

Universität Rostock  Institut für Innere Medizin

Universitätsmedizin Rostock 



Stiff Knee – difficult cases

5th Advanced Course on Knee Surgery, Val d'Isère, 2.-7.2.2014

Stiff knee

2

Associated with endoprosthesis

or not

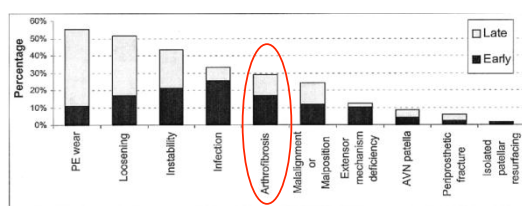
Primary (incidence?)

Secondary e.g.

- after surgery/trauma
- cyklops after ACL reconstruction
- after tibial eminence fracture
- bacterial infections
- surgical failures (malpositioned ACL)

Universitätsmedizin Rostock

Reason for failure of total knee joints:



[Sharkey P et al., CORR, 2002]

Universitätsmedizin Rostock

Definition „Arthrofibrosis“

1. ROM:

Extension $> 20^\circ$ or ROM $< 45^\circ$
[Nicholls DW, Dorr LD. 1990]

Flexion $< 85^\circ$

[Scranton PE, 2001]

ROM $< 70^\circ$

[Christensen CP, ... Vail TP, 2002]

extension $\geq 15^\circ$ and /or flexion $< 75^\circ$
[Kim J et al., 2004]

prevalence of stiffness was 1.3% (n=1,000 pTKA)

Universitätsmedizin Rostock

Definition „Arthrofibrosis“

5

1. ROM:

Criteria:

passive ROM
- enough ??-

active ROM !



painless active ROM ! (..walking, stairclimbing ...)

Universitätsmedizin Rostock

Definition „Arthrofibrosis“

2. Histology

Reduced ROM

Caused by excessive increase

of soft fibrous tissue

with inflammatory signs

1-10% after TKR

[Boldt et al. 2000. Lotke et al. 2004. Gollwitzer H et al. 2006]

Universitätsmedizin Rostock

Factors ?

Motivation
Psycho-social factors

- „Knee loser“ ?*

+ Smoker !**

+ TKR: „spont. early mobilization“ (age)

+ not signif.: man with younger wife



[*Nicholls DW et al, 1990; **Bergschmidt et al., 2009]

Universitätsmedizin Rostock

Factors ?

„low grade“ infection ?

2%

[Wilson MG et al., 1990: 4171 cases]

0.43%

[Peersman G, Laskin R et al., 2001: 6120 cases]



Universitätsmedizin Rostock

Factors ?

Allergy ?

- Incidence increases: Germany 5-20 %*

Prick test

Biopsy ?

LTT-test ??

-Test materials: all & original

Real valid info about
allergy inside the knee?

[*Thomas et al., 2006, 2013]

Universitätsmedizin Rostock

Factors ?

knee trauma ?

- severe trauma with multiligament injury !

[Magit et al., 2007]

Reason for less good results
In posttraumatic TKR ?
[Hofmann et al., 2006]

Universitätsmedizin Rostock

Factors ?

Anticoagulation ?

874 Primary TKR 1993 - 2002

9% Arthrofibrosis / treatment necessary

26% of Warfarin group

9% of control group

[Walton et al., 2005]

Universitätsmedizin Rostock

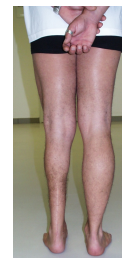
Factors ?

Neuromuscular disease

e.g. Parkinson

More cases with limited extension --
(Tendency)

Therapy: Botulinus toxine

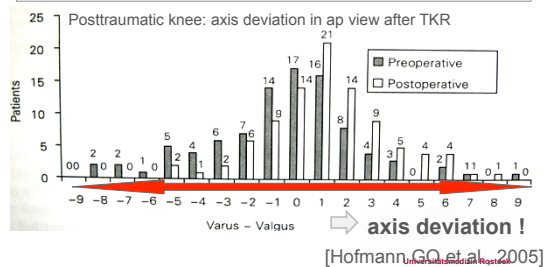


[Shah et al., 2005]

Universitätsmedizin Rostock

Biomechanical factors ?

