The Arthritic Knee. Why Replace It All?

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Osteoarthritis of the Knee

Total Knee Replacement

The old ‘Rules’ of Knee Surgery

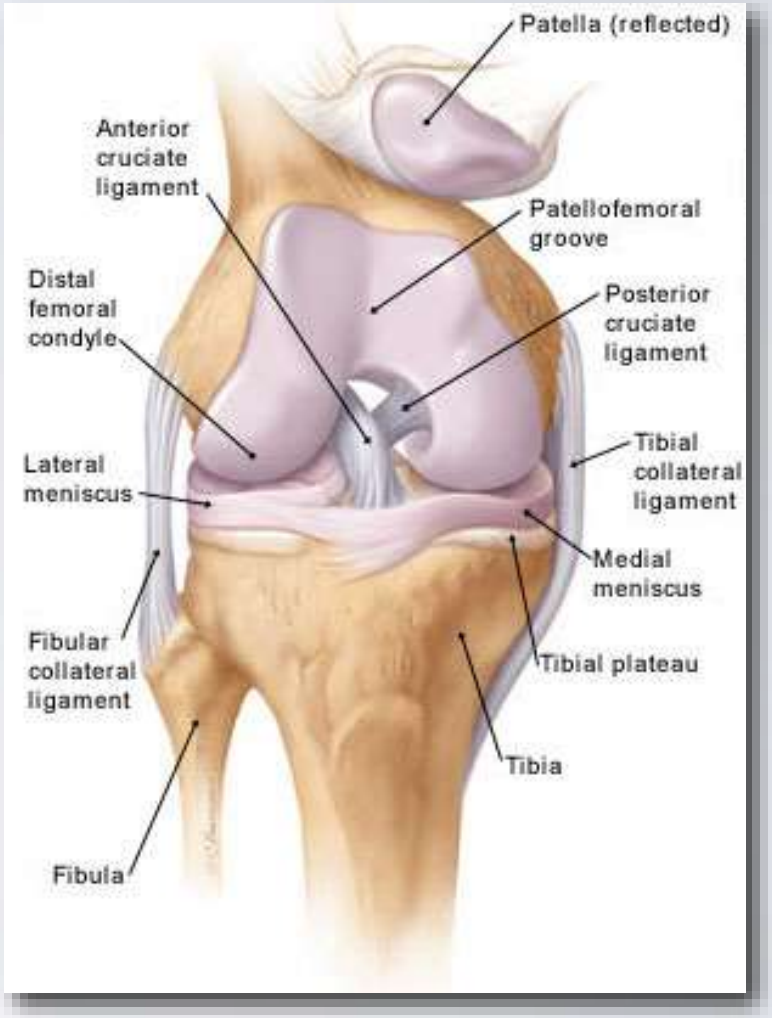
- Patients must be over 65
- Not as good as hip replacements
- ‘Relatively’ poor function
- Large ugly skin incisions

Why ‘Relatively’ Poor?

- Younger patients – higher demands
- Older patients - higher demands
- Pain relief not enough
- Better functional outcome
- Better cosmesis
- Not a ‘normal’ knee

The Knee - A Complex Joint

- Knee complex joint
- Asymmetrical femoral condyles
- Complex intra-articular ligament arrangements
- Not just a simple hinge joint



Total Knee Replacement

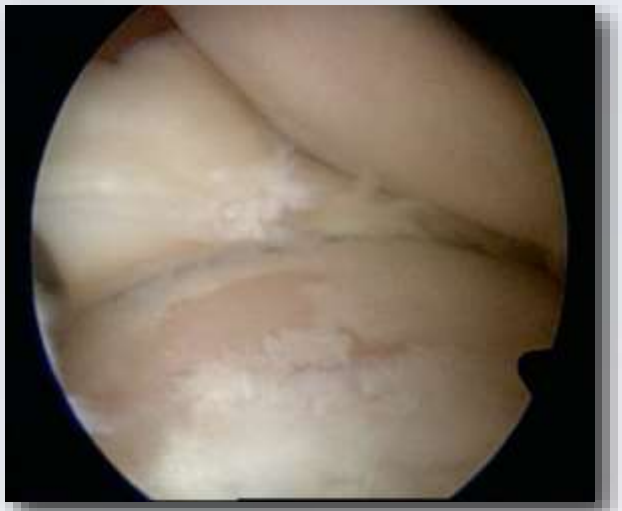
- Doesn’t replicate the full working functional knee
- Every knee is a compromise
- Good ... but not good enough for some!
- Not a ‘normal’ knee

Can We Make A ‘Normal’ Knee?

- Don’t remove ACL - improve proprioception
- Exact replacement of bone cuts - no size alteration
- Don’t release ligaments - maintains normal balancing
- Only replace the worn part - own cartilage is better than any metal/plastic

Medial Sided Arthritis

Arthroscopic Findings

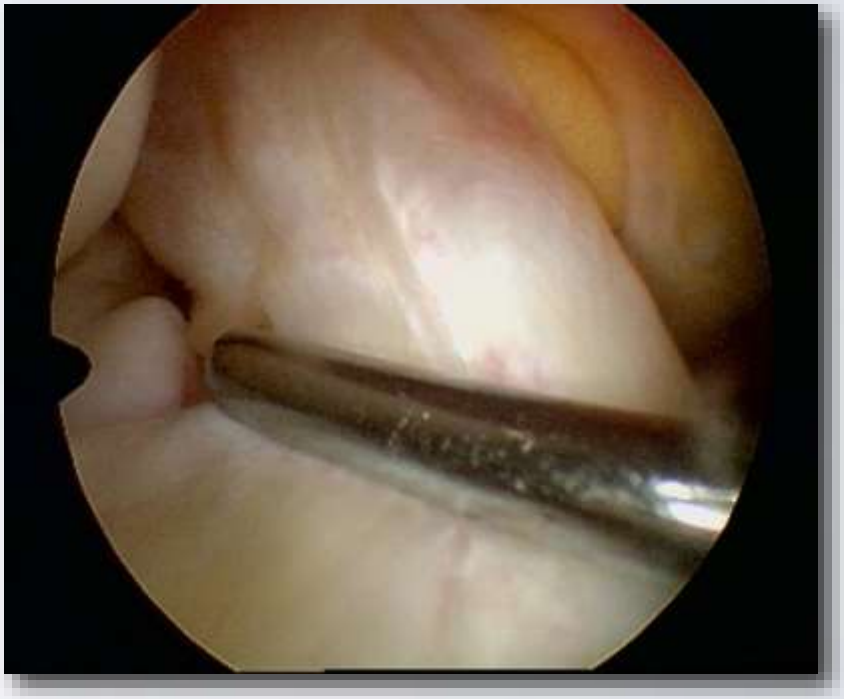


Unicompartmental Knee

Unicompartmental Knee Replacement

Unicompartmental Criteria

- Fixed Flexion Deformity <10°
- Correctable varus
- Intact ACL
- Non-inflammatory
- Minimal patella degeneration



Survival Analysis

- New Zealand Joint Registry - 4284 UKR between 1998 to 2008
- 236 required revision (5.5%)
  - 205 to a total knee replacement
- Revision rate 4x primary TKR
- Patient selection

St Georg Sled

- Bristol - 203 Medial St Georg Uni in 174 patients already >10 years
- Follow-up 10 to 29.4 years (mean 14.8)
- 99 survived 15 years; 21 for 20 years; 4 for 25 years
- 85.9% 20 year survival
- 80% 25 year survival

- Steele et al *JBJS Br* 2006

Oxford Uni - Age Survival

- Oxford multi-centre data
- 10 year all-cause survival in under 60 years - 91%
- 10 year all-cause survival in 60 and over - 96%
  - Price at al *JBJS Br* 2005

Randomisation To UKR or TKR

- 102 knees randomised to LCS UKR or LCS TKR
- 15 years survivorship rate based on revision or failure for any reason
  - 89.8% for UKR
  - 78.7% for TKR
- Little functional deterioration in prosthesis or remainder of the joint

- Newman J et al *JBJS Br* 2009

Does the Patella Matter?

