The Rationale and Registry Data for Cemented TKA

Michael J Dunbar MD, FRCSC, PhD

Professor of Surgery
Professor of Biomedical Engineering
Professor of Community Health and Epidemiology
Dalhousie University
Halifax, Nova Scotia
CANADA

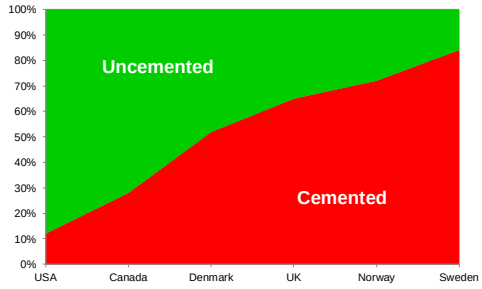
Disclosures

Consultancy/Royalties
- Stryker

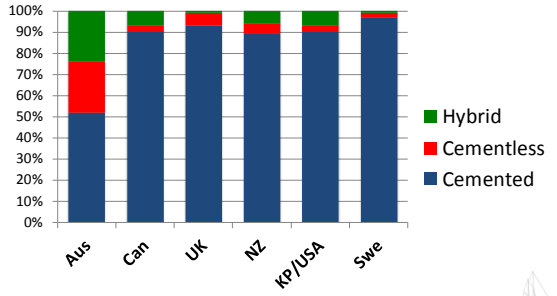
Boards
- Editorial Board, JBJS Br
- Editorial Board, The Journal of Knee Surgery
- Medical Advisory Committee, Arthritis Society of Canada
- Halifax Biomedical

Institutional/Research Support
- Canadian Institute of Health Research
- Atlantic Innovation Fund
- Natural Sciences and Engineering Research Council of Canada
- Stryker
- Wright Medical
- Depuy
- Smith and Nephew
- Zimmer

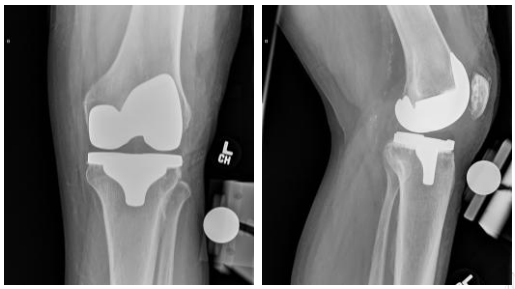
Femoral Fixation (Hip) by Country 2010



TKA Fixation by Country



The Planar Surface of the Tibial Cut is the Weak Link



Rationale for Cemented TKA

1. Improved initial fixation
2. Accommodate for small bone defects and imprecise cuts
3. Lower Costs

Rationale for Cemented TKA

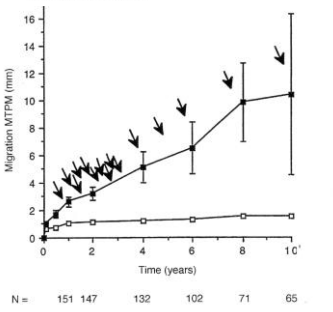
1. **Improved initial fixation**

Leif Ryd

ROENTGEN STEREOPHOTOGRAMMETRIC ANALYSIS AS A PREDICTOR OF MECHANICAL LOOSENING OF KNEE PROSTHESES

LEIF RYD, BJÖRN E. J. ALBREKTSSON, LARS CARLSSON, FINN DANSGÅRD, PETER HERBERTS, ANDERS LINDSTRAND, LARS REGNÉR, SØREN TOKSVIG-LARSEN

From the University of Lund, Sweden

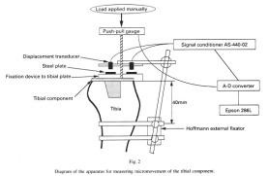


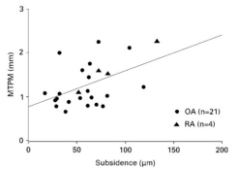
Estimation of the migration of tibial components in total knee arthroplasty

A ROENTGEN STEREOPHOTOGRAMMETRIC ANALYSIS

S. Fukuoka, K. Yoshida, Y. Yamano

From Kansai Rosai Hospital, Hyogo, Japan



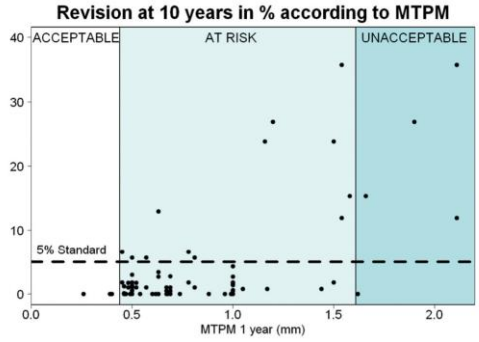


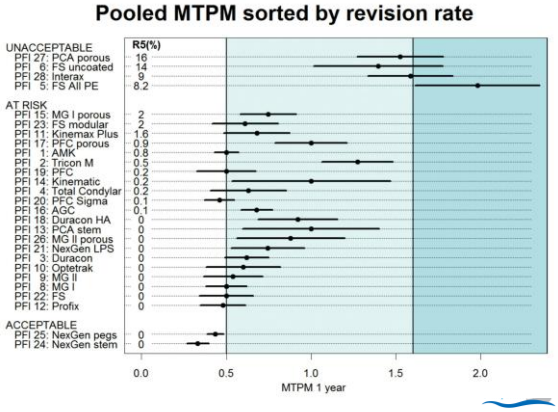
RSA Linked to Registry Data

Early migration of tibial components is associated with late revision

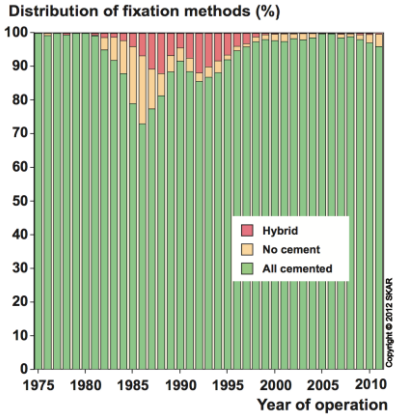
A systematic review and meta-analysis of 21,000 knee arthroplasties

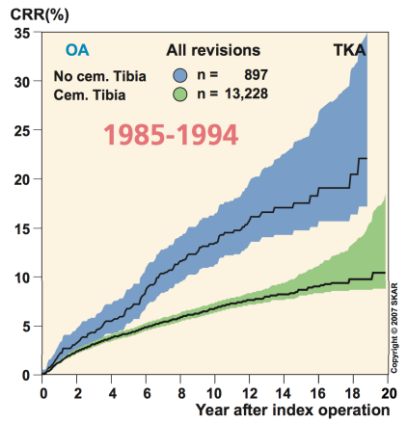
Bart G Pijls[1], Edward R Valstar[1,2], Klaas-Auke Nouta[1], Josepha WM Plevier[3], Marta Fiocco[4], Saskia Middeldorp[5,6], and Rob GHH Nelissen[1]

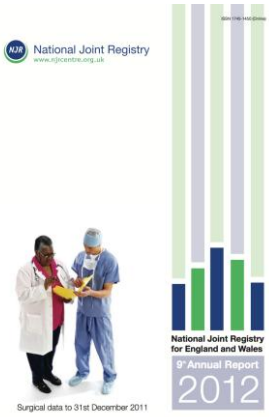





Annual Report
2012
Swedish Knee
Arthroplasty Register
Deptartment of Orthopedics
Skåne University Hospital, Lund
Concerning:
primaries 1975-2011
revisions 1975-2010

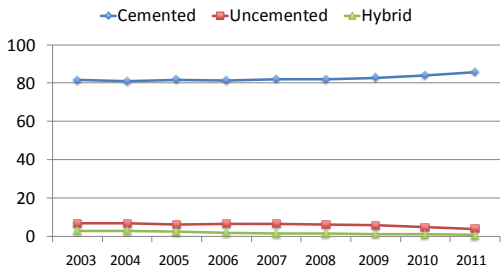

Distribution of fixation methods (%)
100
90
80
70
60
50
40
30
20
10
0
Hybrid
No cement
All cemented
1975
1980
1985
1990
1995
2000
2005
2010
Year of operation
Copyright © 2012 SKAR


