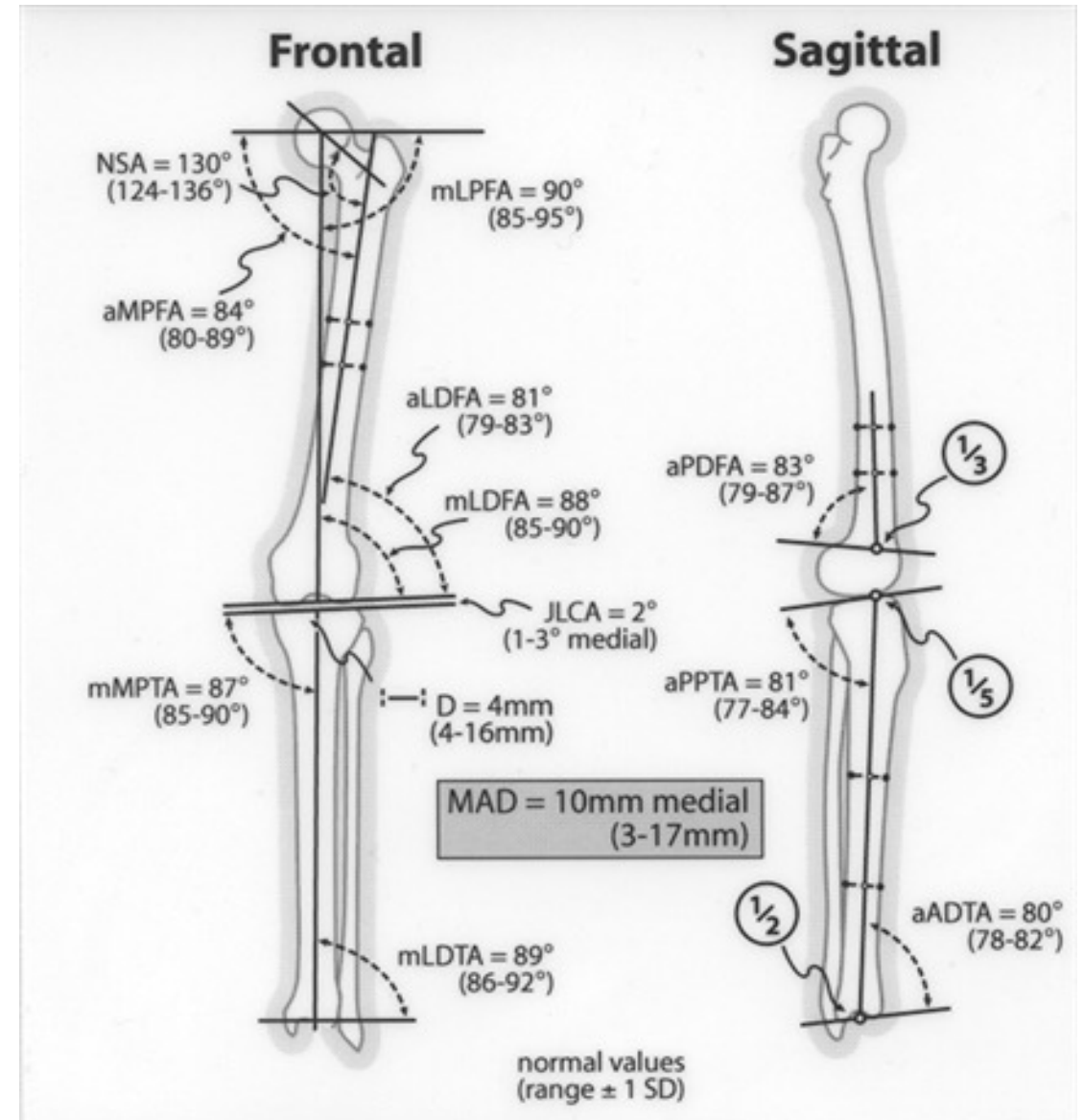
- It is a tool – not a solution
- Necessitate a large setup post-operatively
- A larger number of follow-up visits is needed
- Problems with pin/wire infection, broken wires, reallignment ect.

Prepare!



Alignment

- Know your reference values!