- 824 knees in 793 consecutive patients - Oxford UKR
- Full thickness cartilage loss seen on
  - 100 knees (13%) on trochlear surface
  - 69 knees (9%) on the medial facet of the patella
  - 29 knees (4%) on the lateral facet of patella
- ‘Provided there is not bone loss and grooving of the lateral facet…full-thickness cartilage loss is not a contraindication to a Oxford UKR.’

- Beard DJ et al *JBJS Br* 2007

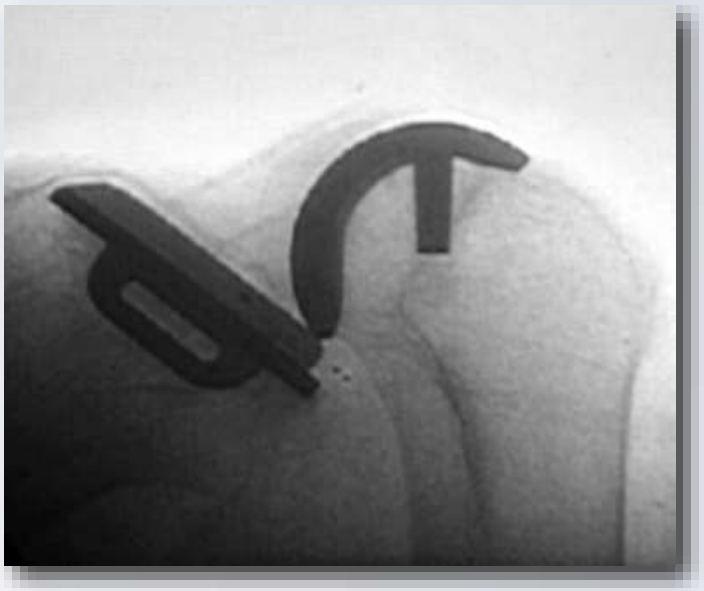
Does Patella Affect Function?

- 195 Oxford uni's in 163 patients
- 125 (64%) had degenerative changes on skyline x-rays
- No difference in post-op Oxford Knee & SF-12 scores
  - (p=0.22 & 0.54)

- Kang et al *JBJS Br* 2011

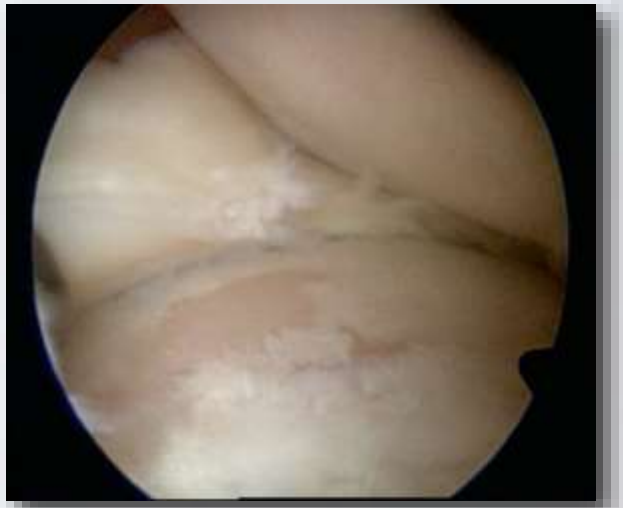
Post-operative Function

- Increased range of movement
  - More ‘normal’
- Can kneel better
  - Patients feel can’t kneel with TKR
  - Debatable
  - Oxford work – can kneel with UKR if taught