CRR(%)
35
30
25
20
15
10
5
0
OA
All revisions
TKA
No cem. Tibia
n = 897
Cem. Tibia
n = 13,228
1985-1994
0
2
4
6
8
10
12
14
16
18
20
Year after index operation
Copyright © 2007 SKAR

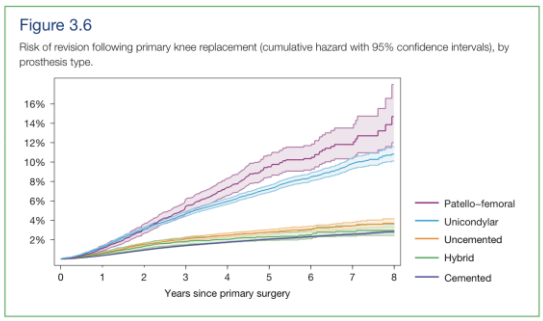


DALHOUSIE Orthopaedics

TKA Fixation Rates in UK by Year



DALHOUSIE Orthopaedics



DALHOUSIE Orthopaedics

Patient Time Incidence Rates per 1,000 Years

Fixation	Rate
Cemented	0.98
Uncemented	1.99
Hybrid	1.31

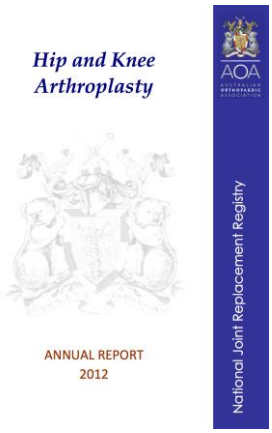


Figure KT4: Primary Total Knee Replacement by Fixation

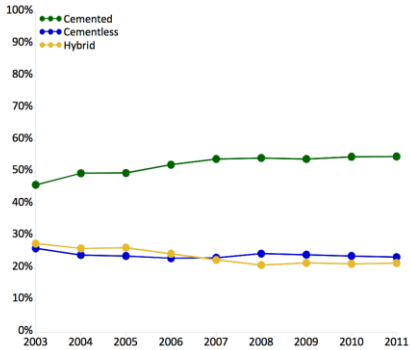
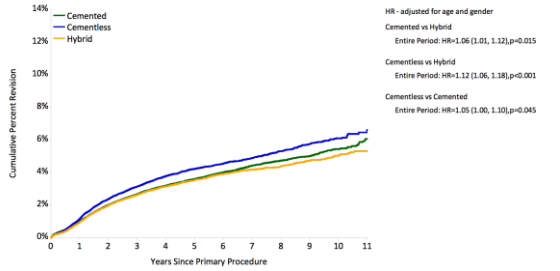
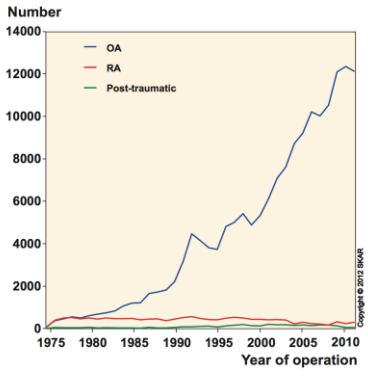


Figure KT18: Cumulative Percent Revision of Primary Total Knee Replacement by Fixation (Primary Diagnosis OA)

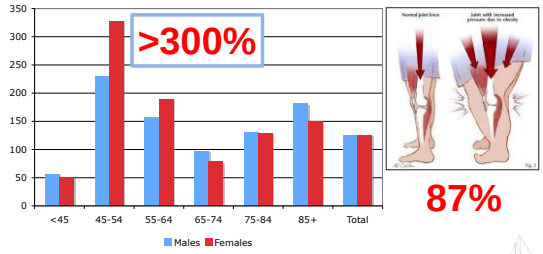


Conclusions

- Cemented fixation in TKA offers advantages in initial fixation
- Initial fixation is critical for TKA survivorship
- Cemented TKA is the gold standard in registries around the world



10 Year % Change in Knee Cases



87%

Cochrane Review 2012

Cemented, cementless or hybrid fixation options in total knee arthroplasty for osteoarthritis and other non-traumatic diseases (Review)

Nakama GY, Peccin MS, Almeida GJM, Lira Neto ODA, Queiroz AAB, Navarro RD

THE COCHRANE COLLABORATION®

5 RCT's on 297 patients
RSA as Outcome
- MTPM and Object Based

RSA Outcomes of Tibial Components at 2 Years

- **Cemented Fixation = Smaller Displacement**

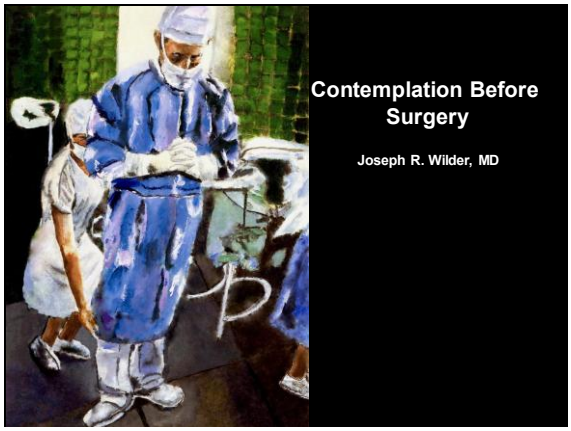
- with and without hydroxyapatite
- MTPM (N = 167) mean difference = 0.52 mm
- 95% confidence interval 0.31 to 0.74

However - Future Risk?

- the risk of future aseptic loosening with uncemented fixation was approximately half that of cemented fixation according to the arthroplasty instability classification
  - RR 0.47, 95% CI 0.24-0.92
  - 16% absolute risk between groups

Future Risk for Revision (OA)

- Uncemented Fixation
  - Thirteen people out of 100 had a future prediction of arthroplasty instability.
- Cemented Fixation
  - Twenty-nine people out of 100 had a future prediction of arthroplasty instability with cemented fixation.



Cementing the Perfect TKA:
Assuring Longevity

Chitranjan S. Ranawat*, MD

Amar S. Ranawat**, MD

*Professor of Orthopaedic Surgery
**Associate Professor of Orthopedic Surgery
Weill Cornell Medical College
Hospital for Special Surgery
New York, NY

Disclosures

Chitranjan S. Ranawat, MD
Hospital for Special Surgery

Royalty and Research
Support Received From:
Stryker
DePuy

Family member consultant & Research:
Conformis
CeremTec
ConvaTec
Medtronic
Pipeline
Mako

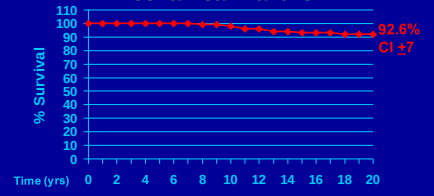
- Evidence for superiority of cemented fixation in TKR over non-cemented fixation

Level of evidence to support cemented fixation in TKR

- **Level I:** Registry Data and Prospective Randomized Study
- **Level II:** Meta Analysis
- **Level III:** Prospective Case Control
- **Level IV:** Case Series
- **Level V:** Opinion of Individual Surgeon

Survivorship for mechanical fixation failure

Survival of Total Condylar Prosthesis
20-Year Follow-up
Mechanical Failure



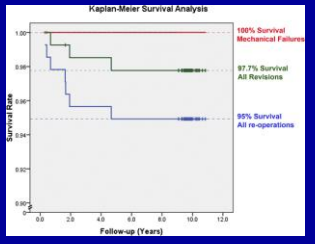
Survivorship for Mechanical Failure:
Literature Review

89 - 98% at 15 - 20 years

Lachiewicz et al, *JBJS 2009*
Abdeen et al, *JOA 2009*
Callaghan et al, *JBJS 2005*
Dixon et al, *JBJS 2005*
Buechel et al, *J Knee Surg 2002*
Ranawat et al, *CORR 2001*
Font-Rodriguez et al, *CORR 1997*
Ritter et al, *CORR 1995*
Ranawat et al, *CORR 1993*

