



History of total knee arthroplasty

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19th century..

- Mostly for tuberculosis
- Resection/interposition arthroplasty (*Verneuil, Ferguson 1860*)
 - Pigs bladder
 - Fascia lata
 - Nylon
- Ivory hinge fixed with plaster of Paris
(*T. Gluck 1891*)

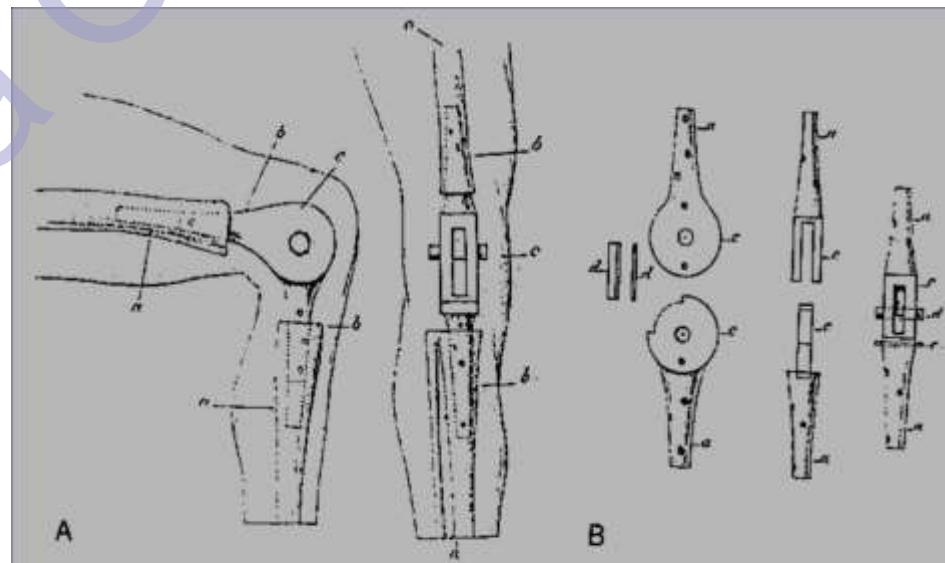
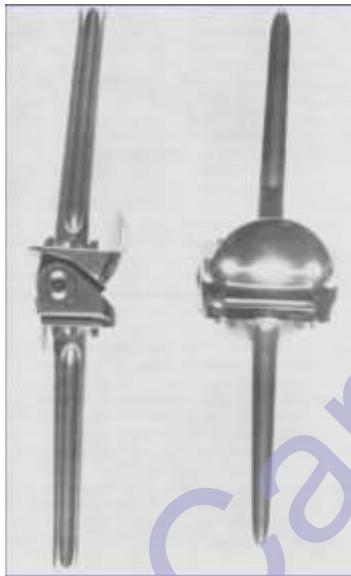


FIGURE 1-8. A, Gluck's ivory total knee arthroplasty held in place with cement of colophony, pumice, and gypsum. B, Component parts of Gluck's knee prosthesis. (Gluck, T. Arch. Klin. Chir. 41:186, 1891.)

1940-1960

- Hinge philosophy

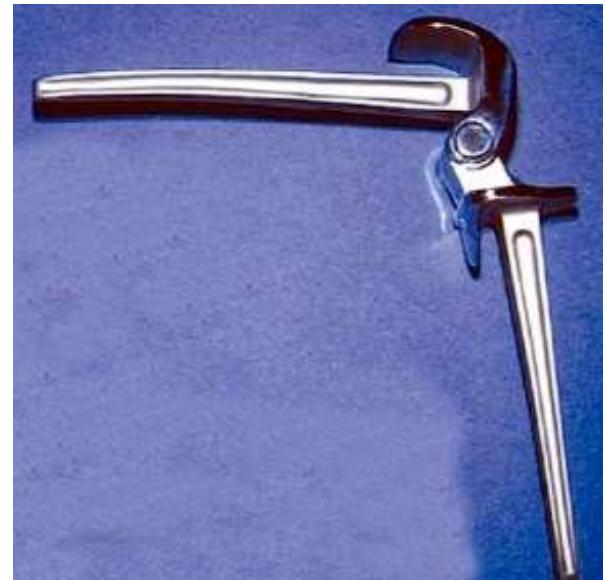
- No need to preserve the cruciates/collaterals
- Early loosening due to high loads in the bone-prosthesis interface