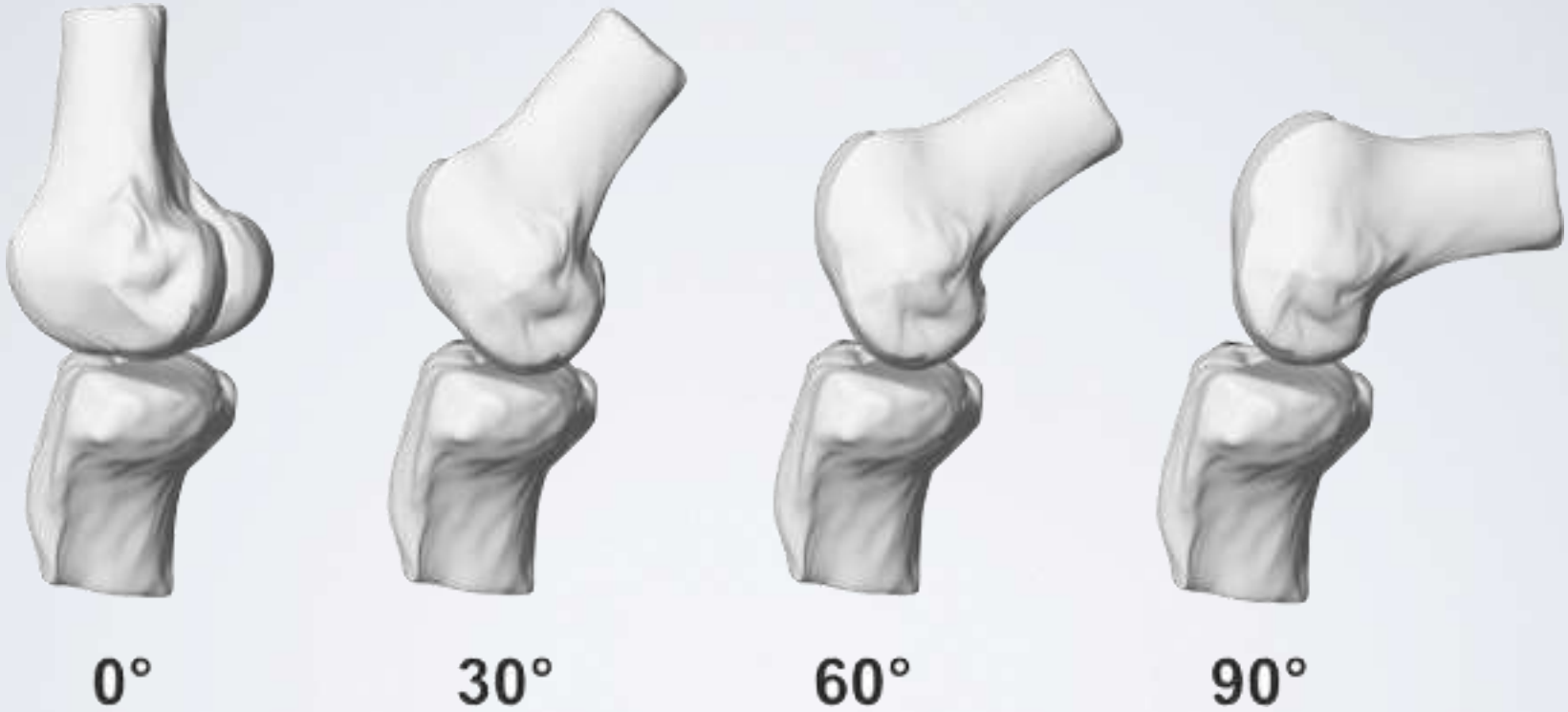


Arthritic Progression

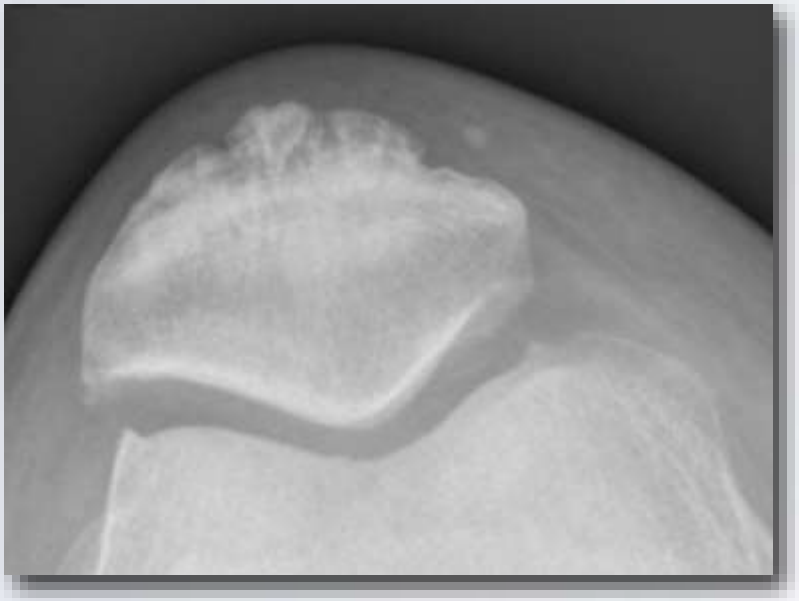
- Evidence to suggest minimal progression of arthritis post-UKR
- Antero-medial arthritis
- Distinct pathology