**Axis deviation: preop. ?
postop ?
high degree of correction ?**

**(bio-) mechanical factors ?**

**Axis deviation preop.:
! 3-dimensional problem !**

valgus

Valgus deviation:
Soft tissue balancing = demanding

e.g.:

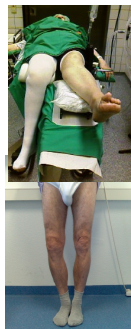
Be careful operating a severe valgus knee* [D.Kohn,2009]

**(bio-) mechanical factors ?**

- Preop. „dysplasia“ of the condyle ?
 - real dysplasia or
 - ? by dysplasia or by loss of cartilage layer ?

- Rotation failure of the condyle ?

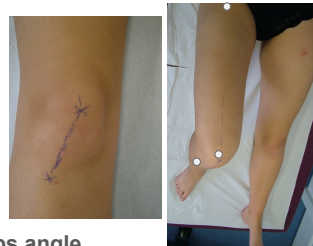
- 3,058 mobile-bearing TKAs: 1.6% arthrofibrosis,
- arthrofibrosis group :
fem. condyle significantly internally rotated by a mean of 4.7°



[Boldt et al., 2007] Universitätsmedizin Rostock

(bio-) mechanical factors ?

- rotation of the tibia preop/ postop.



-quadriceps angle

Universitätsmedizin Rostock

(bio-) mechanical factors ?

- Defect of m. vastus med.

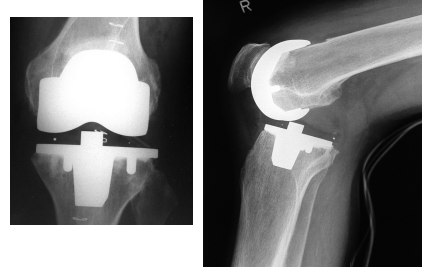


⇒ Early revision

Universitätsmedizin Rostock

(bio-) mechanical factors ?

„wrong“ dimension of condyle (e.g. „under-/ over-stuffing“)

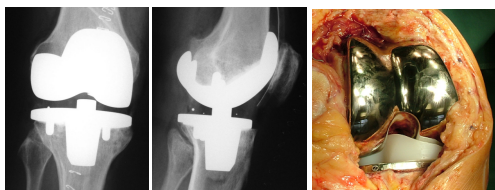


Universitätsmedizin Rostock

(bio-) mechanical factors ?

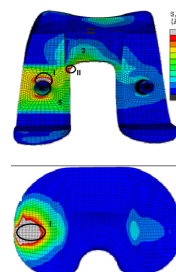
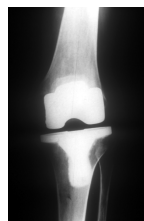
osteophytes

Impingement



Universitätsmedizin Rostock

(bio-) mechanical factors ?

Joint line

Universitätsmedizin Rostock

(bio-) mechanical factors ?

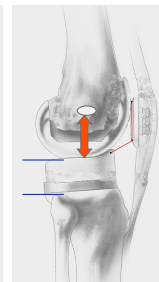
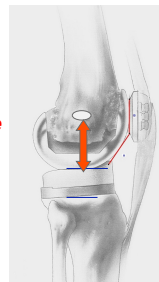
Joint line – sag. slope

Universitätsmedizin Rostock

(bio-) mechanical factors ?

Joint line - vs. rot.center/ ligaments/ patella

PE-size



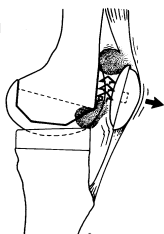
Caton Index: A/B ~ 1

Universitätsmedizin Rostock

(bio-) mechanical factors ?