Waldius Judet Shiers



Young



Guepar

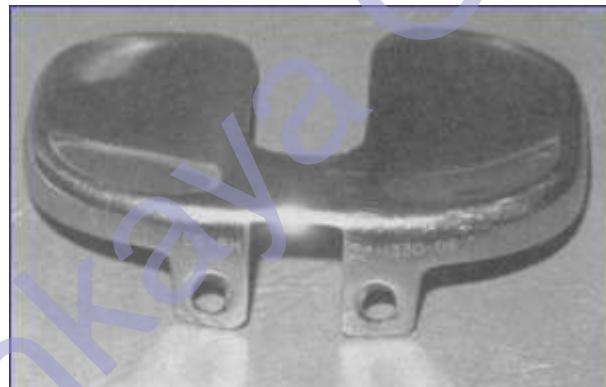


1940-1960

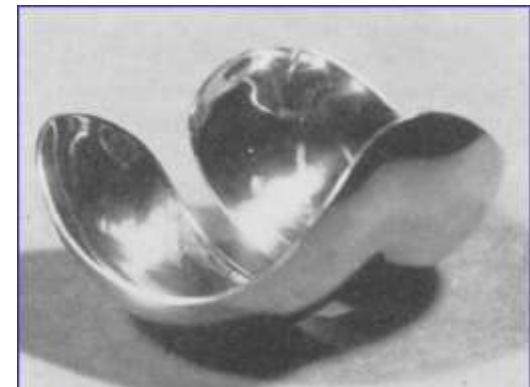
- Resurfacing hemi arthroplasty



McKeever



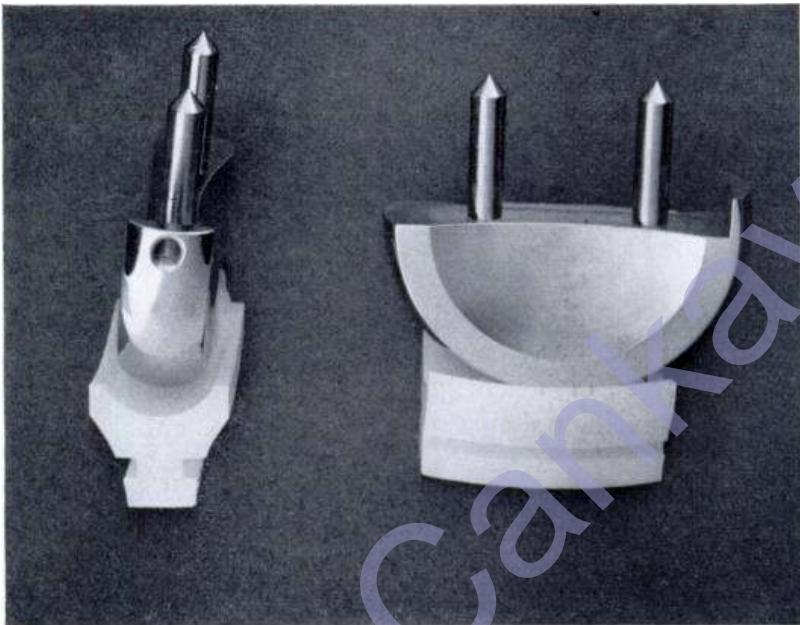
Townley



Campbell

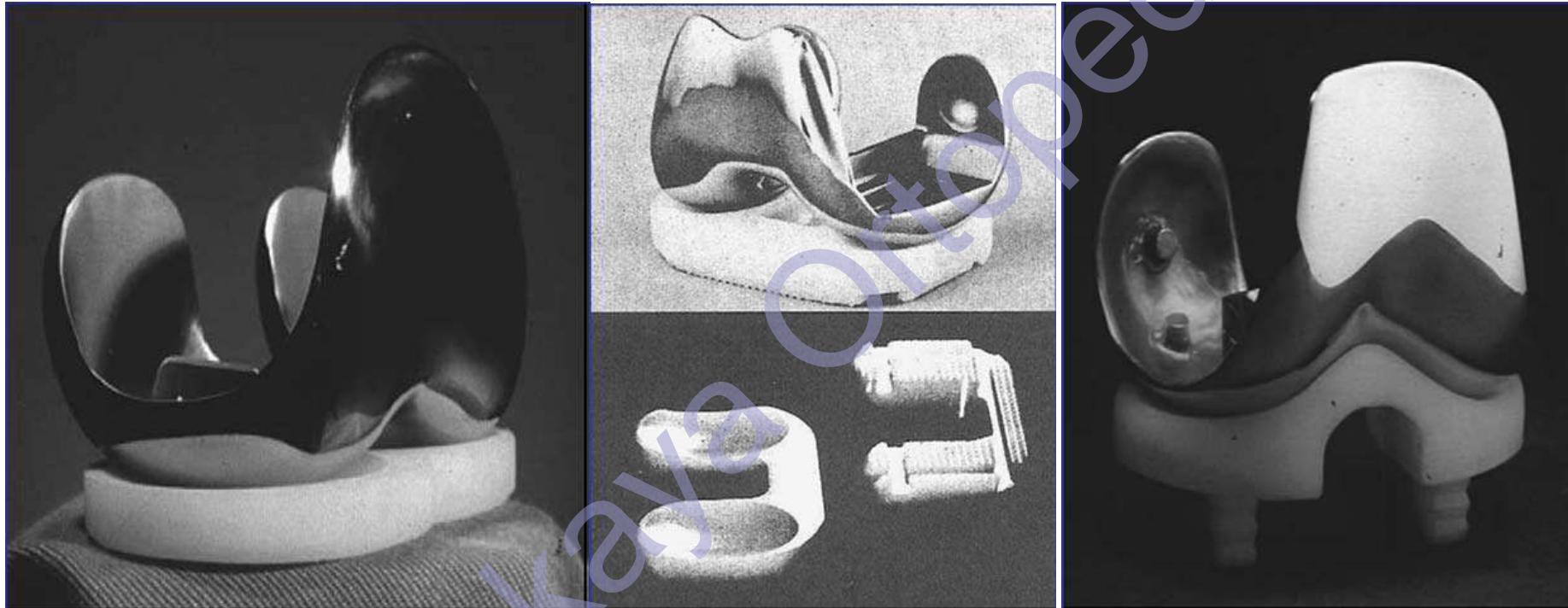
1970's Anatomical approach

- Preservation of cruciates and collaterals
- Resurfacing of the condyles
- No patellar button



Polycentric Knee (Gunston 1970)

Anatomic approach



Kodama-Yamamoto

- Single femoral implant covering both condyles