Femoral Roll Back



Isolated PFJ OA

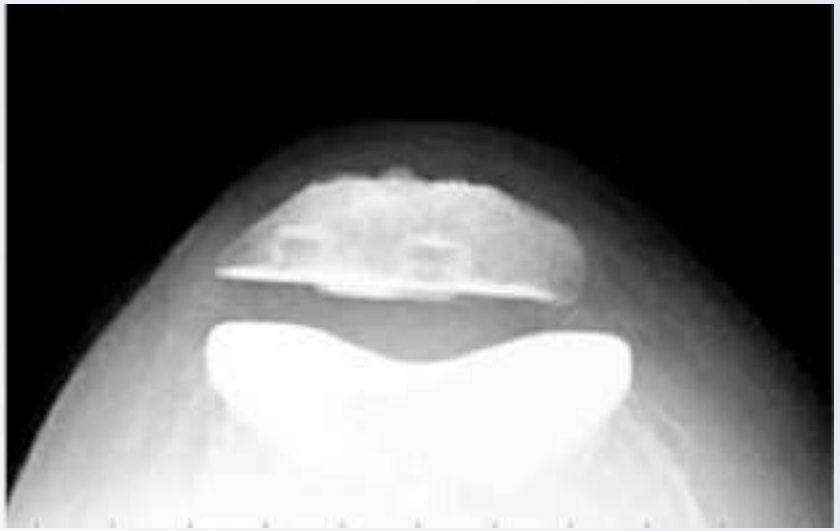


Patello-Femoral Replacement

Patello-femoral Joint Replacement

Avon PFJ



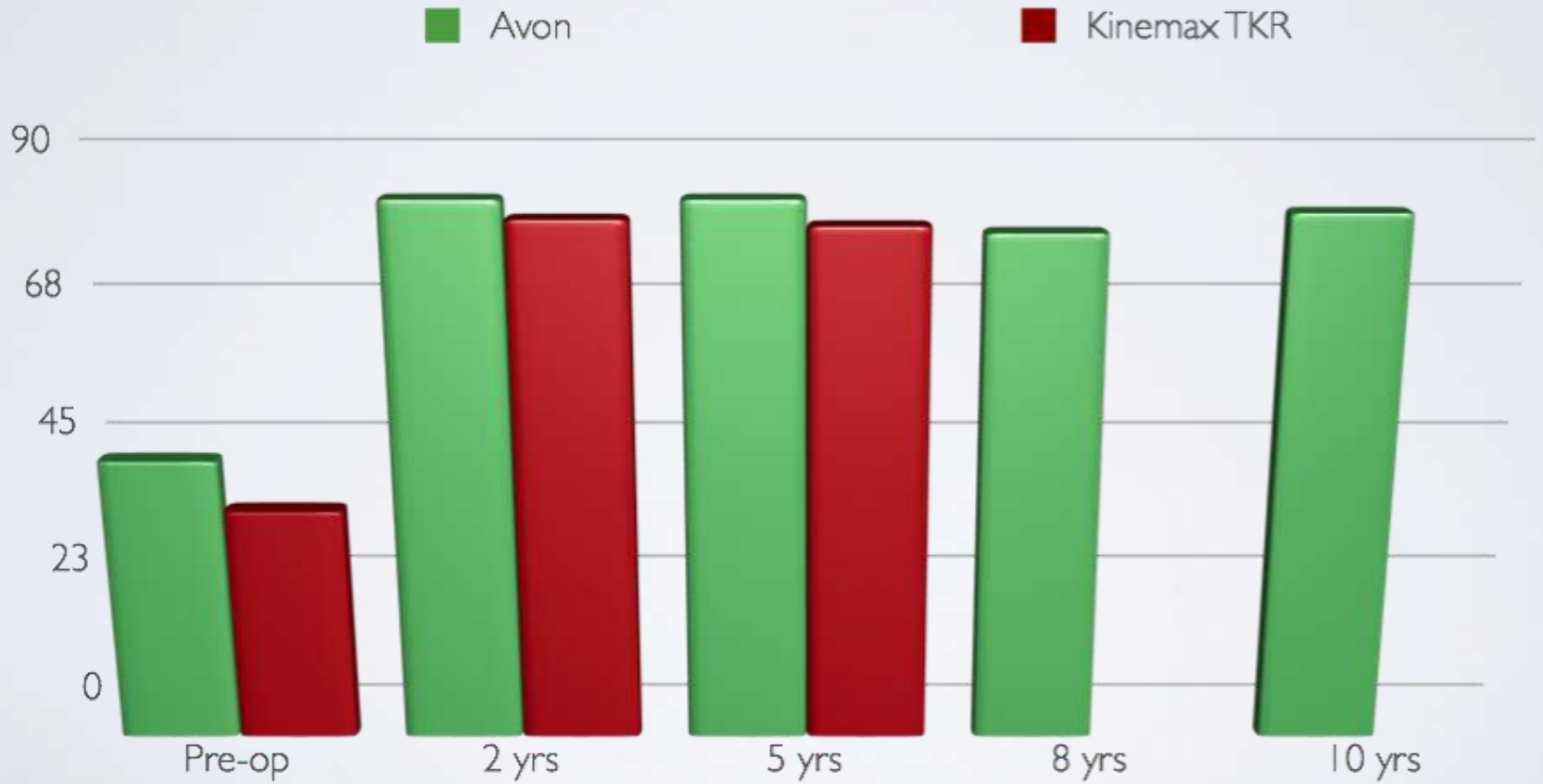


Avon PFJ Survival Analysis

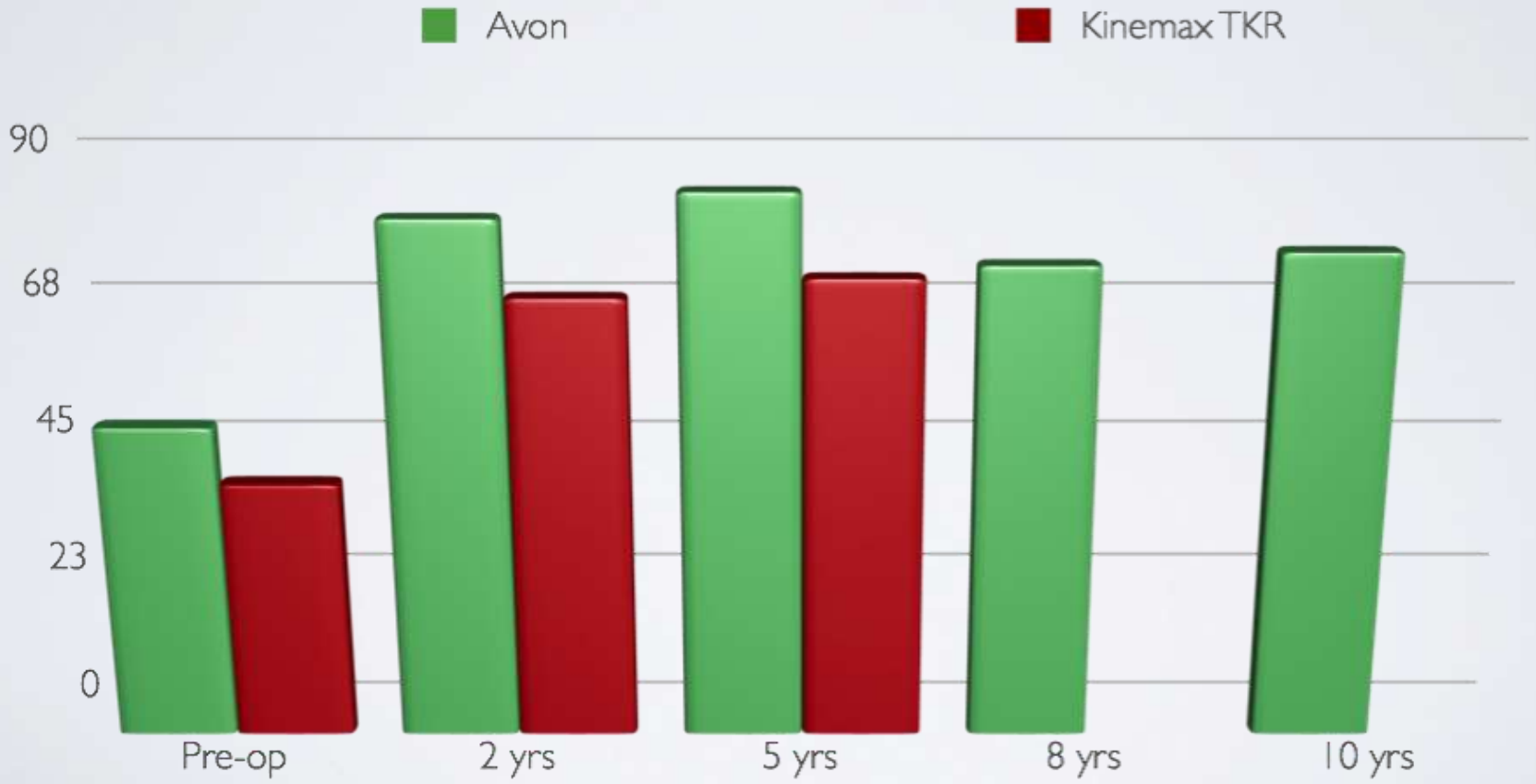
- 106 consecutive Avon PFJ in 85 patients
- Minimum 5 years follow-up
- 95.8% survival at 5 years
- No loosening
- 25 patients (28%) - progression of arthritis
- Careful selection of patients

- Ackroyd C et al *JBJS Br* 2007

WOMAC Pain scores



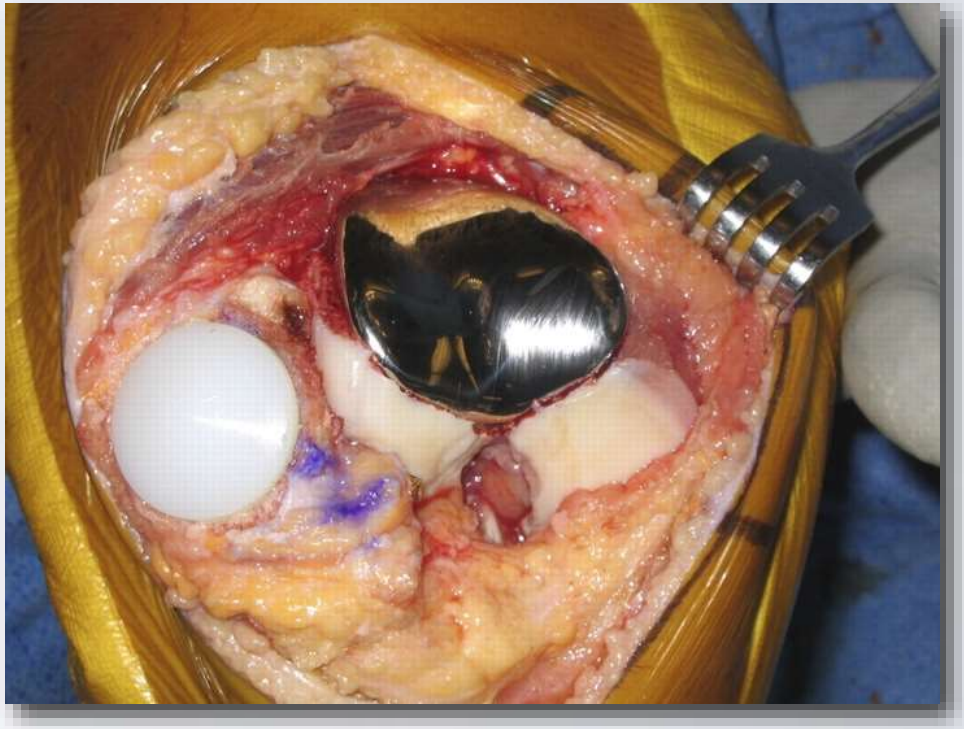
WOMAC Function scores



Oxford Knee Scores

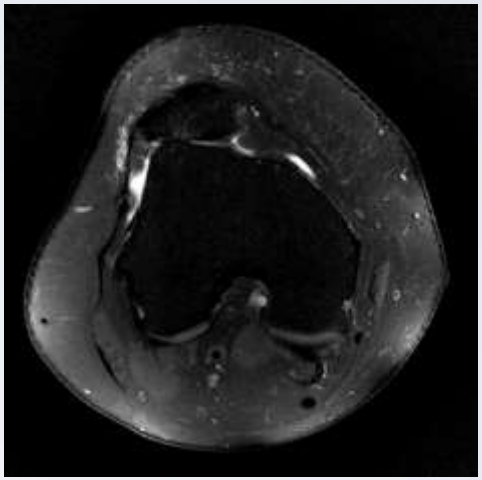
Results in General

- FPV - 84.1% at 5 years
- Avon - 95.6% at 5 years
- Autocentric PFJR - 21 of 24 required further surgery
- Lubinus - 45% satisfaction at 7 years

