



**Centre for Sports and Exercise Medicine**

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**Stiff knee post TKA  
MUA**

Barts and The London  
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## PREVALENCE OF STIFFNESS IN TKA

Kim et al *JBJS 86A, July 2004*

- 1000 knees
- 1.3% prevalence of stiffness
  - flexion contracture  $\geq 15^\circ$
  - flexion  $< 75^\circ$

## GOALS OF TKA

- #1 • relieve pain
- #2 • improve function
- #3 • maximize ROM



## GOAL #3 MAXIMIZE ROM

May be the most poorly understood part of knee replacement



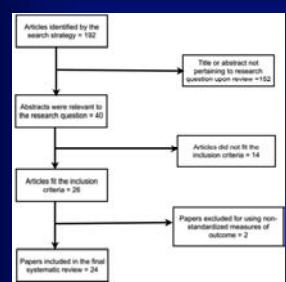
## ROM CRITERIA FOR ADL's

Level walking	65°
Ascending stairs	85°
Descending stairs	90°
Rising from chair	100°

Greater in short people!

## Management of Stiffness following Total Knee Replacement: A Systematic Review

Authors: H Ghani, N Maffulli & V Khanduja



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    graph TD
      A[Articles identified by the search strategy = 152] --> B[Abstracts were relevant to the research question = 40]
      A --> C[Title or abstract not pertaining to research question upon review = 112]
      B --> D[Articles fit the inclusion criteria = 26]
      B --> E[Articles did not fit the inclusion criteria = 14]
      D --> F[Papers included in the final systematic review = 24]
      D --> G[Papers excluded for using non-standardized measures of outcome = 2]
  
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## THE STIFF TKA

What causes it?

How do you prevent it?

How do you treat it once it occurs?

## STIFF TKA

Preoperative Factors

Intraoperative Factors

Postoperative Factors

Treatment Methods

## PREOPERATIVE FACTORS IN MAXIMIZING ROM

### ♦ Realistic Expectations (surgeon and patient)

- Ritter CORR 143
  - ♦ postop motion correlates with preop motion
- Parsley et al CORR 275
  - ♦ patients with limited motion preop improve
  - ♦ patients with  $> 105^\circ$  lose motion in a PCR knee
  - ♦ no difference in degenerative and inflammatory patients pre- and post-op ROM

## PREOP FACTORS – Red Flags



## PREOP FACTORS – Red Flags



## GOAL OF TALK

Preoperative Factors

Intraoperative Factors

Postoperative Factors

Treatment Methods

## INTRAOPERATIVE FACTORS IN MAXIMIZING ROM

- ◆ Factors directly under a surgeon's control
  - ◆ approach
  - ◆ ligament balancing
  - ◆ bone resection
  - ◆ prosthetic design
  - ◆ closure

## INTRAOPERATIVE FACTORS - APPROACH

- ◆ Mid vastus vs. median parapatellar
  - no significant difference
  - Keating JAP Vol 14 #1
- ◆ Limit anterior dissection
  - ? association with heterotopic ossification
  - keep debris out of suprapatella pouch



## INTRAOPERATIVE FACTORS – LIGAMENTOUS BALANCING

- ◆ May be most important intraoperative factor

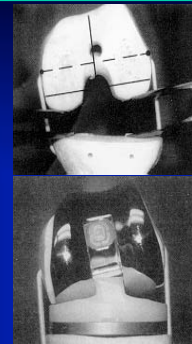
- #1) must do a complete concave release to catch up with convex side or risk tightness on one side during the flexion arc



## INTRAOPERATIVE FACTORS – LIGAMENTOUS BALANCING

- ◆ May be most important intraoperative factor

- #2) must create a rectangular flexion gap or risk a "nutcracker" effect as the knee bends



## INTRAOPERATIVE FACTORS – LIGAMENTOUS BALANCING

- ◆ May be most important intraoperative factor

- #3) must equalize the flexion and extension gaps

The concept of leaving the flexion gap loose to encourage ROM leads to flexion instability



## INTRAOPERATIVE FACTORS – BONE RESECTION

- Do not increase patellofemoral joint height
  - ↑ patella thickness
  - reverse notch
- Leads to excessively tight extensor mechanism



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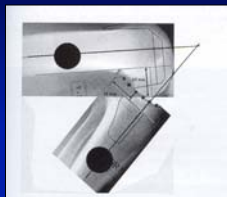
## INTRAOPERATIVE FACTORS – BONE RESECTION

- Oversized femoral component (i.e.) under-resected posterior femur
- leads to overstuffed flexion gap and subsequent loss of ROM



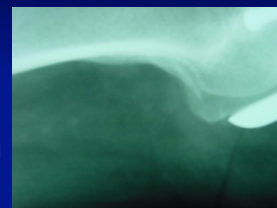
## INTRAOPERATIVE FACTORS – BONE RESECTION

- Undersized femoral component (i.e.) over-resected posterior femur
- leads to early tray/posterior femur impingement