Patella

Lateralisation
Clunk-sy.
ap-gliding
Patella bache



[Vernace, '89]



Indication for revision ?

N=1000 - 56 with AF

[Kim et al., 2007]

no significant factors of prevalence
but: **small ROM preoperat.**

After the revision:

Extension: -11,3° ⇒ -3,2°

Flexion: 65,8° ⇒ 85,4°

Not better: in 30%

Knee Soc.Score: 38 preop ⇒ 86 postop.

Knee Soc.Function Score: 40 preop ⇒ 58 postop.

Universitätsmedizin Rostock

Best time for revision ?

< 2 years ?

If malrotation as mechanical reason
32% instability
36% small ROM
Function score sign. better
[Incavo et al., 2007]

> 6 weeks &
< 6 months

No ideal time of revision (EBM)



Universitätsmedizin Rostock

Method for revision ?

1. Arthroscopy

2. Open revision without exchange

3. exchange of implant components / PE-Inlay

4. complete revision / exchange



Universitätsmedizin Rostock

Outcome

27

Management of stiffness following total knee arthroplasty: A systematic review

Ghani, Maffulli, Khanduja. Knee 2012

MUA: 26 - 47°

Arthroscopic: 18,5 – 60°

Open: 20 - 60°

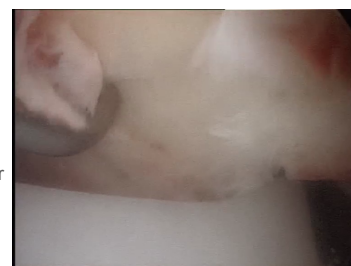
How to Treat the Stiff Total Knee Arthroplasty? A Systematic Review
Fitzsimmons, Vazquez, Bronson. CORR 2010

Universitätsmedizin Rostock

•Arthroscopy

Sampling for:
Microbiology
Histology

Release suprapatellar
Release Patella
Hoffa
PCL

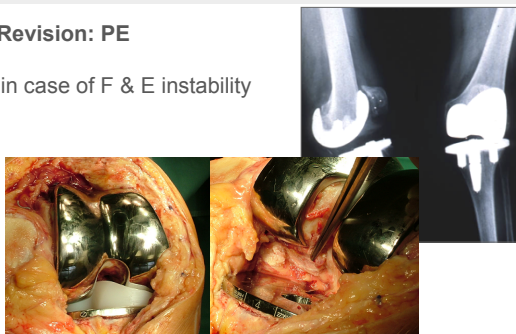


[Kircher. 2007]

Universitätsmedizin Rostock

•Revision: PE

in case of F & E instability



Universitätsmedizin Rostock

•Revision: PE

sometimes succesful
in case of flex. & ext. instability/ suitable implants

Lower PE ??

N=7 / ROM 38,5° (15-60°)

12 mts. After 1. op

FU 4,2 J.

Results:

1 sept.loosening: Re-revision

1 asept.loosening: Re-revision

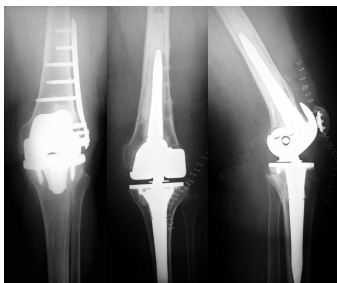
5 stiff & painful: av.ROM 58° [Babis et al.,2001]

➔ No real standard solution

Universitätsmedizin Rostock

•Complete revision: e.g.

1. Pr.TKR
2. Periprosth.fracture
3. Malposition of distal femur (rotation + valgus)
+ instability
+ neg. slope
+ "Arthrofibrosis"
4. Revision after 6 mts.



