Knee Arthroplasty

My algorithm for materials and fixation

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Disclosure

- Designer (Royalty income) - **DePuy A Johnson & Johnson Company**
- *Consultant* on Knee Products for **Smith & Nephew Orthopaedics**
- *General Research Funding –* ***Inova Health System and the U.S. Army Medical Research & Materiel Command and the Telemedicine & Advanced Technology Research Center***
- *Investor -* ***Alexandria Research Technology***

Disclosures made in accordance with Anderson Orthopedic Research Institute Policy

TKA-preferences

1) Femur: cruciate retaining, fixed bearing
   oxinium <65 CoCr>65
2) Tibia: metal backed/ modular / polished CoCr
3) Tibial stem: short stem (20mm) with keel
4) Polyethylene insert: Non-irradiated
5) Patella: resurfaced
6) Fixation: cement

1) Why a cruciate retaining implant?

- Allows the soft tissue envelope to guide kinematics

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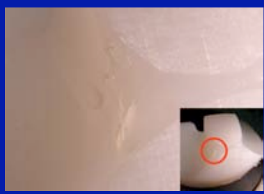
- Reduces concerns with :
  - post wear
  - backside wear
  - patellar clunk
  - bone loss



1) Why a fixed bearing implant

- Proven clinical outcomes

Moderately Conforming Articular Geometry

Clinical Outcomes

Implant	Average follow-up	ROM	Knee Society Score		Average Survivorship	Investigator
		Flexion	Functional	Clinical		
PFC	5 years	111°	78	93	97.0%	Ranawat
PFC	10 years	98°	-	-	95.5%	Khaw
PFC	10 years	113°	84	95	90.0%	Schai
PFC	15 years	114°	78	96	92.6%	Dixon
PFC	15.8 years	112°	65	89	91.5%	Rodricks
Genesis I	7.3 years	112.5°	88	92	97.0%	Chen
Genesis	10 years	114°	-	90.5	96.5%	Laskin
Nexgen	8 years	109.5°	-	91.4	97.7%	Bozic
Nexgen	7 years	123°	87.3	97.7	98.0%	Bertin
Natural	10 years	120°	-	-	93.4%	Hofmann
Average		**107.5°**	**80**	**93**	**94.4%**	

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Khaw F JOA 2001;16(2):161-167.
Schai P JBJS Br 1998;80-B:850-8.
Dixon M JBJS 2005;87:598-603.
Rodricks D JBJS 2007;89:89-95.
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Laskin R CORR 2001;388:95-102.
Bozic K CORR 2005;430:117-124.
Bertin K CORR 2005;436:177-183.
Hofmann A CORR 2001;388:85-94.

Flat Articular Geometry

Clinical Outcomes

Implant	Average follow-up	ROM	Knee Society Score		Average Survivorship	Investigator
		Flexion	Functional	Clinical		
AGC	11 years	110.9°	67	91	95.0%	Emerson
AGC	15 years	110°	-	81	98.9%	Ritter
MG-I	11 years	104°	-	-	84.1%	Berger
MG-I	15 years	115°	84	91	87.0%	Goldberg
MG-II	9 years	111°	-	-	100.0%	Berger
AMK	6.9 years	107°	-	90	99.0%	Bugbee
AMK	7.4 years	120.9°	-	93.3	98.0%	Kim
Average		**107.5°**	**76**	**89**	**94.6%**	

Emerson R JOA 2000;15(4):418-423.
Ritter M CORR 1995;321:79-85.
Berger R CORR 2001;388:58-67.
Goldberg V CORR 2004;428:214-220.
Bugbee W CORR 1998;348:1528-165.
Kim Y CORR 2001;392:101-115.

Highly Conforming Articular Geometry

Clinical Outcomes

Implant	Average follow-up	ROM	Knee Society Score		Average Survivorship	Investigator
		Flexion	Functional	Clinical		
IB-I	10 years	110°	71	92	96.4%	Brassard
IB-I	12 years	111°	69	91.6	92.2%	Thadani
IB-II	6 years	105.6°	-	89.4	100.0%	Bhan
IB-II	6.4 years	113°	79	85	94.3%	O'Rourke
IB-II	7 years	112°	52	89.3	-	Lachiewicz
IB-II	10 years	100°	56	87	92.3%	Li
IB-II	10 years	111°	69	94	92.6%	Brassard
LCS	6 years	106.9°	-	90	94.0%	Bhan
LCS	10 years	100°	65.1	86.4	99.1%	Ali
LCS	12 years	105°	72	85	92.1%	Huang
LCS	12 years	105°	-	-	89.5%	Sorrells
LCS	13 years	105.3°	-	-	98.0%	Buechel
LCS	14 years	115°	-	-	88.0%	Sorrells
LCS	15 years	105°	58	85	97.0%	Callaghan
Average		**107.5°**	**64**	**88**	**94.3%**	

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Callaghan J JBJS 2005;87:1995-1998.