- Single tibial implant covering the entire plateau
- Fixation with bone cement

Townley

Leeds

Functional approach



Duocondylar knee

- Preservation of both cruciates
- Separate tibial implants



Duopatellar knee

- ACL sacrifice
- Single tibia
- Patellar implant



Total condylar knee

- Sacrifice of ACL+PCL
- All poly tibia
- Patellar groove

1980's

Insall Burstein

- Conforming surfaces
- Metal back tibia
- PCL sacrifice



PCA (Porous coated anatomic)

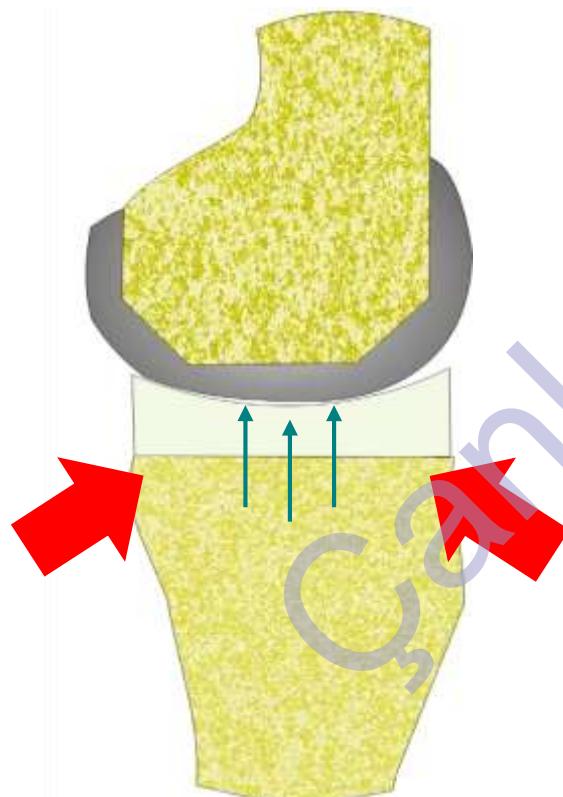
- Round on flat design
- Cementless fixation