ROC

10 year Survivorship- RP-PS



Ranawat CS, JBJS, 2012

ROC

Level I Evidence: Registry Failure Rate

Registry	Failure Rate (%)
NJR-England	C: 3.81
	NC: 4.75
Australian	C: 5.6
	NC: 6.2
Swedish (up to 1994)	C: 9
	NC: 23
New Zealand	C: 4.28
	NC: 6.93

ROC

Level I Evidence: Registry Data on Usage

Registry	Usage (%)	
NJR-England	C	85
	NC	5
Australian	C	55
	NC	29
Swedish (up to 1994)	C	95
	NC	3
New Zealand	C	89
	NC	4

Level I Evidence: Prospective Randomized Study

Author/Journal/year	Follow-UP (Years)	Conclusion
Park et al, JBJS-Br, 2011	14	For Cemented
Baker et al, JBJS 2007	15	For Cemented

Level II Evidence: Meta Analysis

Gandhi et al. JBJS 2009

Improved survivorship of cemented Knee

Discussion

- **Although results for non-cemented fixation in TKR are improving, level I, II and III evidences are still in favor of cemented fixation**

Technique

1. Proper exposure with adequate length of incision
2. Avoid cutting the quadriceps tendon in oblique direction (medial-lateral plain)
3. Reduced Tissue Trauma Surgery (RTTS), no tourniquet except for cementing
4. Deliver the tibia in front of the femur (Ran-Sal maneuver)
5. Preserve supra-patellar pouch, coagulate lateral genicular artery
6. 8 to 10 mm tibial cut from the uninvolved side, identify the cortex off the tibial cut
7. Adequate rotation, alignment, lateralization and restoration of the posterior offset of the femoral component

Technique

8. Pulsatile lavage the cut surfaces to clean the cancellous bone
9. Drill holes in the sclerotic bone surface
10. Heated Simplex cement at doughy state
11. Apply cement on the bone surfaces including posterior femoral condyles and pressurize, apply cement on the components as well
12. Apply manual constant pressure
13. Remove excess cement from posterior femoral condyles, tibia and patella (if resurfaced)
14. Further pressurization in extension with trial insert
15. Release the tourniquet and thorough irrigation
16. Closure in flexion without tourniquet and with good approximation of dermal layer

Conclusion

Cemented fixation remains the "Gold Standard" in TKR at present

"All good things ultimately prevail"

CSR


Thank you!
HOSPITAL FOR SPECIAL SURGERY
ROC

Orthopedics & Sports Medicine

Best Available Evidence for Cementless TKA

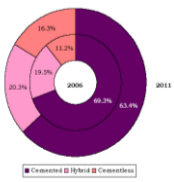
R. Michael Meneghini, MD
Director, IU Joint Replacement Fellowship
Indiana University School of Medicine

Disclosures

- Consulting Payments and Royalties:
  - Stryker
- Research Support:
  - Stryker
- Fellowship Funding:
  - OREF
- Editorial Boards:
  - J Arthroplasty
  - JBJS Knee Newsletter

Fixation in Total Knee Replacement

- Cement Fixation: "The Gold Standard"
  - Reliable long-term results
- Uncemented Fixation Increasing
- Cementless Fixation is more biologic
  - Eventually **"The Gold Standard"**



Cemented TKR: "The Gold Standard"

- 85% Survivorship at 21 years[1]
  - Cemented Total Condylar
  - Mean Age = 65 years
  - **95% survivorship at 15 years !**
- 98% Survivorship at 20 years[2]
  - Cemented AGC
  - **Mean Age = 70.4 years**

1. Ranawat CS, et al. *CORR*, 1993;286: 94-102.
2. Ritter MA, et al. *CORR*, 2001;388: 51-7.

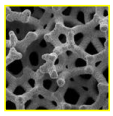
Cemented TKR: *Young Patients*

- Younger age at TKR = lower survival rate
  - Gioe et al *CORR* 2004
- Cemented TKR patients under 55
  - Survival rates from 85-95% at 10-18 years
  - Better for RA versus OA
  - Concern regarding survivorship past 15 years
- TKR in younger patients increasing !!
  - Greatest increase in <65 and <45 year-old groups
  - Kurtz et al. *JBJS-Am* July 2005

Cement in TKR

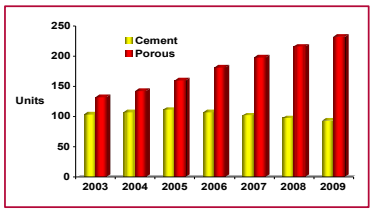
- Additional interface to fail
- 3rd body wear-failure mode
- Most durable long-term fixation is osseointegration
- Increasingly, surgeons are eager to embrace

Why Cementless TKR ?


- Patients younger & more active
  - Demand for OR efficiency
- Established long-term success via biologic fixation
  - Past problems identified and correctable
  - Improved biomaterials for fixation and wear

Cementless Fixation: Hip Replacement



- *Cementless surpassed Cement Fixation in 2000*

Minimizing Surgical Time

- Need for increased OR efficiency
- Idle time in OR for curing cement
  - Inefficient and wasteful
  - Less surgical time decreases infection
- Decrease in TKR reimbursement


Past Failures of Cementless TKR

- Patch porous coating
- Screw osteolysis
- Poor polyethylene / locking mechanism
- Fatigue failure of femoral components
- Failure of metal-backed patellar components

- **All are CORRECTABLE !**

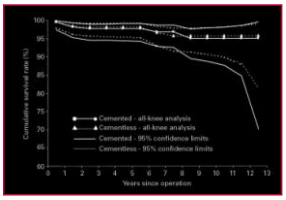
Long-Term **Cementless** TKR

- Hardeman (2007) 10 yr – 97.1% ProFix
- Epinette (2007) 10 yr – 98.1% HA Omnifit
- Khaw (2002) 10 yr – 95.6% PFC
- Hofmann (2002) 10 yr - 99.0% Natural
- Schroder (2001) 10 yr - 97.1% AGC-2000
- Watanabe (2004) 13 yr - 96.7% Osteonics

Long-Term **Cementless** TKR

- Tai (2006) 12 yr – 97.5% HA
- Watanabe (2004) 13 yr - 96.7% Osteonics
- Goldberg (2004) 14 yr - 99.0 % MG-I
- Tarkin (2005) 17 yr - 97.9 % LCS-RP
- Whiteside (2002) 18 yr - 98.6% Ortholoc-I
- Buechel (2002) 20 yr - 97.7% LCS-RP

Long-Term FU Cementless TKR

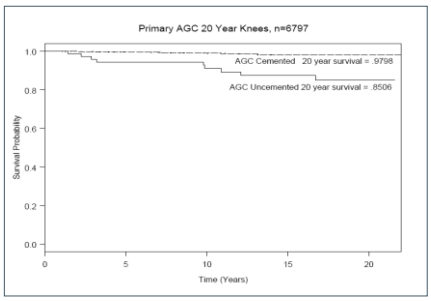


- 10 Year Follow-up: PFC Design
- Cementless (224) Cemented (277)
  - 95.6% 95.3%

Khaw FM, et al. *JBJS* 84-B:658, 2002

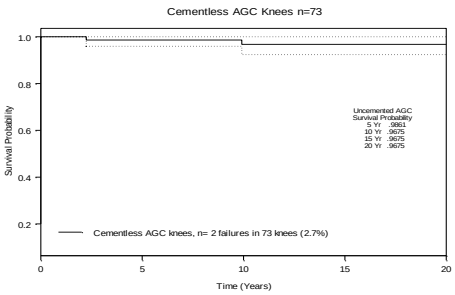
Cemented and Cementless AGC TKR

Kavolous, Ritter, et al CORR 1991



Cementless AGC TKR

Remove 12 Metal-Backed Patella Failures



Cementless AGC at 20-Years

Ritter & Meneghini, J Arthroplasty 2010

- 1983 - 1986
- 73 Cementless AGC TKR
- No adjuvant screw-fixation
- Females: 58%
- Mean Age: 59 years (range, 18-79)
- All minimum 10-Year Follow-up
- None Lost to Follow-up
- Minimum 20 Year Follow-up: 24

Cementless AGC at 20-Years

Ritter & Meneghini, J Arthroplasty 2010

- Two tibial aseptic failures
  - *1.1 and 2.2 years*
- 12 failed metal-backed patellae
- 97% Survivorship at 20 years