Universitätsmedizin Rostock

Perioperative treatment in case of revision

Need of painless situation

Pain control

Active physioth. as possible

CPM ?(sometimes additional)

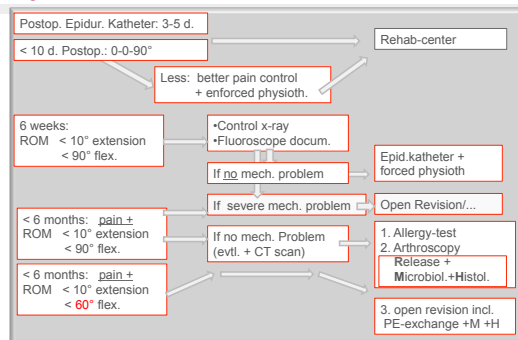
„Psycho-treatment“

together with active pos. Patient
„Simulation“ of daily life
(Germany: coffee time)



Universitätsmedizin Rostock

Algorithm



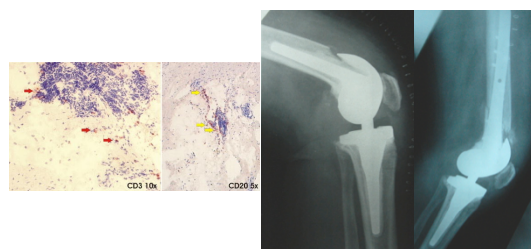
[adapted from: Gollwitzer H et al. 2006]

Universitätsmedizin Rostock

Conclusion

„Always look on the bright **mechanical** side of life“
[M.Python]]

➔ **Bio - mechanical reasons ? !**



Conclusion

Definition: •ROM: extension<10, flex. 70...90?
•+Pain
•+Histology

Analysis: (exclusion of)
1. many diff. mech. aspects
imbalance of ligaments / instability
impingement
axis deviation
2. Low grade infection
3. Allergy
4. Real psycho-social component

X-rays
Fluoroscope
CT-scan

Treatment: •Avoid additional mech. damage!
•Algorithm!
•Early start of treatment [Incavo et al., 2007]
•Think on early revision in case of mech. failure
(decision: risk of procedure/ chance of better result)

Universitätsmedizin Rostock

Conclusion

Individual decisions +
Play all your levels of the piano
And use the complete orchestra !



Universitätsmedizin Rostock

Universität Rostock  Institut für Innere Medizin

Universitätsmedizin Rostock 



Kontakt
 Univ.-Prof. Dr. Thomas Tischer
 Sektion Sportorthopädie und Prävention
 tel. +49 381 4949335
 E-mail: thomas.tischer@med.uni-rostock.de

Surgical causes of stiff arthroplasty

38

Pre-operative: decreased pre-operative range of movement, history of previous surgery, diabetes mellitus, "knee looser?"

Per-operative risk factors leading to stiffness include:

- incorrect flexion-extension gap
- malpositioning of components
- inadequate femoral or tibial resection
- excessive joint line elevation
- creation of an anterior tibial slope
- incomplete resection of posterior osteophytes

Post-operative: poor patient motivation, lack of compliance with physiotherapy, deep infection, arthrofibrosis of the knee joint, patellar complications, complex regional pain syndrome and heterotopic ossification, antikoagulation??? Ghani et al., Knee 2012

Universitätsmedizin Rostock

(bio-) mechanical factors ?

Rotation failure / tibial component

3058 TKR

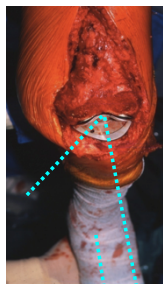
4,7 ° Rotationsfehler

Extension > -10°

Flexion < 90°

[Boldt et al., 2007]

⇒ CT-scan: but guidelines ?