## INTRAOPERATIVE FACTORS – BONE RESECTION

- Posterior osteophyte retention
- leads to early tibial tray impingement and subsequent loss of ROM



## INTRAOPERATIVE FACTORS – BONE RESECTION

- Inadequate proximal tibial resection
- modular tibial tray metal 3-5 mm. thick
  - ✦ poly thicker than the F/E gap
  - ✦ thin poly
  - ✦ up to 10 mm. acceptable with regard to bone strength



## INTRAOPERATIVE FACTORS – BONE RESECTION

- Femoral component extension
- Reverse tibial slope
  - limits flexion
- Excessive tibial slope
- Femoral component flexion
  - can lead to a flexion contracture



## INTRAOPERATIVE FACTORS – BONE RESECTION

### Inadequate distal femoral resection

- lower joint line leads to flexion contracture

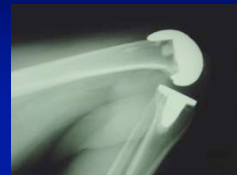


## INTRAOPERATIVE FACTORS – PROSTHETIC DESIGN

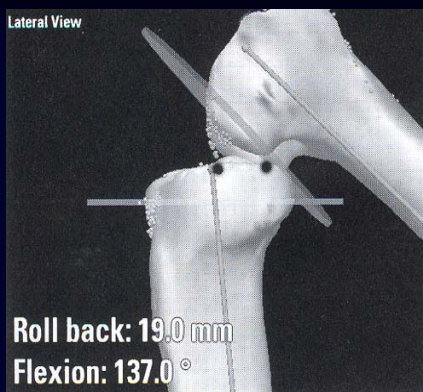
### PCS vs. PCR

Hirsch CORR 309

- PCS significantly greater ROM than PCR



Lateral View



Roll back: 19.0 mm  
Flexion: 137.0°

### Range of Motion After Total Knee Arthroplasty

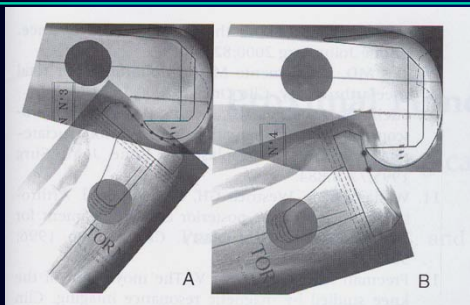
The Effect of Implant Design and Weight-Bearing Conditions

Douglas A. Dennis, MD,\* Richard D. Komistek, PhD,\* James B. Stiehl, MD,†  
Scott A. Walker,\* and Kendall N. Dennis\*

*Journal of Arthroplasty*, #13, 1998

- Fluoroscopic study
- PCS greater ROM than PCR
- Paradoxical roll forward of PCR knees

## INTRAOPERATIVE FACTORS – MAINTENANCE OF POSTERIOR OFFSET



## INTRAOPERATIVE FACTORS - CLOSURE

### Review of Literature

- ♦ Emerson - CORR 368
  - 50 patients in each group
  - extension vs. flexion closure
    - 112°      117°
  - same surgeon and prosthesis
- ♦ Masri - CORR 331
  - 0 significant difference
  - multiple surgeons and prostheses



## INTRAOPERATIVE FACTORS

- ◆ Drop and dangle



## GOAL OF TALK

- Preoperative Factors
- Intraoperative Factors
- Postoperative Factors
- Treatment Methods

## POSTOPERATIVE FACTORS IN MAXIMIZING ROM

- ◆ Formal physical therapy
- ◆ CPM
- ◆ Overuse syndrome
- ◆ Follow-up schedule

## POSTOPERATIVE FACTORS - PT

- ◆ Home physical therapy
  - advantage - patient convenience
  - disadvantage - variable quality
- ◆ Office physical therapy
  - advantage - quality control  
equipment access
  - disadvantage - patient inconvenience

## POSTOPERATIVE FACTORS – OVERUSE SYNDROME

- ◆ Usually Type AAA males
- ◆ Eager to return to work or play
- ◆ Physical therapy to excess
- ◆ Treatment – immobilization  
NSAID's

## POSTOPERATIVE FACTORS – Follow-up Schedule

- ◆ Identify the patient with predisposition to stiffness
  - ◆ Sometimes only evident postop
  - ◆ Manipulate at 4-6 weeks
  - ◆ See all within 2 weeks of surgery
- | problem patient                | routine patient       |
|--------------------------------|-----------------------|
| - more intense P.T.            | f/u at 5-6 wks postop |
| - ↑ frequency of office visits |                       |



## GOAL OF TALK

Preoperative Factors  
Intraoperative Factors  
Postoperative Factors  
Treatment Methods

## TREATMENT METHODS

- ✦ Manipulation
- ✦ Arthroscopic debridement
- ✦ Open debridement +/- revision of components