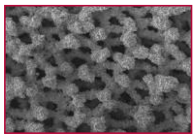
- Equal Survivorship as Cemented AGC
  - **Younger patients by mean 11 years !**

Cementless vs Cementless TKA

Nakama GY et al. Cochrane Database Review 2012

- 5 RCTs, 297 patients
- Meta-Analyses of RSA data
- Greater displacement of uncemented TKA compared to cemented
  - Up to 2 years
  - Mean 0.5mm max total point motion
- Cementless risk of future loosening one-half that of cemented TKA
  - Based on RSA inferred classification

Improved Biomaterials



- Hydroxyapitite / Periapitite
- Porous Tantalum
- Highly porous Titanium
- Highly Cross-Linked Polyethylene

Cementless vs Cementless TKA

Bercovy M et al. JBJS-Br 2012

- 157 cementless versus 146 cemented TKA
  - Rotating Platform Bearing, HA-coated
- Mean follow-up 7.6 years (range, 5-11)
- After 3-months, no radiolucent lines in cementless group
  - $p < 0.01$
- Identical survivorship of 99% both groups
- Less operative time cementless TKA
  - $p < 0.006$

Posterior-Stabilized Cementless TKA

Harwin et al, J Arthroplasty 2013

- Peri-apetite Coated
- Adjuvant Tibial Screw Fixation
- PS-Design
- 114 TKRs, Mean age 62 years
- Mean 36-month follow-up
- No failures or aseptic loosening

Cementless Fixation in Tantalum TKA

Dunbar et al, JBJS-Am 2009

- 70 pts randomized
  - Uncemented tantalum tibia
  - Cemented Tibia
- RSA data at 6, 12 and 24 months
- 9 of 28 TM patients migrated extensively at 1 year, but stabilized and 0% at risk for failure
- 4/21 cemented tibias "at risk"
- 5-yr follow up: no further TM migration
  - Acta Orthop 2012

Posterior-Stabilized Cementless TKA

Kamath et al, J Arthroplasty 2011

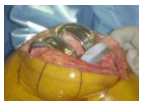
- 100 cementless TKRs under age 55
- PS monoblock porous tantalum tibia
- Cementless CoCr femoral component
- Compared to 312 cemented controls
- No failures due to loss of fixation at minimum 5 years in cementless group

Mid-Term Registry Results Cementless Porous Tantalum Tibia*

- Finnish Arthroplasty Registry
- 2003-2010
- 1143 Tantalum TKAs
- 100% tibial survivorship for loosening at 7 years

*** Niemelainen, et al. J Arthroplasty, 2013**

Summary: Cementless TKA



- There is sufficient evidence to support cementless fixation
- Cementless TKR is increasing
- Cementless fixation is more biologic
- Caution!!
  - Further study / development
  - Patient selection likely critical
- Will eventually be **"Gold-Standard"**

Thank You

Osteointegration
in TKA
Design
Porous Technology
Instruments
Technique

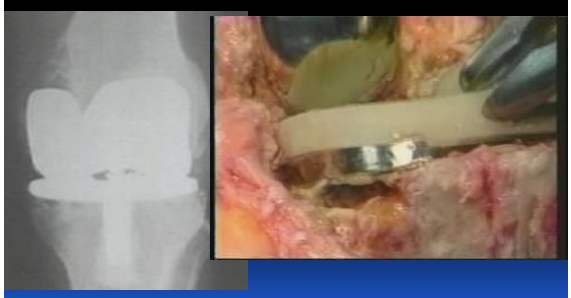
Early reports were NOT favorable due to inadequate design and engineering

Inadequate Fixation

Metal-Backed Patellar Component

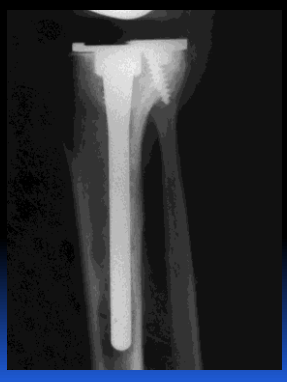
Gamma-Irradiated Poly

Polyethylene Locking Mechanism

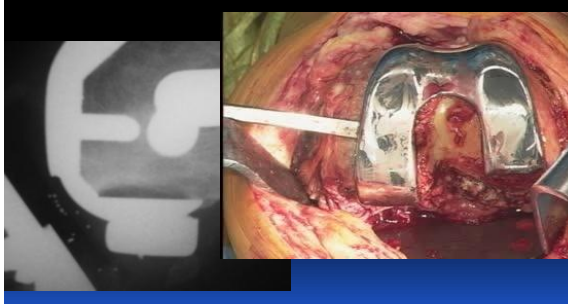


Porous Coating Configuration

Porous Coating Configuration



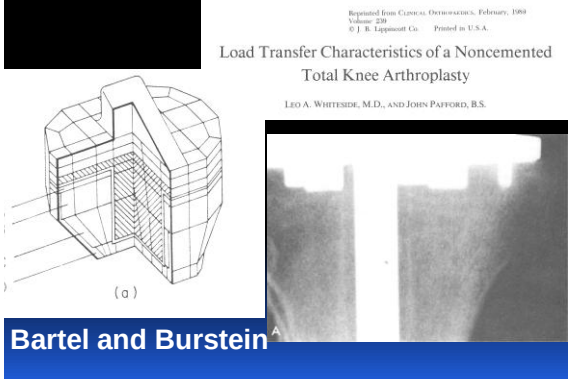
Effect of Porous Coating on Strength



But reliable technology has been available since since 1980.

Whiteside and Summers Orthopaedic Transactions 1982

CORR 1989



Bartel and Burstein

Medium-Term Followup Ortholoc Knee CORR 1994

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 309, pp 185–192

Cementless Total Knee Replacement

Nine- to 11-Year Results and 10-Year Survivorship Analysis

Leo A. Whiteside, MD

Medium-Term Followup Ortholoc TKA……CORR 1994

256 Knees
Mean Age 77 (18-93)
95% OA
5% Inflam

MEDIUM-TERM ORTHOLOC TKA

Complications

- **1 Loosening**
- **1 Acute Infection**
- **4 Late-Onset Infection**
- **3 Unexplained Pain**
- **2 Fatpad Impingement**
- **5 Osteolysis and Wear**
- **1 Patellar Tendon Avulsion**

Long-Term Followup Ortholoc TKA CORR 2001

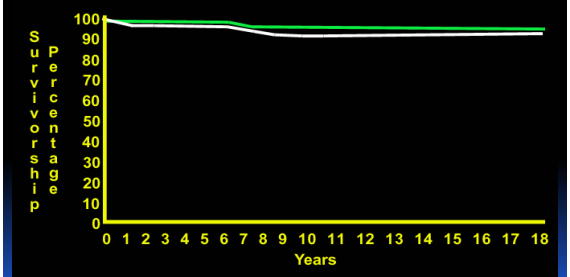
Reprinted from CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 388 July 2001
Lippincott Williams & Wilkins Printed in U.S.A.

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 388, pp. 77–84
© 2001 Lippincott Williams & Wilkins, Inc.