Clinical Outcome Averages

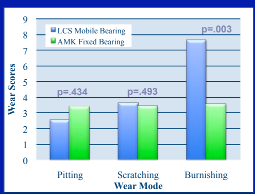
Level of Conformity	Follow-up	ROM	Knee Society Score Functional	Knee Society Score Clinical	Survivorship
High-FB	8.8 years	108.9°	66	90	94.6%
High-MB	11.7 years	106.0°	65	85	94.0%
Moderate	9.8 years	107.5°	80	93	94.4%
Flat	10.8 years	107.5°	76	89	94.6%

AORI retrievals
Good Poly

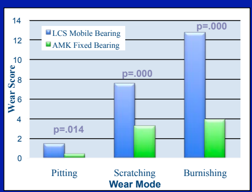
- Fixed Bearing
  - 49 Sigma PFC inserts
  - Gamma in Barrier
  - In situ: 32 months
- Mobile Bearing
  - 23 LCS RP inserts
  - Gas Plasma
  - In situ: 29 months

Mobile Bearing vs Fixed Bearing Inserts

AORI Retrieval Study
Enduron polyethylene (DePuy)



Topside Wear



Backside Wear

Results: Mobile Bearing Knees exhibited significantly more topside and backside burnishing

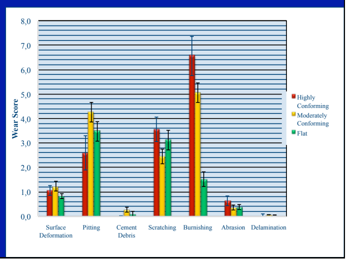
AORI Retrieval Study

Overall Wear Score

Highly Conforming	14.4
Moderately Conforming	13.7
Flat	9.5

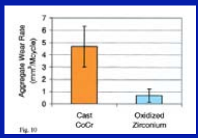
↑ Conformity ↑ Burnishing

Wear scores did not decrease with increasing conformity



Why oxinium for pts under 65

- Scratch resistance/ reduced wear
- Established outcome reports
  - Australian registry
  - Bourne



Alternative Metal Femurs

Oxidized Zirconium femurs

Significantly reduced the wear rate in simulator studies

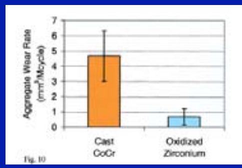


Figure 10: The UHMWPE molecular wear rate was 85% less for oxidized zirconium than for CoCr (regression and standard error)

Ezzet K CORR 2004
Image from Spector M JBJS Am 2001;Suppl 83-A:80-86.

Why metal-backed?

- Reduced stress on fixation interface
- Ease of insertion
- Access to posterior femur-cement removal
- Enhanced bone support
- Better tibial coverage
- Outcome studies

TKA Survivorship

- 9200 cases- Mayo clinic
- "Use of a metal-backed tibial prosthesis resulted in a significant lower rate of failure"

Rand, JBJS, 1991

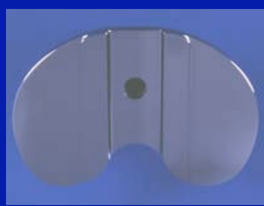
1430 Cemented TKA's

	Survivorship
Total Condylar	90.5% (10yrs)
Post Stab. Poly tibia	97% (10 yrs)
Post Stab. Metal-backed	98.7% (7yrs)

Scuderi JBJS-B, 1989

2) Why a modular tibial tray?

- Easier to implant
- Access to posterior compartment for cement removal



Why not an all poly tibia?

- Disadvantages:
- > Bone stress
- Fewer sizing options
- Limited access to posterior compartment
- Harder to insert

3) Why a short stemmed tibia?

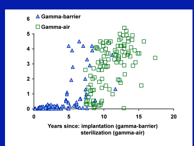
- Ease of insertion
- Less invasive exposure
- Avoid MCL avulsion

Long tibial stem requires hyper-flexion for insertion

Short-stem tibia insertion in extension

4) Why non-irradiated poly?

- Irradiated poly prone to oxidation

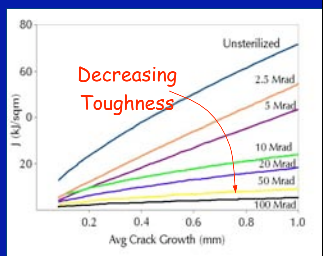


- Non-irradiated poly Retrievals-nominal wear

6 implants in vivo >15 years

Why not highly x-linked poly ?

- Reduced strength
- No outcome reports



5) Why resurface the patella?

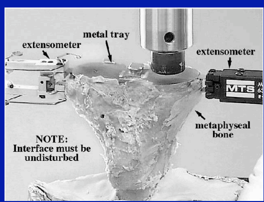
- 10% of knees have unexplained pain
  - Resurfacing eliminates one possible cause
- No problems with patellar implant wear

6) Why cement ?

- Enhances component fixation
- Outcome studies with cementless
  - ↑ revision risk *Gioe,CORR-07*
  - lower survivorship most studies: 64% at 15 yrs *Duffy,JArth-07*
  - at best equivalent results at 15 years: *Baker JBJSB-07*

6) Why cement fixation ?

- No deterioration in fixation stability with time in situ
- Post-mortem retrievals at 10.2 years
- Motion only tens of microns



Rao, JArth-09

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Thank you