Constraint & conformity

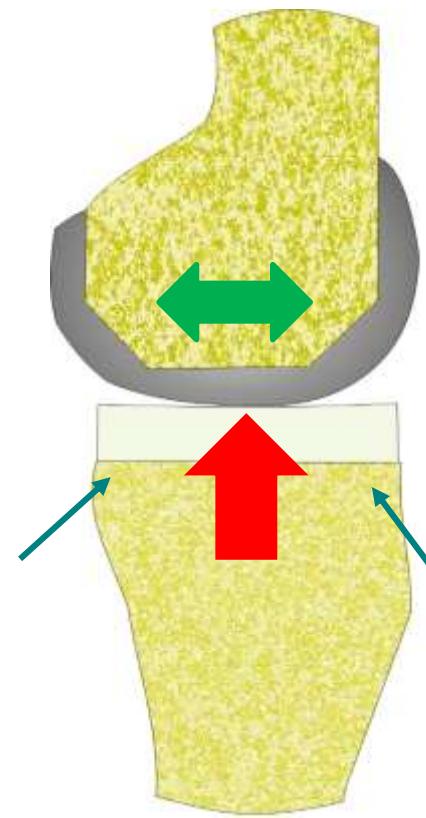
Increased conformity

- More stability, less contact stress & wear
- High loads on the prosthesis bone interface



Decreased conformity

- Less stability, Low loads on the prosthesis bone interface
- More contact stress & wear





Mobile bearing knees

- High conformity, low constraint
- Low wear on the articulating surface

But ...

- Backside wear
- Dislocation
- Loss of mobility in time



1980's

- Reliable & reproducible instrumentation



PFC Sigma



Miller-Galante



LCS Mobile



IB II PS

Howmedica Kinemax

Natural knee
Intermedics



1990's

- Better instrumentation
- Better selection of sizes
- Better P-F kinematics
- Minor design changes



Zimmer NextGen



Biomet AGC



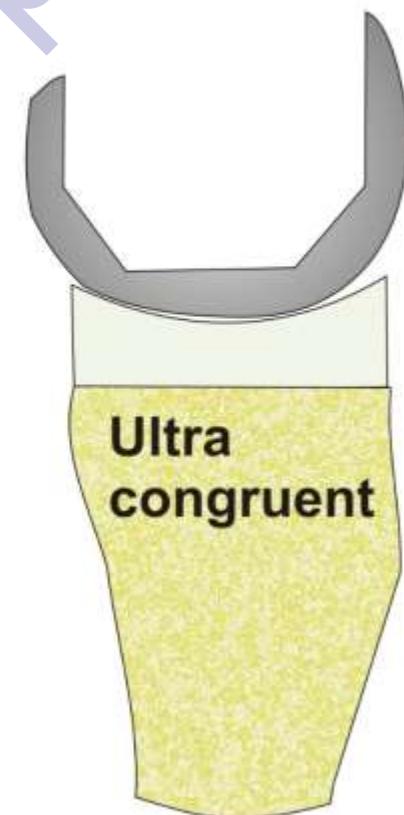
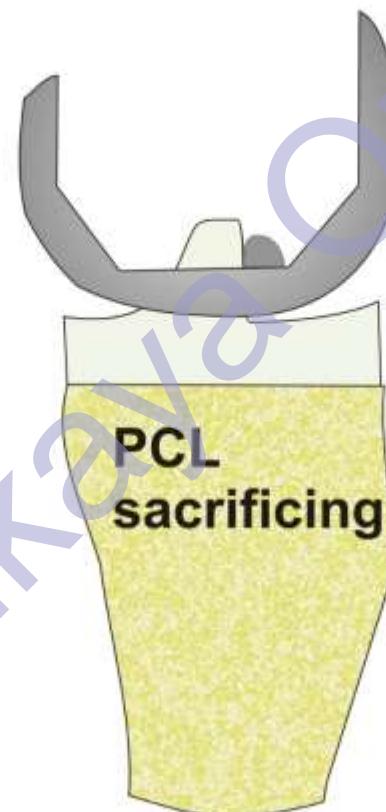
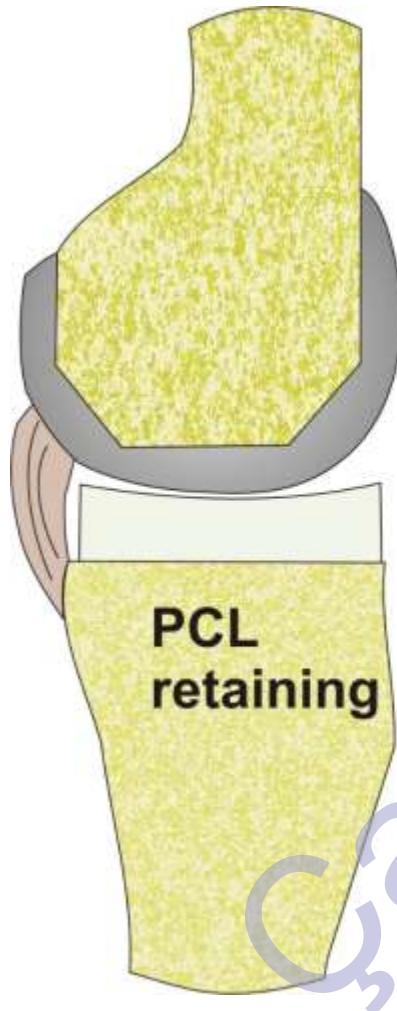
Stryker Scorpio