Long-Term Followup of the Bone-Ingrowth Ortholoc Knee System Without a Metal-Backed Patella

Leo A. Whiteside, MD

Clinical and Radiographic Loosening Survivorship >99%



Bone Ingrowth Ortholoc TKA

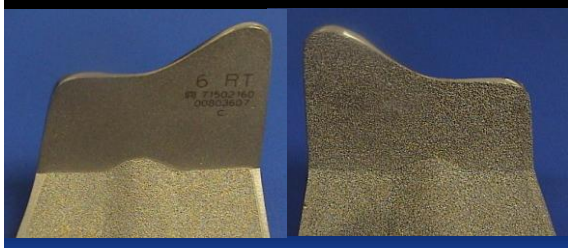
Pain Results

Pre-op	10.8
2 yr	48.3
5 yr	45.4
10 yr	46.3
20 yr	47.3

Osteointegration: How to do it right

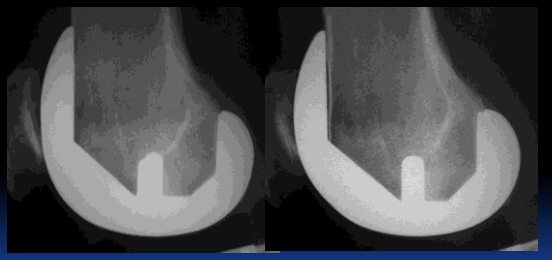
Instruments and Implant Design

Porous Coating Femoral Component



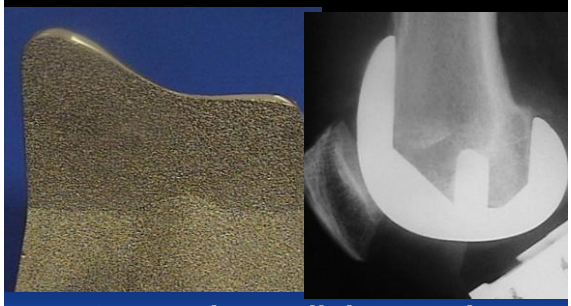
Missouri Bone & Joint

Porous Coating
Femoral Component



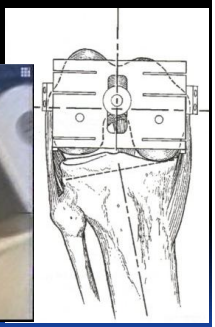
23% Anterior RLL

Second Generation

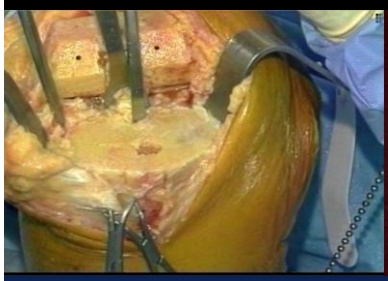


4% Anterior Radiolucent Line

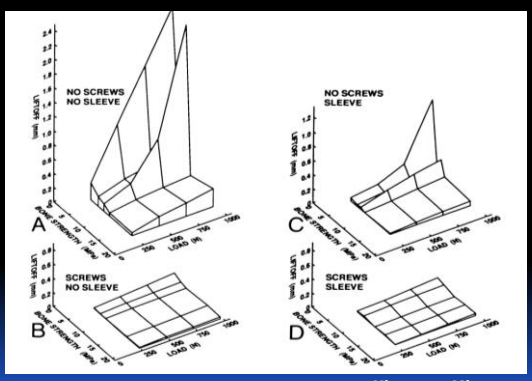
Surface Preparation
Accuracy
Viability



Re-cut if needed
Careful Irrigation



Rigid Fixation,
Full Porous Coat



Hiromasa Miura

Missouri Bone & Joint

Missouri Bone & Joint

Bone Ingrowth Profix TKA Survivorship 1,567 Knees

2 yr: (1567) 100%
5 yr: (954) 99.7%
10 yr: (443) 99.3%
12 yr: (257) 98.8%
None Revised for Loosening

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 464, pp. 93–98
© 2007 Lippincott Williams & Wilkins

Young and Heavy Patients with a Cementless TKA Do As Well As Older and Lightweight Patients

Leo A. Whiteside, MD; and Roberto Viganò, MD†*

10 years: No Loosening

Clin Orthop Relat Res (2008) 466:3071–3077
DOI 10.1007/s11999-008-0394-1

ORIGINAL ARTICLE

Clinical Results of Bone Ingrowth TKA in Patients with Rheumatoid Arthritis

Roberto Viganó MD, Leo A. Whiteside MD, Marcel Roy PhD

10 years: No Loosening

Challenging Cases:
CORR 2002

Cementless Total Knee Arthroplasty in Patients 50 Years or Younger

Aaron A. Hofmann, MD; Scott M. Heithoff, DO; and Marcelo Camargo, MD

0 Loosening at 10 yrs

Current Literature

Excellent Fixation Achieved With Cementless Posteriorly Stabilized Total Knee Arthroplasty

Steven F. Harwin, MD, FACS,* Mark A. Kester, PhD, Arthur L. Malkani, MD, and Michael T. Manley, PhD

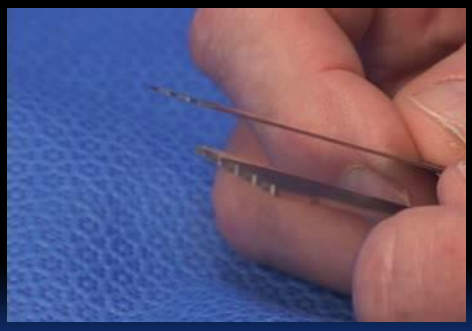
Current Literature

Twenty-Year Survivorship of Cementless Anatomic Graduated Component Total Knee Arthroplasty

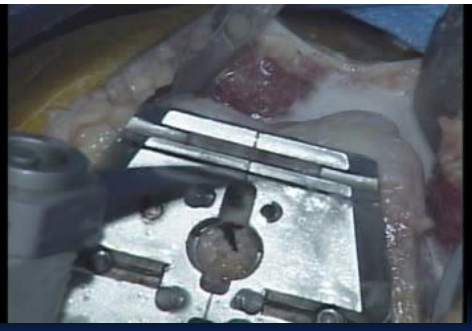
Merrill A. Ritter, MD,* and R. Michael Meneghini, MD†

Current Literature

Current Practice and Techniques



Thin Saw Blade
Viable Bone Surfaces



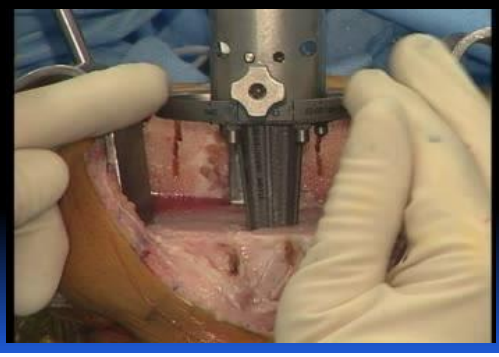
Accurate Bone Cuts
Viable Bone Surfaces

Check Surface:Recut if needed

Re-cut tibia if necessary

Rigid Fixation

Rigid Fixation

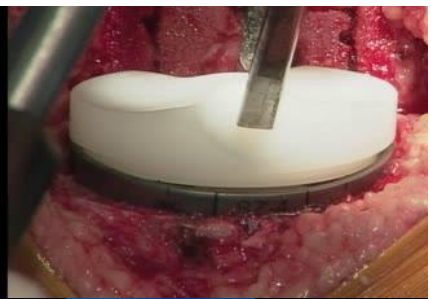


Rigid Fixation

Rigid Fixation

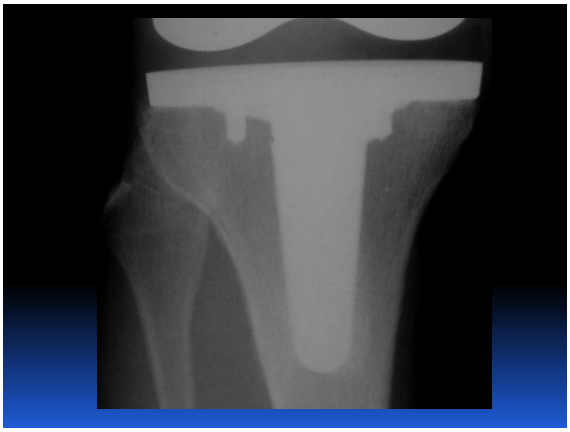
Rigid Fixation

Rigid Fixation



Secure Locking and Sealing

Rigid Fixation:
Strong Implant



Advanced Porous Surface
Strong Implant
Fail-safe Surface Fixation

Fixation and Strength

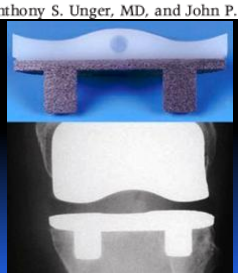
New Technology: BEWARE

Current Practice

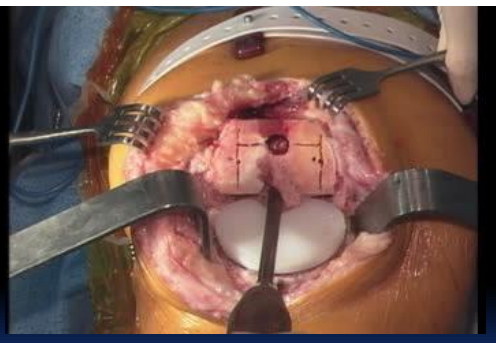
Midterm Results of a Porous Tantalum Monoblock Tibia Component