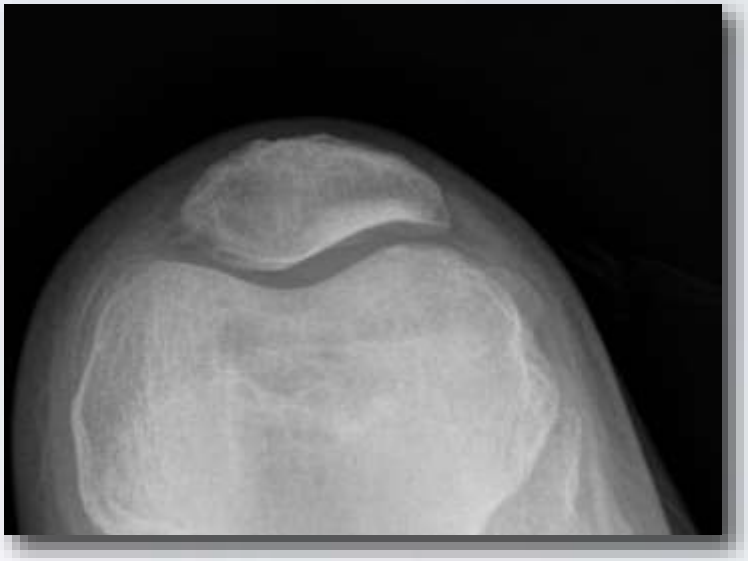


Why Some Poorer Results?

- Pre-op normal anatomy
  - Secondary OA
- Pre-op dysplastic anatomy
- Pre-op limb mal-alignment
  - Patella mal-tracking
  - ?MPFL Reconstruction



PFJ Mal-alignment

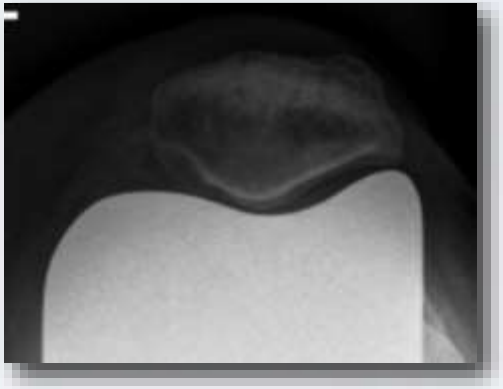


PFJR & MPFJ Reconstruction

Bi-compartmental OA

- What if medial and patello-femoral joint also involved
- ? leave the patella – potential anterior pain post-op
- ? total knee replacement
- ? unicompartmental plus patello-femoral replacement

Deuce Bicompartmental



Survival Analysis

- 7000 implanted world-wide
- Only available commercially in last 3 years
- 2 in Liverpool – both have had arthroscopic debridements
- Recurrent effusions
- No medium or long term data

Cardiff Review

- 15 Deuce replacements reviewed at mean 18 months
- Patella resurfaced in 12
- 5 patients - tibial plate loosening
- 1 revised for patello-femoral pain & maltracking
- Recurrent effusions
- 8 listed for revision surgery within 2 years

- SP White et al *BASK* 2011

Florida Experience

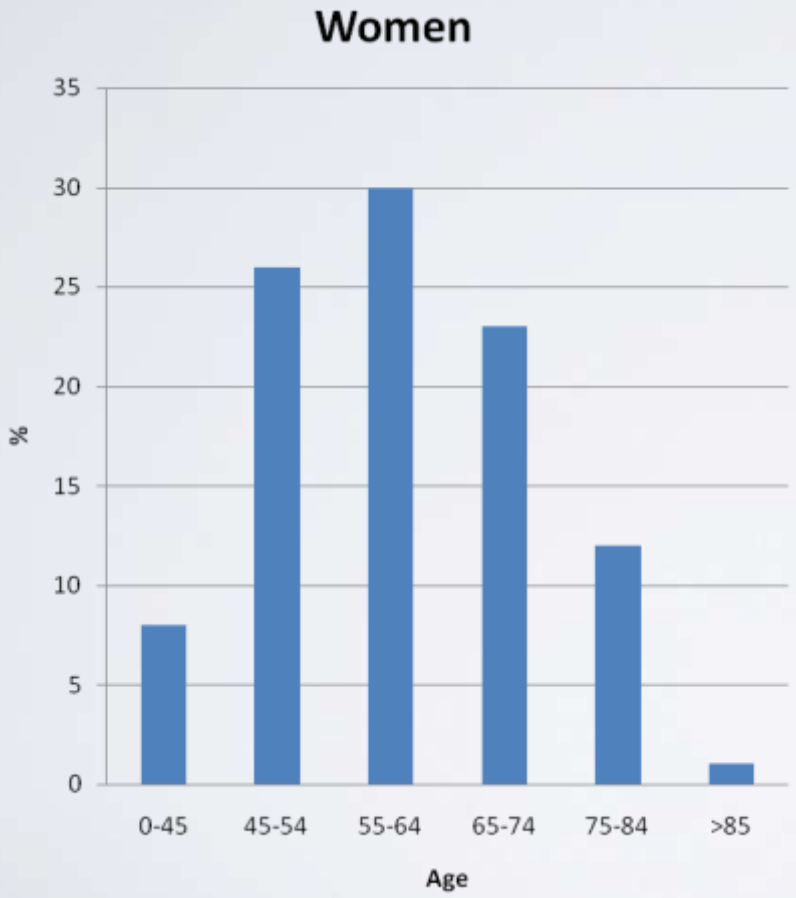
- 36 Deuce in 32 patients - mean follow-up 21 months
- 31% patients unsatisfied with surgery
- 53% would not repeat surgery
- 86% survival rate
- 1 catastrophically failed tibial base plate