S&N Profix



Options for PCL





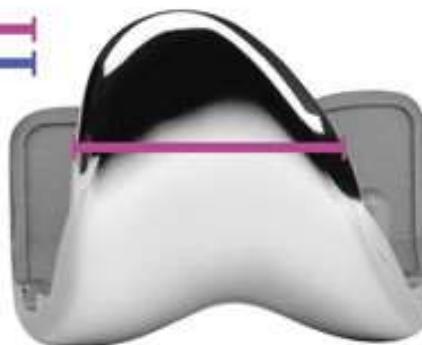
Issues in 1990's

- PCL retention vs. sacrifice
 - *Verra WC. Cochrane Database Syst Rev. 2013 Oct 11;10:CD004803.*
- Patella resurfacing or not
 - *Fu Y. Knee Surg Sports Traumatol Arthrosc. 2011;19(9):1460-6.*
- Cementless vs. cemented fixation
 - *Nakama GY. Cochrane Database Syst Rev. 2012 Oct 17;10:CD006193.*
- Mobile vs. fixed bearing
 - *Hofstede SN. Cochrane Database Syst Rev. 2015 Feb 4;2:CD003130.*

Equally good results with correct patient selection

Gender specific designs

- Mismatch of male/female anatomy on the M-L and A-P dimensions
- Lateral overhang more than 3 mm is painful
 - *Mahoney OM : J Bone Joint Surg Am. 2010; 92(5):1115-21*
- Gender specific designs
 - Thinner anterior component, narrow mediolateral size, Q angle different