Clinical and Radiographic Results of 108 Knees

Anthony S. Unger, MD, and John P. Duggan, MD



New Technology
Porous-Coated Ceramics



New Technology
Porous-Coated Ceramics

New Technology
Porous-Coated Ceramics

Osteointegration
in TKA
Design
Porous Technology
Instruments
Technique

New Developments
are all in
Osteointegration

Current Literature:
Pertinent Studies

- 122 Studies
- 10 Negative
- 101 Neutral
- 11 Positive

Current Literature:
Comparative Studies

- 46 studies
- 5 negative
- 31 neutral
- 10 positive

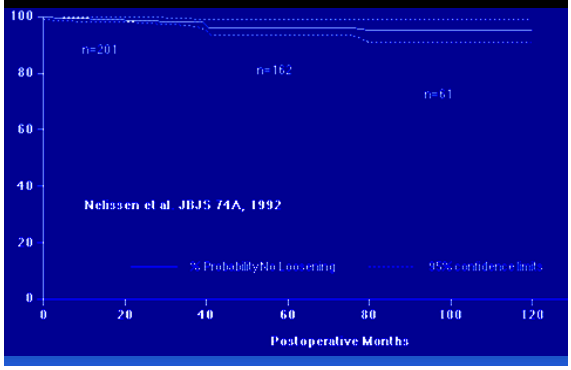
Controlled Studies

- 5 studies
- 2 negative
- 3 positive

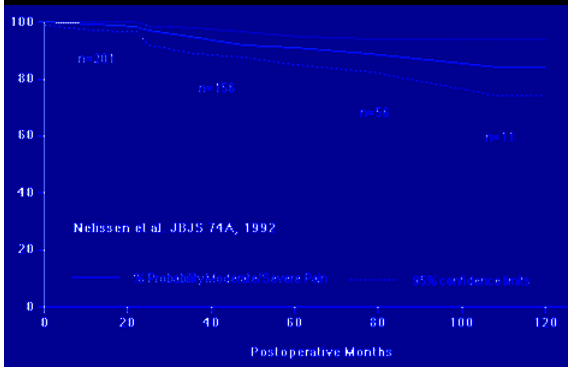
Hybrid

- 13 Studies
- 2 Negative
- 11 Positive

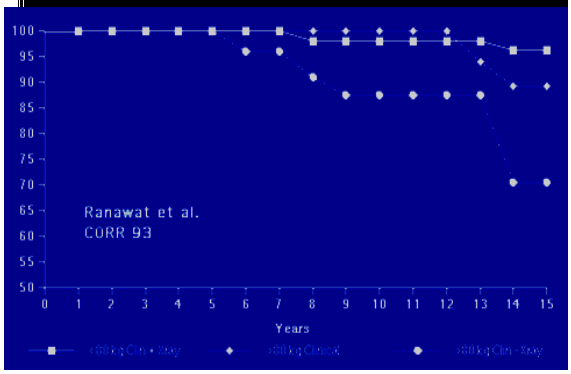
Cemented TKA: Loosening



Cemented TKA: Pain



Cemented TKA: Body Wt



Cemented TKA: CORR 2000

Total Knee Arthroplasty in Patients 40 Years of Age and Younger With Osteoarthritis

Jess H. Lonner, MD; Stuart Hershman, BA*; Michael Mont, MD**; and Paul A. Lotke, MD**

12.5% Loosening at 8 yrs

Missouri Bone & Joint

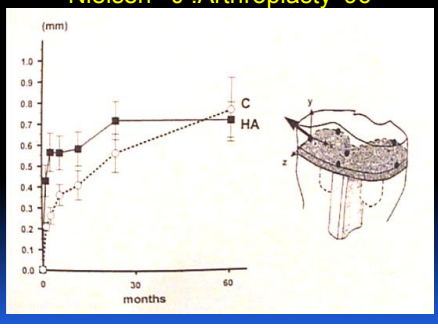
Cemented TKA

McKaskie et al JBJS '99

- Randomized Study PFC Cemented vs Non-Cemented
- Significantly Higher RLL's with Cement

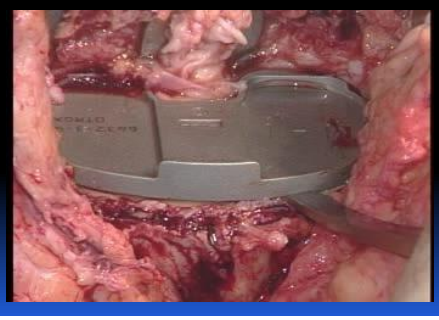
Bone Ingrowth vs Cemented TKA

Nielsen J .Arthroplasty '96

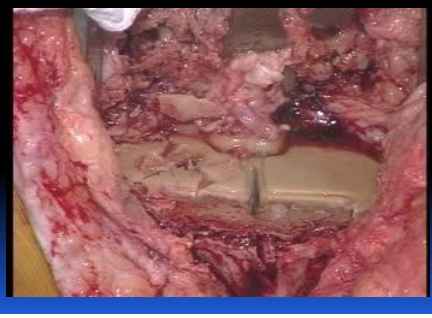


Failure of Cement Bond

Failure of Cement Bond



Failure of Cement Bond

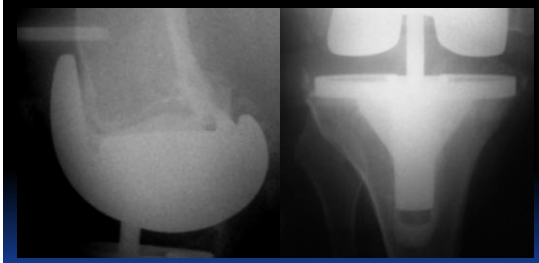


Failure of Cement Bond

Failure of Cement Bond

Failure of Cement Bond

Failure of Cement Bond

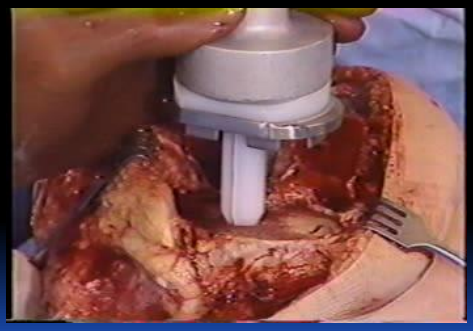


Failure of Cement Bond

Long-Term Followup Ortholoc TKA..... CORR July 2001

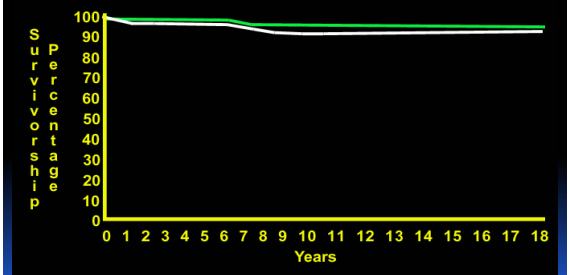
256 Knees
Mean Age 77 (18-93)
95% OA
5% Inflam
16-18 Yr Followup