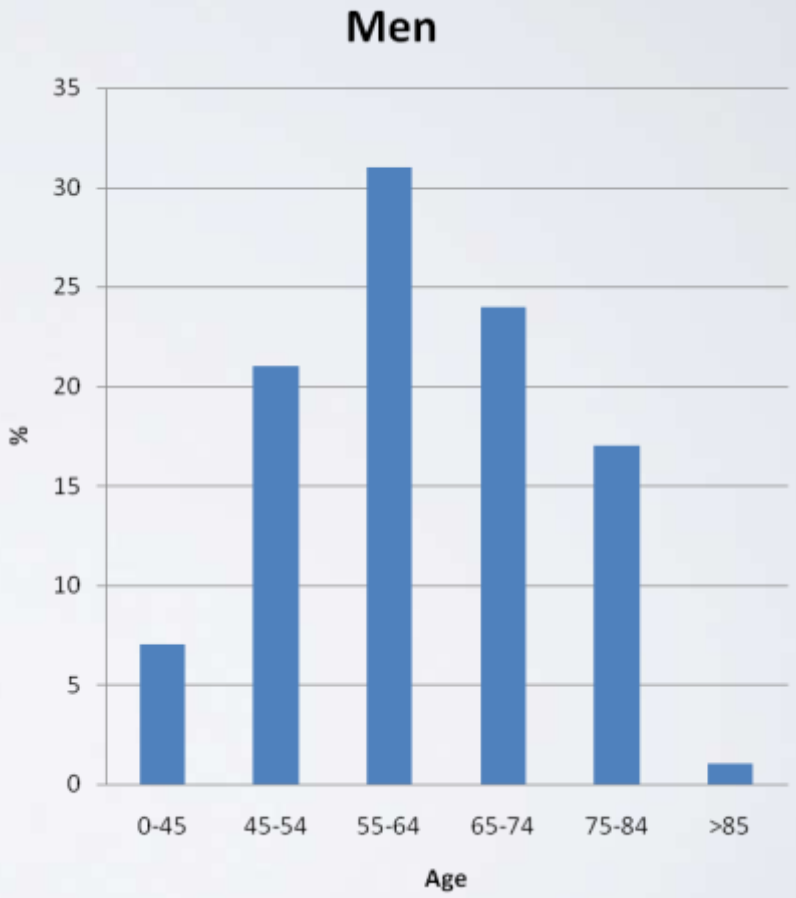
- Palumbo BT et al *J Arthroplasty* 2011

2011 National Joint Registry

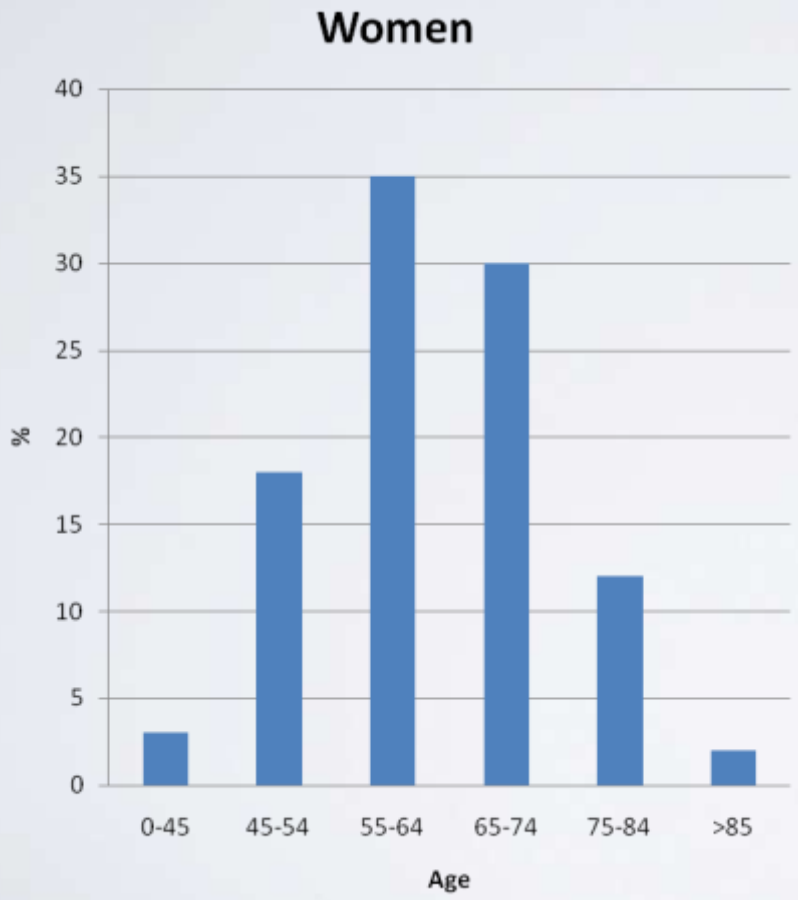
	Primary TKR cemented	Primary TKR uncemented	Primary TKR hybrid	PJFR	UKR	Total
Female	86%	5%	1%	2%	6%	41,417
Av age	70	69	69	61	64	
Male	83%	5%	<1%	<1%	10%	31,628
Av age	70	68	69	62	64	