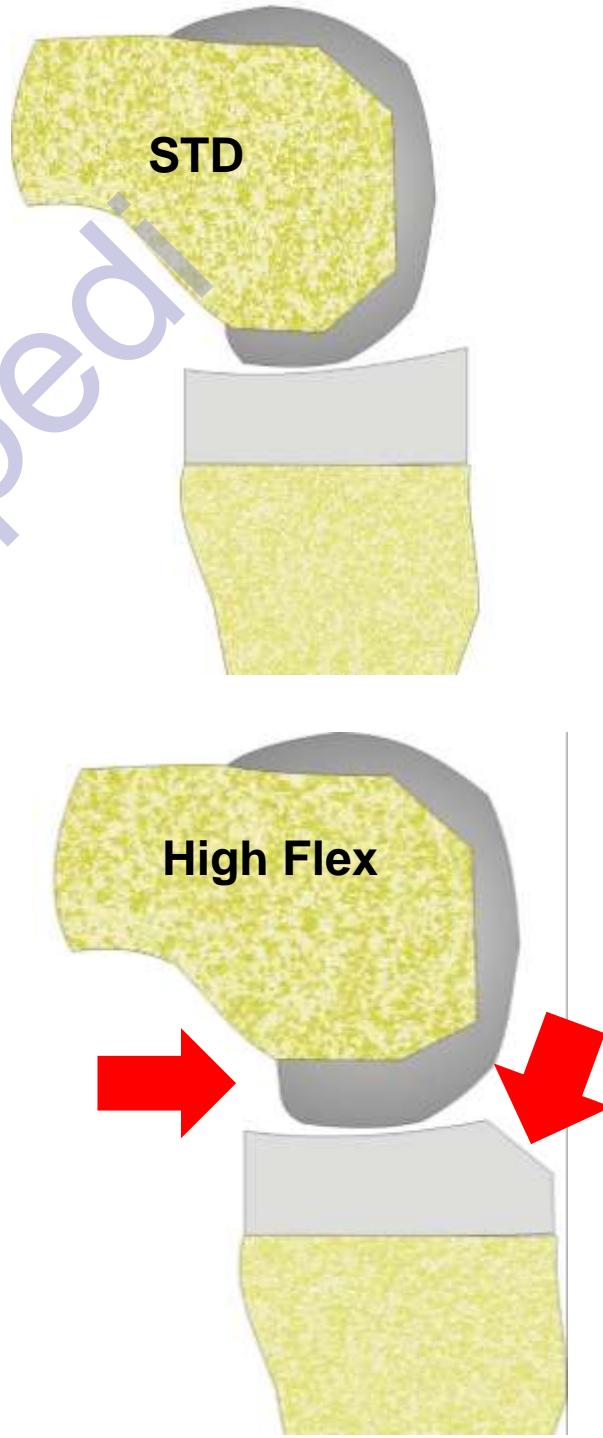
Gender specific designs

- No significant difference in the coverage of the femur and clinical results compared to standard designs.
 - *Song EK: J Arthroplasty. 2012; 27(2):226-31.*
 - *Kim YH : J Bone Joint Surg Br. 2010;92(5):639-45.*
 - *Johnson AJ: Clin Orthop 2011;469(7):1852-8.*



High flexion designs

- Increased need for kneeling in eastern populations
- Thicker posterior femoral condyle
- Anterior tibial cut-out
- Modified tibial post
- Deeper trochlea
- Fixed or mobile bearing



High flexion designs



- No difference compared to standard designs if pre-op ROM is good
 - *Mehin R: J Bone Joint Surg Br. 2010;92(10):1429-34.*
 - *Bauman RD : Clin Orthop. 2012;470(1):150-8.*
 - *Hamilton WG: J Arthroplasty. 2011 Sep;26(6 Suppl):28-34.*
- Hyperflexion may lead to early femoral loosening
 - *Zelle J : J Orthop Res. 2011;29(7):976-83.*
 - *Cho SD : Knee Surg Sports Traumatol Arthrosc. 2011;19(6):899-903.*
 - *Bollars P:J Bone Joint Surg Br. 2011;93(10):1355-61.*

Patient Specific Cutting Guides

- Proposed advantages
 - Less bone resection
 - Better alignment
 - Less surgical time
 - *Bali K: J Arthroplasty. 2012 Jan 26.*
- No violation of the intramedullary canal
- Pre-op CT or MRI
- 6-8 w manufacturing time





Patient Specific Cutting Guides

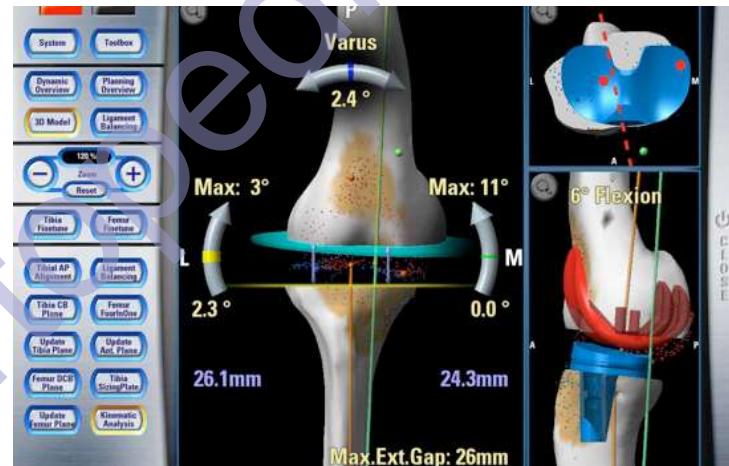
- No clinical difference in standart cases
 - *Mannan A. Orthop Traumatol Surg Res. 2015 Mar 19. pii: S1877-0568(15)00061-4.*
 - *Shen C. Orthopedics. 2015;38(3):e178-88.*
 - *Zhang QM. Orthop Surg. 2015 Feb;7(1):19-25.*
- Useful in patients with
 - Femoral intra-medullary implants
 - Patients with significant pulmonary problems
 - Infrequent surgeons