Ortholoc Knee: 1980



Missouri Bone & Joint

Clinical and Radiographic Loosening Survivorship >99%



Missouri Bone & Joint

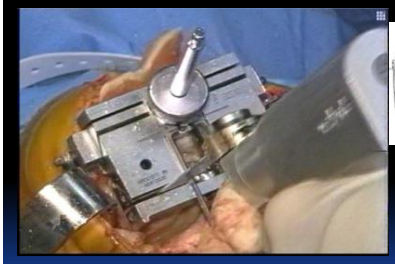
Bone Ingrowth Ortholoc TKA

Pain Results

Pre-op	10.8
2 yr	48.3
5 yr	45.4
10 yr	46.3
20 yr	47.3

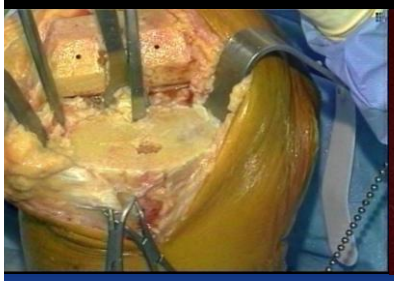
Missouri Bone & Joint

Accurate Surface Preparation



Missouri Bone & Joint

Final Components



Missouri Bone & Joint

Bone Ingrowth Profix TKA Survivorship 1,556 Knees

2 yr: (1556) 99.8%
5 yr: (954) 99.7%
10 yr: (443) 99.3%
12 yr: (257) 98.8%

Missouri Bone & Joint

Bone Ingrowth TKA: CORR 2002

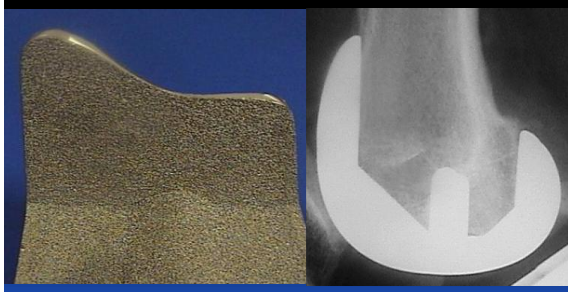
Cementless Total Knee Arthroplasty in Patients 50 Years or Younger

Aaron A. Hofmann, MD; Scott M. Heithoff, DO; and Marcelo Camargo, MD

0 Loosening at 10 yrs

Missouri Bone & Joint

Stable Interface



Stable Interface

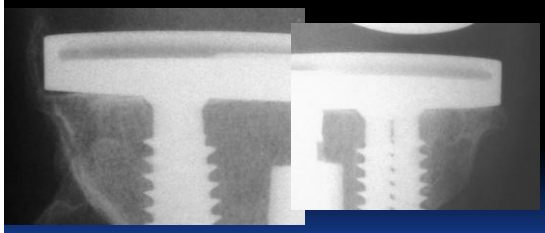
Missouri Bone & Joint

Stable Interface

Missouri Bone & Joint

Stable Interface

Stable Interface



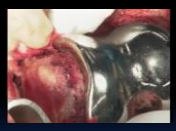
Missouri Bone & Joint

Durable Osteointegrated Bond

Durable Osteointegrated Bond

Durable Osteointegrated Bond

Durable Osteointegrated Bond



Durable Osteointegrated Bond

New Developments:
All are in Osteointegration

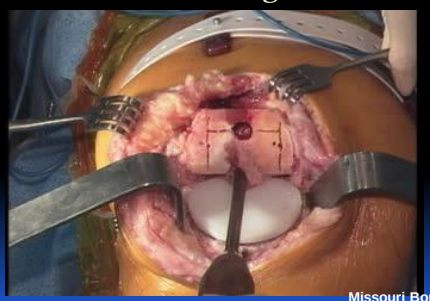
- Hydroxy-Apatite on Porous
- Porous Surface on Ceramic Components
- Porous Metals

Missouri Bone & Joint

New Developments:
All are in Osteointegration

Missouri Bone & Joint

New Developments:
All are in Osteointegration



Missouri Bone & Joint

New Developments: All are in Osteointegration

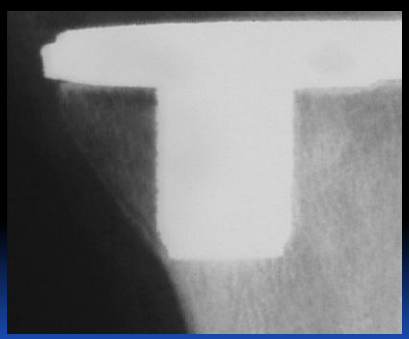
Missouri Bone & Joint

New Developments: All are in Osteointegration

Beware of New Technology

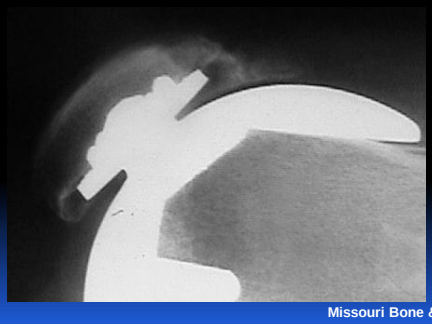
Missouri Bone & Joint

Beware of New Technology



Missouri Bone & Joint

Metal-Backed Patellar Component

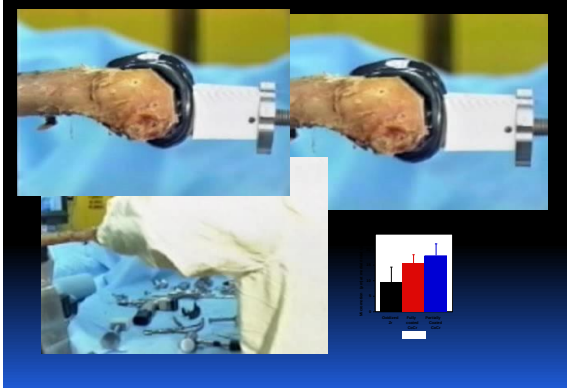


Missouri Bone & Joint

Macro-Textured Surface

Missouri Bone & Joint

Macro-Textured Surface



Macro-Textured Surface

Missouri Bone & Joint

Macro-Textured Surface

17 out of 18 Loosened

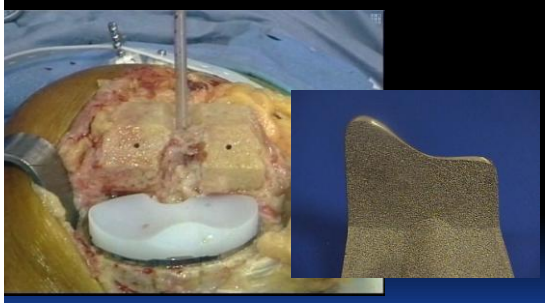
Current Implants and Surgical Technique

Missouri Bone & Joint

Peripheral Capture

Missouri Bone & Joint

Press-Fit Femoral



Missouri Bone & Joint

Results Bone Ingrowth TKA
>90 Kg: <55 y/o

- 167 Knees (125 pts)
- 90% OA, 68% Male
- 7-10 yr Followup
- No Revisions for Loosening

Missouri Bone & Joint

CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 464, pp. 93–96

Young and Heavy Patients with a Cementless TKA Do As Well As Older and Lightweight Patients

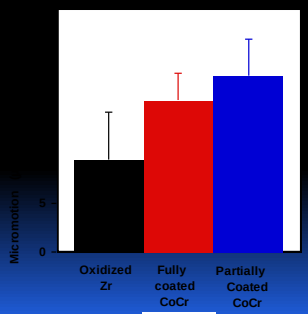
Leo A. Whiteside, MD; and Roberto Viganò, MD†*

12 Years Post-Op

Missouri Bone & Joint

New Technology in O

New Technology in Osteointegration

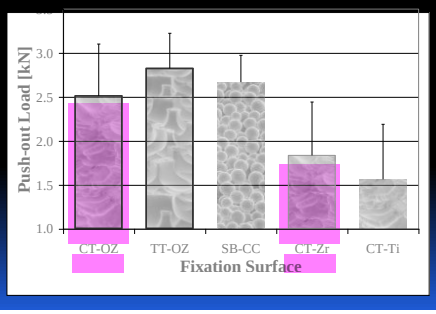


The Study

- Model:
  - Skeletally mature sheep
  - 6-week implantation in distal femur
  - 5 implant sample groups
  - 12 implants per sample group

Mechanical Testing Results

- Oxidized vs. Non-oxidized Textured Zr-2.5Nb ($p = 0.04$)

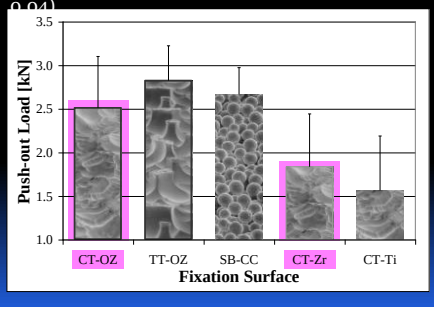


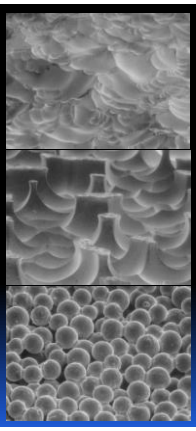
Reason?