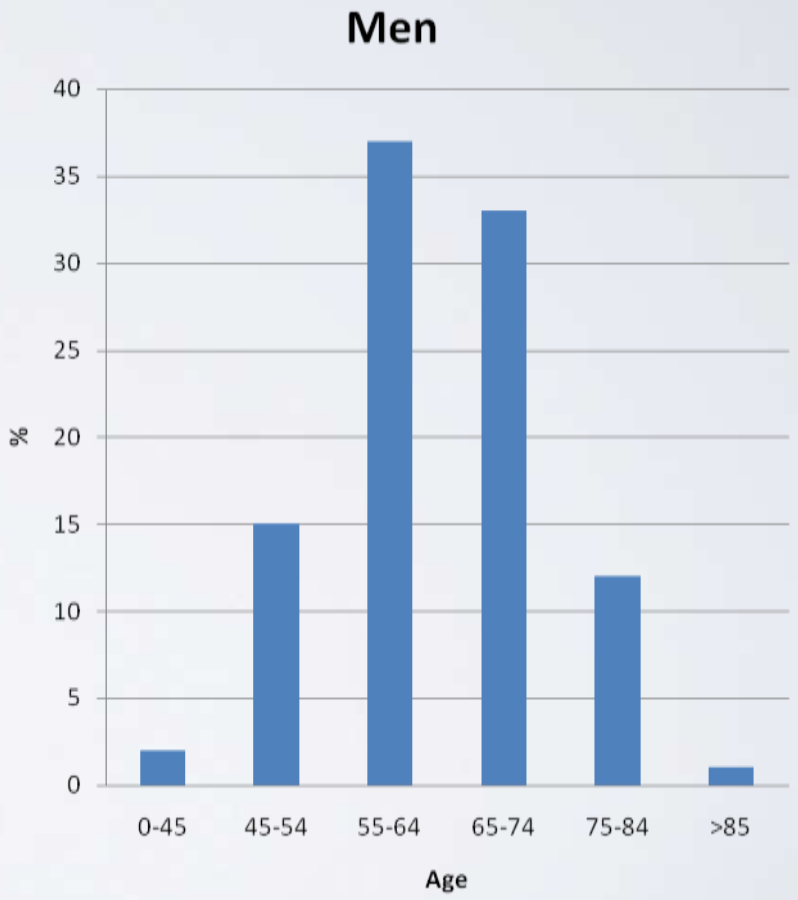
Age distribution - PFJ



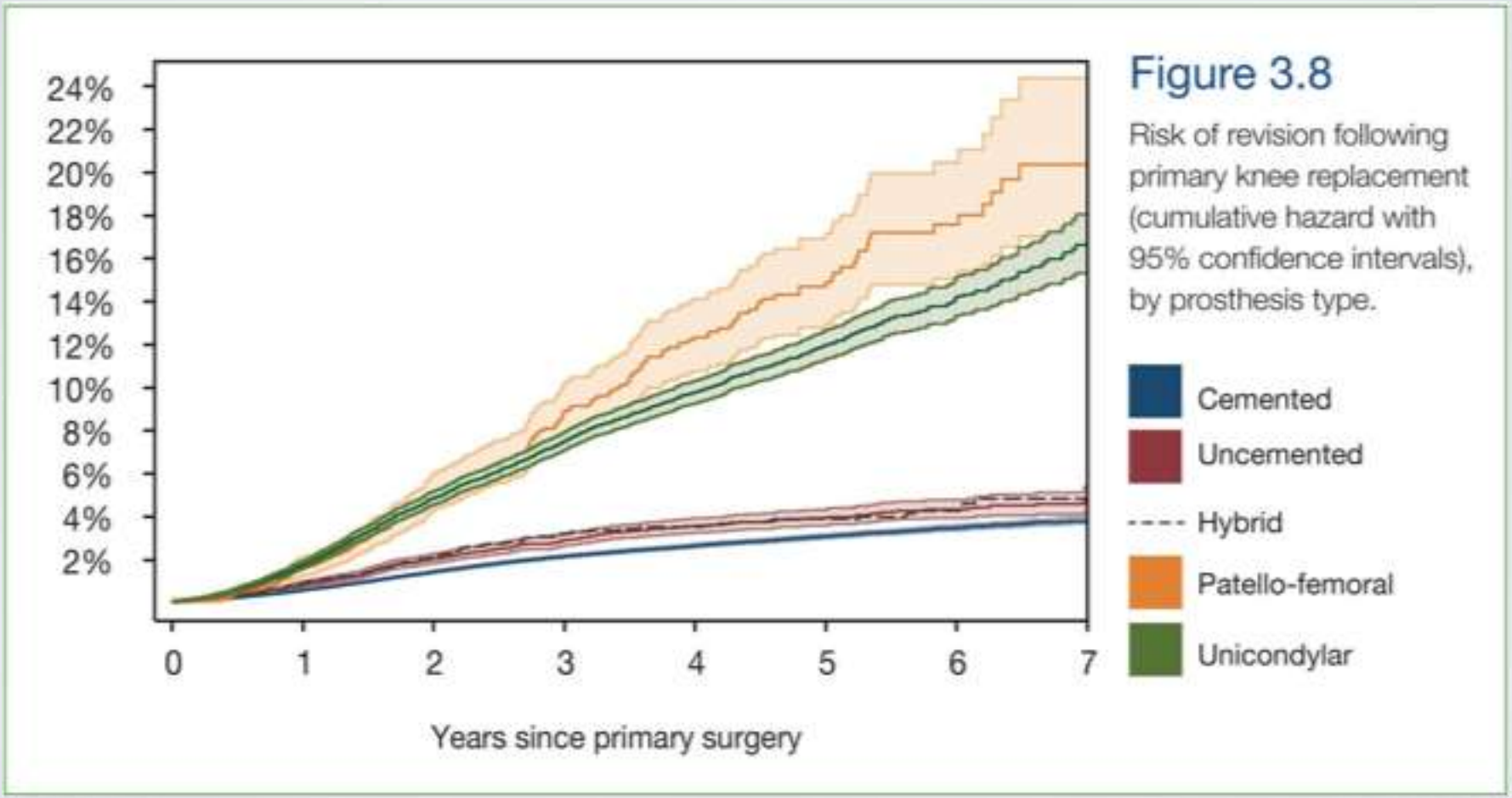


Age distribution - UKR





Revisions by Prosthesis



Note: 95% confidence intervals not shown for hybrid group because of overlap obscuring plot.

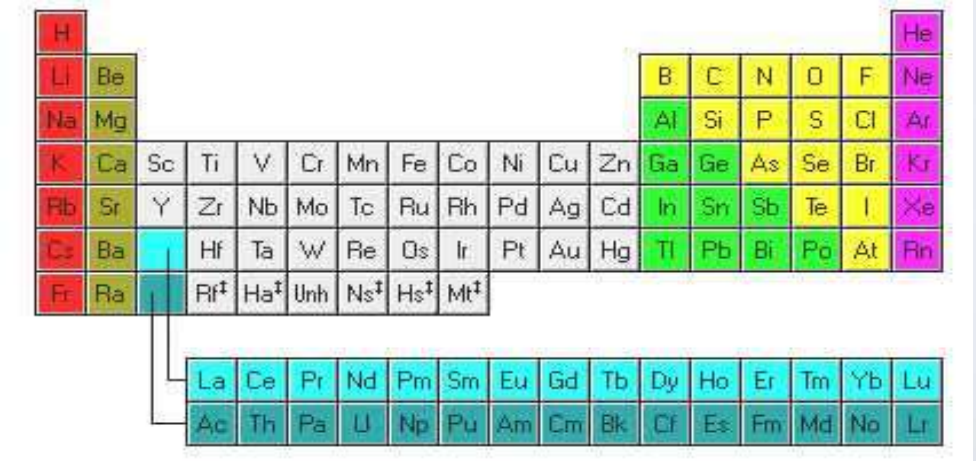
Why Increased Revision Rate?

- Failure of implant - ? poor design
- Progression of arthritic process
- Learning curve
- Poor patient choice
  - missing the ‘failing joint’
- Perceived ease

Zirconium

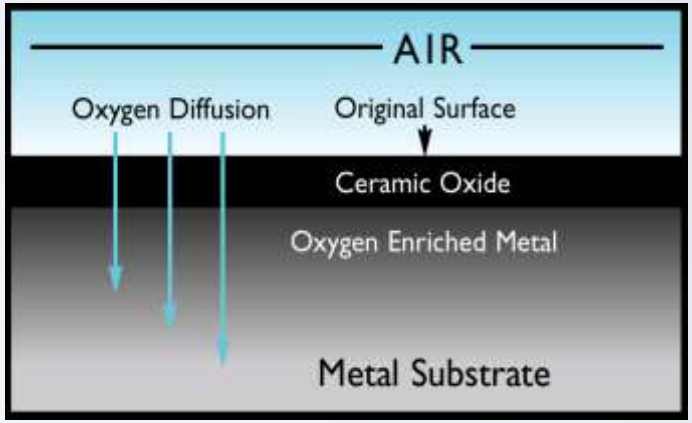
- Metal alloy with surface transformed to ceramic
  - Zirconium (97.5%) + Niobium (2.5%)
  - Metal alloy heated in oxygen
  - Zirconia: ceramic compound (zirconium oxide)

IV B	V B
22 47.90	23 50.94
Ti	**V**
Titanium	Vanadium
4.5	5.96
3130 1812 (Ar)	3530 1730 (Ar)
$3d^2\ 4s^2$	$3d^3\ 4s^2$
40 91.22	41 92.91
Zr	**Nb**
Zirconium	Niobium
6.4	8.4
3580 1852 (Kr)	3300 1950 (Kr)
$4d^2\ 5s^2$	$4d^4\ 5s$