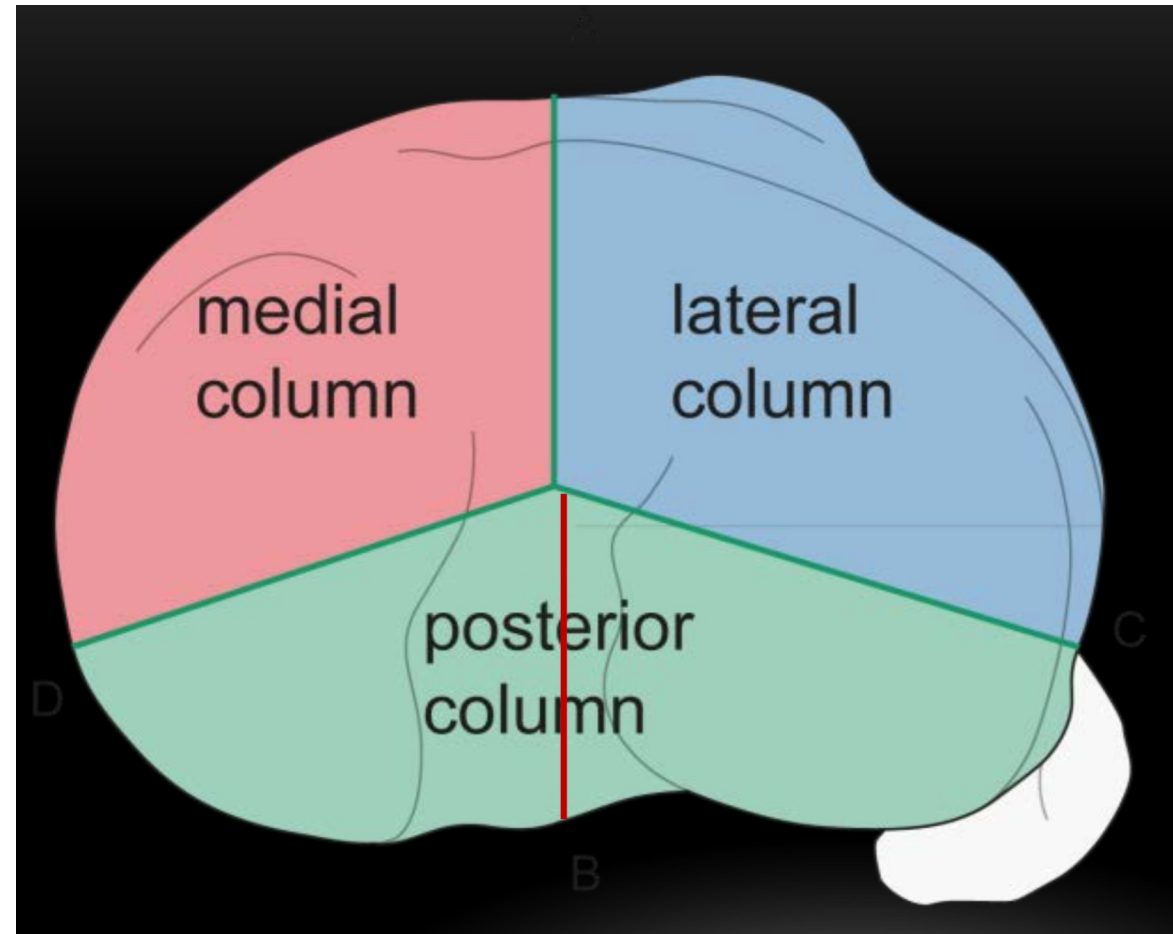


Preoperative planning: 3 column concept

Medial approach in supine position

Lateral approach in supine position

Postero-medial / posterior approach in prone position



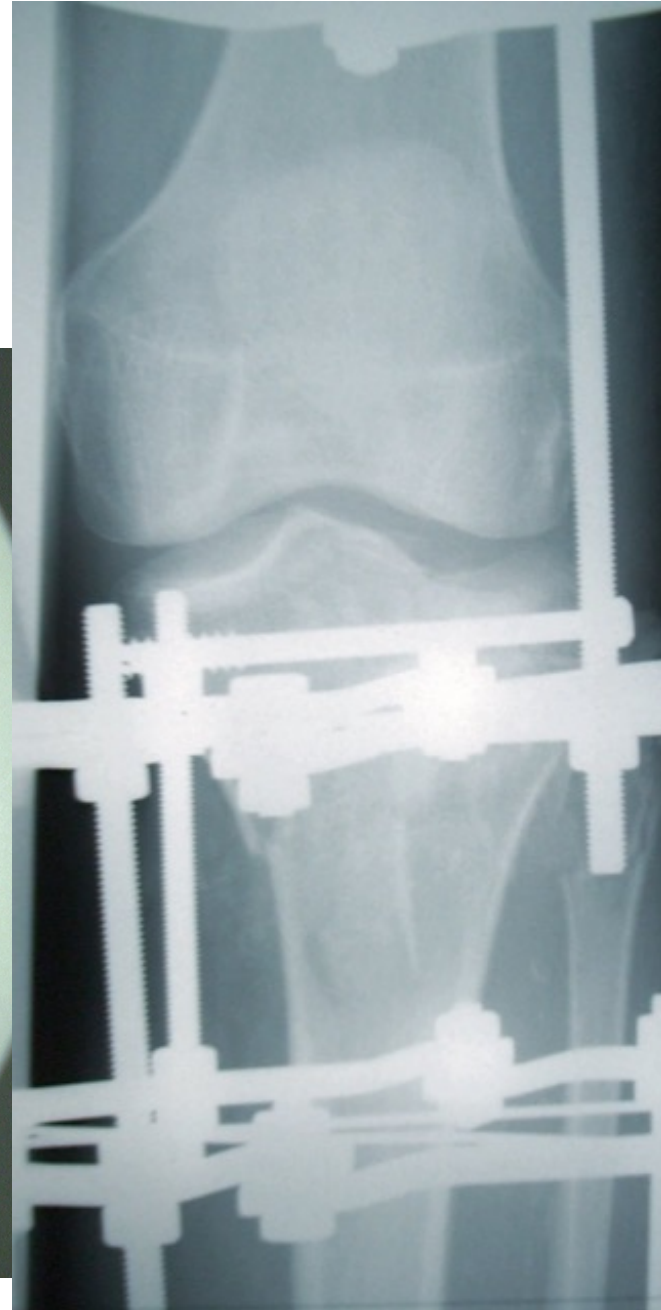
Peroperativt



Circular frame strategy

- 1) Base frame – Femur ring: Ligamentotaxis (condylar height)
- 2) Open reduction: allograft; cannulated screws: absolute stability of intra-articular fragments
- 3) Proximal tibia ring: relative stability of metaphyseal fracture

Peroperativt



Postoperativt



What is important ?

Alignment and reduction^{1,2}:

Step-off > 2-3 mm correlates to poor outcome

Malalignment correlates strongly to poor outcome.

Unstable fixation correlates to poor outcome.

Bone metabolism³:

- Impaired bone metabolism is a risk factor of poor outcome.

Postoperative regime⁴:

- Early range of motion exercises and early weight bearing should be encouraged.
- Immobilisation does not seem to provide any benefit
- Ongoing rehabilitation should be considered with the view of better clinical outcomes

¹ Rademaker M.V. et al, Operative treatment of 109 tibial plateau fractures: five- to 27-year follow-up results. J Orthop Trauma. 2007;21(1):5–10. doi: 10.1097/BOT.

² Parkkinen M et al., Predictors of osteoarthritis following operative treatment of medial tibial plateau fractures. Injury. 2018;49(2):370–375.

³ Iliopoulos E. et.al. Physiotherapy after tibial plateau fracture fixation: A systematic review of the literature, SAGE Open Med. 2020, Oct 14_8:2050312120965316

⁴ Krause M. et al. Bone metabolism is a key factor for clinical outcome of tibial plateau fractures, Eur J Traume emerg Surg. 2020; 46(6): 1227–1237.

Outcome

- Infektion 14% to 87% ^{2,3,4}
- Compartment syndrome 10% - 30%⁵
- DVT 50%⁶
- High rate failure of fixation in the old 31%⁷
- Secondary surgery¹
 - 5-12% TKA
 - HR 5.0 increased risk of arthroscopy¹²
- Significant impairment of movement and muscle function¹⁰