## TREATMENT METHODS - MANIPULATION

- ✦ "Timing is everything"
- ✦ Fibroblasts mature at 6-8 weeks
- ✦ Proper follow-up schedule is essential to time manipulation before six weeks

## TREATMENT METHODS - MANIPULATION

### Literature Review

9 studies in world literature  
Only 1 prospective  
No recognised outcome score except KSS (two studies)  
Low complication rate  
Average ROM gained: 38.4 deg  
No adequate stats in 4 of 9 studies  
Beware osteoporotic patients  
Possible to re-MUA

## TREATMENT METHODS - MANIPULATION



## TREATMENT METHODS - MANIPULATION

### Complications



- ✦ Fatal PE after manipulation  
Stecker JBJS, Jan. '96

## TREATMENT METHODS - MANIPULATION

### Keys to avoidance

- ◆ early identification of problem patient
- ◆ early manipulation first 4-6 weeks "just do it"
- ◆ proper technique "A stiff knee is infinitely better than a patella tendon rupture or femoral fracture"

## TREATMENT METHODS - MANIPULATION

### Flexion Contracture

- ◆ effective if done early and was correctable at time of surgery
- ◆ most minor flexion contractures stretch out in time

McPherson, JAP Vol 9, #5



## TREATMENT METHODS - MANIPULATION

### Ways to hasten flexion contracture resolution

1. gait training heel toe
2. shoe lift on opposite foot
  - patient must then stretch posterior capsule to get to the floor



## TREATMENT OPTIONS - MANIPULATION

### Passive manipulation

- ◆ no data
- ◆ useful in late cases of recalcitrant flexion contractures or failed manipulations



## Surgical Treatment of Flexion Contractures

Fehring et al., AAHKS, 2006

- ◆ 14 patients > 15° flexion contracture
- ◆ 10/14 complete resolution
- ◆ 1 patient 5° FC
- ◆ Significant improvement
  - Extension p < 0.0001
  - Flexion p = 0.002
  - Total arc of motion p < 0.0001

## Predictive Risk Factors for Stiff Knees in TKA

Ghandi, et al, JAP, 2006

1200 Knees  
3.7% < 90°

### Risk Factors

- preop flexion
- intraop flexion
- patella baja pre- or post-op



## TREATMENT METHODS - ARTHROSCOPIC DEBRIDEMENT

### Arthroscopic release of PCL for stiffness

Williams CORR 331

- 10 cases
- average pre-op ROM 0-73
- **average post-op ROM 0-112**

### Arthroscopic treatment for arthrofibrosis

Bocell CORR 271

- **7 cases - 2 successes**
- Sprague CORR 166
- 1 case - not successful

## TREATMENT METHODS – DEBRIDEMENT AND POLY EXCHANGE

Babis et al., JBJS 83A, 2001

- ♦ only 7 patients
- ♦ debridement and exchange to thinner poly
- ♦ very poor results
- ♦ mean ROM arc 58° (40°-70°)

## TREATMENT METHODS – DEBRIDEMENT AND POLY EXCHANGE

### Surgical Treatment and Customized Rehabilitation for Stiff Knee Arthroplasties

Michael A. Mont, MD; Thorsten M. Scler, MD; German A. Marulanda, MD;  
Ronald E. Delanois, MD; and Anil Bhargava, PT

#### 18 Knees

- aggressive PT postop 3-5 times/week
- functional bracing
- mean ↑ in ROM 31°
- only 2/3 had G/E Knee Society Scores

## TREATMENT METHODS – REVISION TKA

Nicholls and Dorr

- ♦ 12 patients 13 knees
- ♦ 4 revised for flexion contracture
- ♦ 9 revised for ↓ ROM
- ♦ **11 of 12 satisfied, yet ROM improved in only 3 patients**

Christensen et al.

- ♦ 11 knees
- ♦ preop average ROM 39°
- ♦ postop average ROM 83°
- ♦ **all patients satisfied**

## TREATMENT METHODS – REVISION TKA

Kim et al JBJS 86A, July 2004

- 56 knees – complete revision in all
- ♦ significant improvement in KS Clinical Score ( $p < 0.001$ )
- ♦ 93% ↑ motion
- ♦ 66% ≥ 20° increase
- ♦ mean ↑ 65 → 85°

## THE STIFF TKA



What causes it?  
How do you prevent it?  
How do you treat it once it occurs?

# KEYS TO SUCCESS - AVOIDANCE



Last previous emergency and hospitalization	
Diagnosis	Fracture of the distal radius
Interventions	Open reduction and internal fixation
Complications	None
Discharge	Home
Referral	None
Follow-up	None
Activity	None

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end ...

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WSIC London 2012

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Thank you

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Books shown: *Instigator Cluff: Epidemiology and Prevention of Sports Injuries*, *Combat Sports Medicine*, *Minimally Invasive Surgery of the Foot and Ankle*, *Postgraduate Orthopaedics*, *Sports Injuries*, *Sports Medicine for Specific Age- and Sex-Related Issues*, *The Achilles Tendon*.