Computer assisted surgery

- Better alignment

- Hetaimish BM, J Arthroplasty. 2012; 27(6):1177-82.
- Moskal JT. J Knee Surg. 2014;27(3):235-48.
- Rebal BA. J Arthroplasty. 2014;29(5):938-44.



But..

- Expensive
- Invasive/Tracker complications
- Longer time
- No difference in clinical outcomes



Hinges for primary TKA

- Elderly patients with distal femoral fractures
- Ekstensor mechanism insufficiency
- Severe deformity and instability not amenable to CCK implants
- Congenital knee dislocation
- Knee ankylosis or arthrodesis conversion



Evolution of hinges ..

- 1st generation rotating hinges
- Short cemented stems
 - Early loosening
 - Mechanical problems/breakage
 - Patellar problems
 - High infection rate
 - Rand JA: *J Bone Joint Surg* 1987, 69-A:489
 - Springer BD: *Clin Orthop* 2001, 392: 283-91



2nd generation hinges

- Cementless diaphyseal filling stems
- Better hinge design
- Better P-F design
- 65 % survival at 5-10 years
 - *Gudnason A: Arch Orthop Trauma Surg. 2011;131(11):1601-7*
 - *Pour AE: J Bone Joint Surg Am. 2007 89(8):1735-41.*
- Older sedentary patients



Alternative bearings

■ Oxidized zirconium

- Better wear characteristics in vitro
 - *Spector M : JBJS Am 2001; 83:S80-86*
- No clinical difference compared to Cr-Co
 - *Hui C: J Bone Joint Surg Am. 2011;93(7):624*
- No difference in serum metal ion levels
 - *Garrett S: Acta Orthop Belg. 2010:513-20.*

■ Ceramic

- Good short term results
- Fracture & increased radiolucencies
 - *Bergschmidt P. Open Orthop J. 2012; 6: 172–178*





Messages...

- Modern TKA is a reliable operation with over 90% survival at 10-15 years
- Improvements in design, bearings and technique continue to evolve
- 15-20% of patients still unhappy after TKA
- There is room for improvement ...

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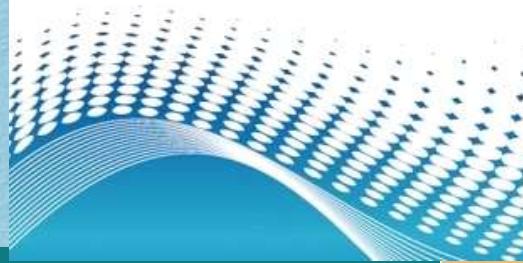
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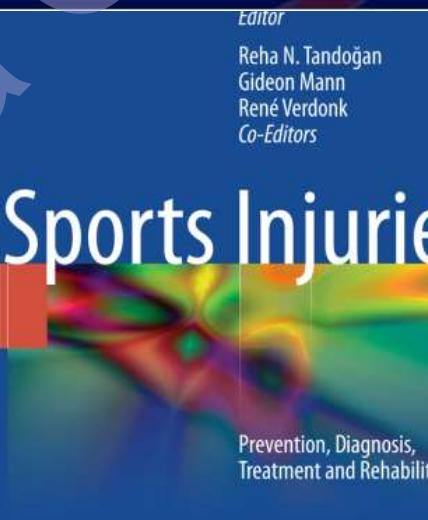
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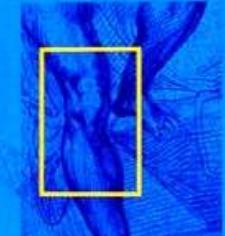
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