- Post traumatic osteoarthritis 31% - 44% ^{8,9} - increases if meniscus is removed.
- Reduced structure specific and generic PROM scores²

¹ Haselhofter et. Al ,Risk for total knee arthroplasty after tibial plateau fractures: a systematic review, *Knee Surg Sports Traumatol Arthrosc.* 2023 Nov;31(11):5145-5153.

² COT Society, Open reduction and internal fixation compared with circular fixator application for bicondylar tibial plateau fractures. Results of a multicenter, prospective, randomized clinical trial. *J Bone Joint Surg Am.* (2006) 88(12):2613–23

³ Yang et. Al., Metaphyseal dissociation fractures of the proximal tibia. An analysis of treatment and complications. *Am J Orthop (Belle Mead NJ).* (1995) 24(9):695–704.8548264

⁴ Young et al., Complications of internal fixation of tibial plateau fractures. *Orthop Rev.* (1994) 23(2):149–54.8196973

⁵ Chang YH et al., Tibial plateau fracture with compartment syndrome: a complication of higher incidence in Taiwan. *Chang Gung Med J.* (2000) 23(3):149–55.15641218

⁶ Geerts et al., A prospective study of venous thromboembolism after major trauma. *N Engl J Med.* (1994) 331(24):1601–6. doi: 10.1056/NEJM199412153312401

⁷ Failure of fixation of tibial plateau fractures. *J Orthop Trauma.* (2002) 16(5):323–9. doi: 10.1097/00005131-200205000-00006

⁸ Honkonen SC et al., Degenerative arthritis after tibial plateau fractures. *J Orthop Trauma.* (1995) 9(4):273–7.

⁹ Rademakers MV et al., Operative treatment of 109 tibial plateau fractures: five- to 27-year follow-up results. *J Orthop Trauma.* (2007) 21(1):5–10.

¹⁰ Gaston P et al., Recovery of knee function following fracture of the tibial plateau. *J Bone Joint Surg Br.* (2005) 87(9):1233–6.

¹¹ Tibial plateau fractures are associated with a long-lasting increased risk of total knee arthroplasty a matched cohort study of 7,950 tibial plateau fractures

Take Home Message

Circular frames and plates are not competing methods, but complementary tools

Select on the basis of fracture patterns and soft tissue status