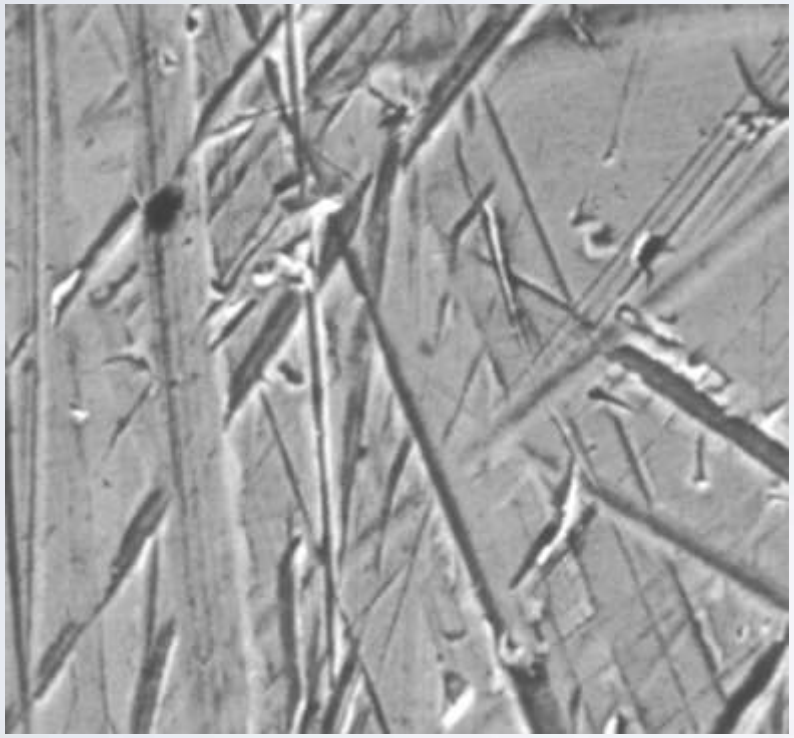


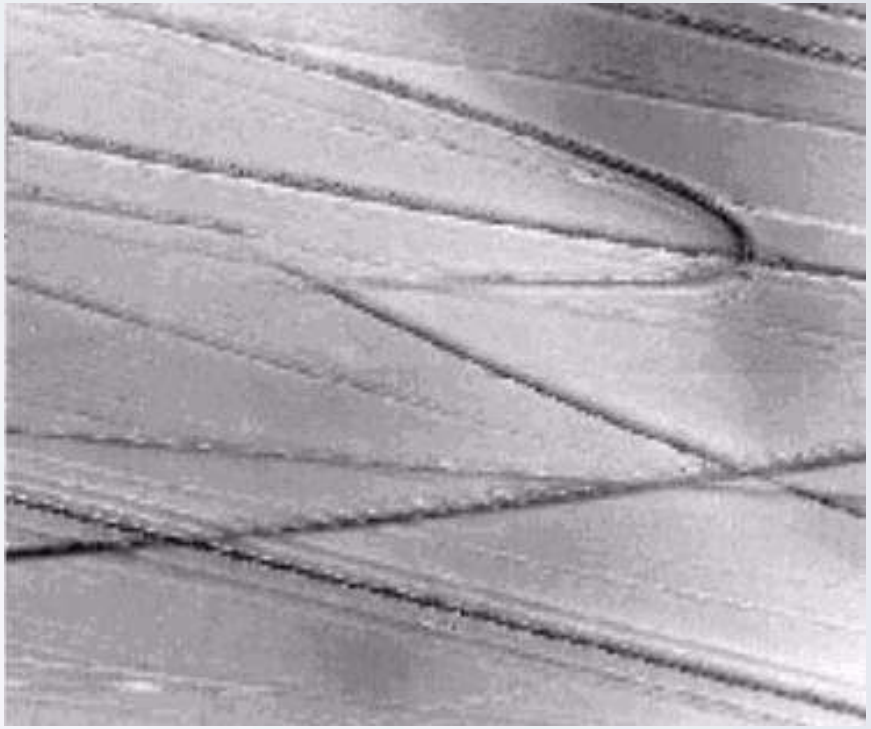
Zirconium – A metal ceramic

- Oxidised surface acts like a ceramic (5 microns thick)
- Rest of implant remains metal so maintains overall strength
- Troughs, but no peaks
- Harder : 4900 x more scratch resistant
- 75% better wear characteristics at 6 million cycles *in-vitro*

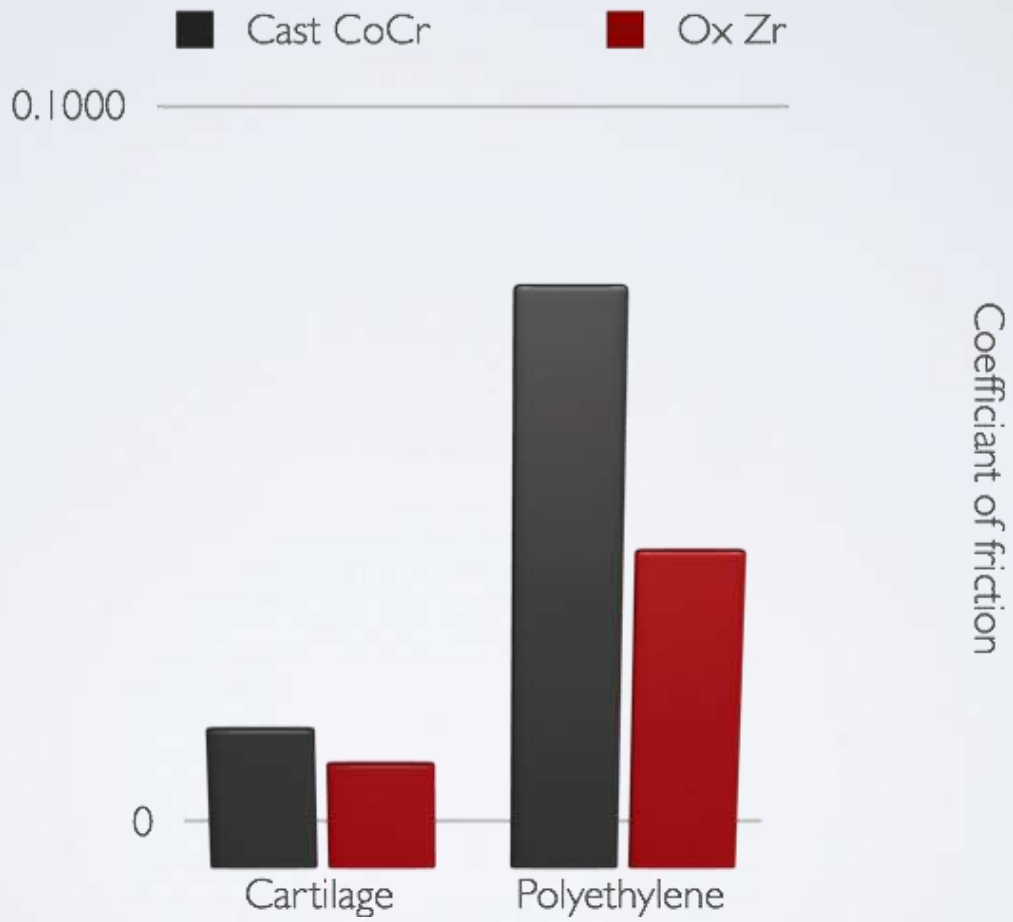


Scratch Resistance in Zirconium





Zirconium – Less Friction



Zirconium

- Very biocompatible
- Zirconium is one of five most biocompatible metals
  - Other four metals: niobium, titanium, tantalum, platinum
  - Ranked on self-passivation and lack of biological function
- Zirconium has 0.0035% Nickel

Re-write the ‘Rules’ of Knee Replacements

- Total knee replacements are very good - not a ‘normal’ knee
- In compartmental O/A - consider partial replacement
  - Unicompartmental
  - Patello-femoral
- Partial knee replacements can give more ‘normal’ knee
- Age – old or young – not a contra-indication
- Zirconium

- www.alasdairsantini.co.uk

- AJAS 2013