- Oxide structurally reinforce the texture asperities
  - more resistant to shear
- Hardened textured surface abrades bone rather than becoming abraded with press-fit insertion
  - self-grafting effect

Mechanical Testing Results

- Oxidized vs. Non-oxidized Textured Zr-2.5Nb (p = 0.04)

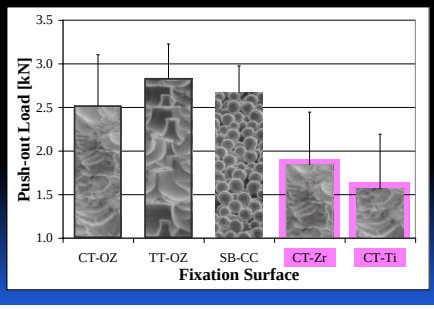




- ChemTex
  - CT-Ti, CT-Zr, CT-OZ
- TecoTex
  - TT-OZ
- Porous Sintered Beads
  - SB-CC

Mechanical Testing Results

- Textured Ti-6Al-4V vs. Textured Zr-2.5Nb (p = 0.39)



Conclusions

- Chemically textured surfaces do not inhibit bone growth
- Chemically textured and oxidized Zr-2.5Nb is equivalent to or better than other clinically available biological fixation surfaces

POROUS COATING CONFIGURATION

POLY REVISION IN TKA

Missouri Bone & Joint

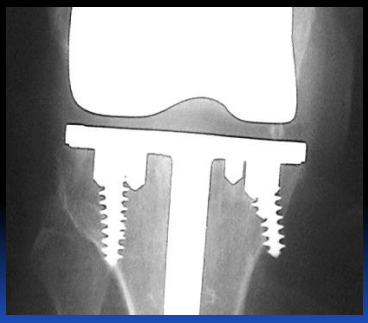
Polyethylene Insert Micromotion and Backside Wear
Harman, Banks, Campbell, Hodge
AAOS 2003

- Minimal or no Backside Wear
- Minimal Upside Wear
- Tighter as Time Passed
- No Complications Related to Modular Poly

Revision for Wear

Missouri Bone & Joint

Revision for Wear



Missouri Bone & Joint

Worn Poly, Minimal Osteolysis, Good Locking Mechanism

Missouri Bone & Joint

Minimal Backside Wear

Missouri Bone & Joint

Minimal Osteolysis

Missouri Bone & Joint

Best Solution: Revision Poly

Tension Ligaments

Missouri Bone & Joint

Final Poly

Missouri Bone & Joint

Correctly Designed and Carefully Manufactured
No Known Problems with Modularity

Missouri Bone & Joint

Correctly Designed and Carefully Manufactured

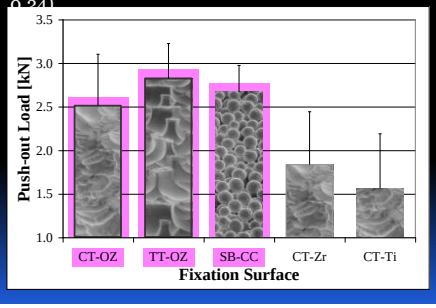
Missouri Bone & Joint

New Osteointegration Technology

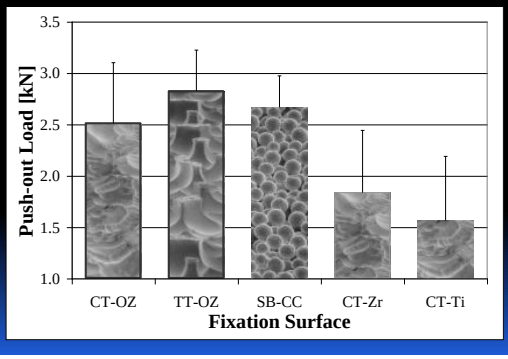
CEMENTLESS TKA

Mechanical Testing Results

- Co-Cr Beads vs. Textured & Oxidized Zr-2.5Nb ($p > 0.24$)

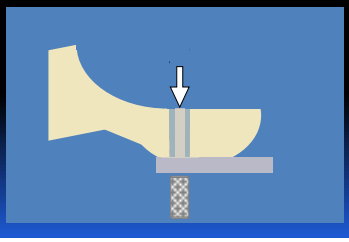


Mechanical Testing Results



Pin Push-out Testing

- Bone sectioned away from each end of pin
- Steel plunger and restricter plate used to axially push the pin out of the bone

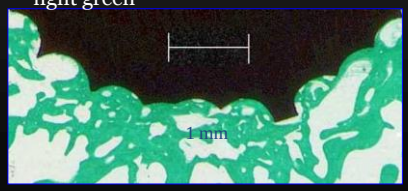


Histological Assessment

- Bone formed in direct apposition to the deepest recesses of each test surface
  - mechanical interdigitation
  - Bone labels indicated that bone formation had:
    - started within 2 weeks
    - continued out to 5 weeks

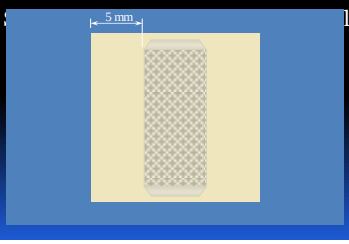
Histological Analysis

- Sections were ground and stained with light green



Histological Analysis

- Bone sectioned at least 5 mm from test surfaces
- [illegible] leared

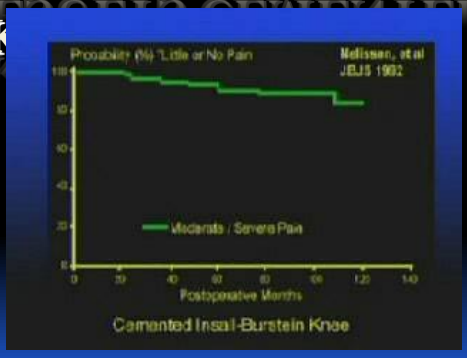


Bone Labels

- Bone labeling solutions given to 4 sheep in each group
  - calcein injection @ 2 weeks
  - oxytetracycline injection @ 5 weeks
- Sheep euthanized and femora harvested @ 6 weeks

New Technology in Osteointegration

RESULTS CEMENTED TK

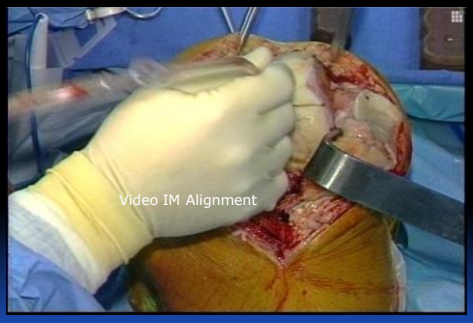


I.M. Alignment

Trial Implants

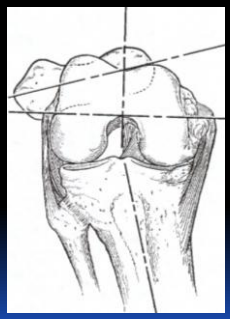
Missouri Bone & Joint

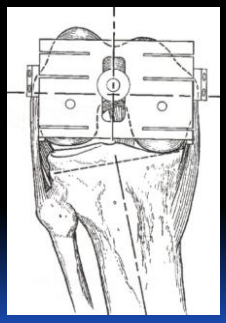
I-M Alignment



Missouri Bone & Joint

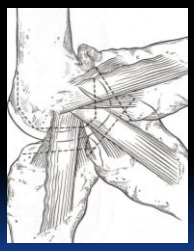
A-P Axis





Missouri Bone & Joint

Measured Resection



Missouri Bone & Joint

Tibial IM Alignment

Missouri Bone & Joint

Femoral Resection

- Diverging
- Irrigation

Tibial Resection

- Rough Cut
- Irrigation

Tibial Resection

- Finish Cut
- Irrigation

Trial Components

Tibial Component

- Porous Undersurface
- Grit Blasted Stem
- Screws

Femoral Component

- Porous Undersurface
- Femoral Pegs

Accurate Reference Landmanks

New Technology in Osteointegration in TKA

- Hydroxyapatite on Porous
- New Porous Metals
- Porous Coating on Ceramic Implants
- Bone Growth Factors

Missouri Bone & Joint