Universitätsmedizin Rostock

Damaschke, geb. 10.01.2011

40

Frühgeborenes 36. ssw, 1670g, Angeborene Hüftluxation und

Streckkontraktur des Kniegelenkes rechts

Längsextensionsbehandlung

MRT in Narkose 16.2.2011



MRT 16.02.2011

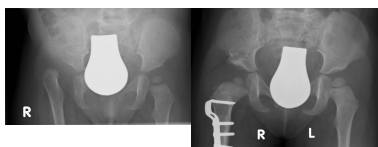
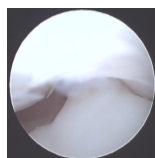
Universitätsmedizin Rostock

Damaschke, geb. 10.01.2011

41

OP 2.3.2011: Untersuchung hohe Hüftlux, Flexion Knie bis 0°, Arthroskopie (Rec. Suprapatellaris -> Flex 20°; Notchplastik, etwas Kerbung ACL -> 80°) und Oberschenkelcast (70°)

26.09.2012: Offene Reposition, ITO (derotierend, varisierend, acetabuloplastik)

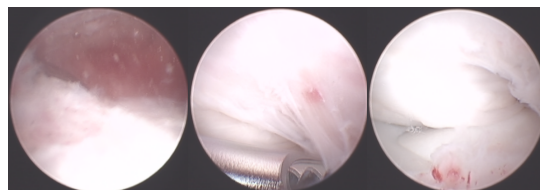


Universitätsmedizin Rostock

Damaschke, geb. 10.01.2011

42

18.11.2013: ask rec supra, patella mobi, hoffa -> F/E 110-0-0



Universitätsmedizin Rostock



Conclusion

How to avoid arthrofibrosis ?

Early active mobilization



Psycho-social aspect

Universitätsmedizin Rostock

Conclusion

How to avoid arthrofibrosis ?

- Careful operation technique ?
MIS =? ..best way: „Maximally intelligent surgery“
- Less particles & ions ?
↓
- Ceramic ?! further development
(metal particles)

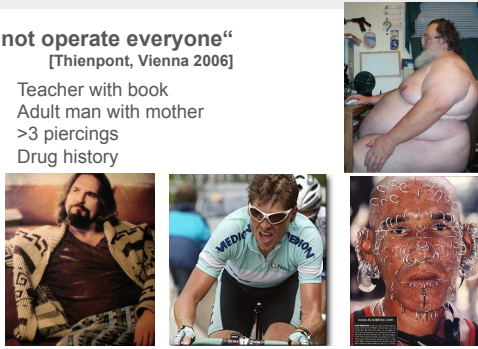


Universitätsmedizin Rostock

Conclusion

„Do not operate everyone“
[Thienpont, Vienna 2006]

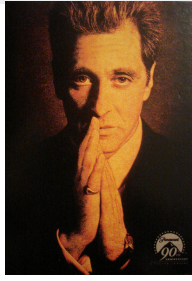
Teacher with book
Adult man with mother
>3 piercings
Drug history



Universitätsmedizin Rostock

Fazit

„Mache gleich Dein Ding am Anfang recht.
Denn Nachbesserung macht oft Halbgutes völlig schlecht.“



Universitätsmedizin Rostock

Conclusion

Not every person with **emotions** is a knee loser !

First look on possible mechanical „failures“ !



Universitätsmedizin Rostock

Patella bacha

49

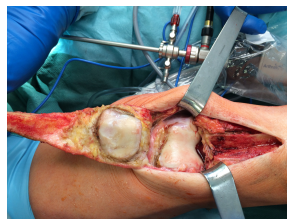


Universitätsmedizin Rostock

Patella bacha

50

Easy case, female, 17 years old, extension block after ACL reconstruction



Universitätsmedizin Rostock

Patella bacha

51

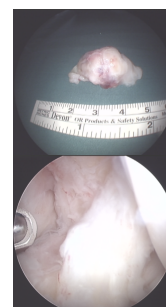


Universitätsmedizin Rostock

ACL cyclops

52

Easy case, female, 17 years old, extension block after ACL reconstruction



Universitätsmedizin Rostock

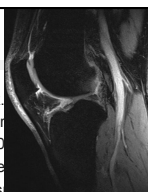
ASK Arthrolyse

Herr Wasner erhielt vor vielen Jahren eine VKB-Plastik. 2012 progred. Beschwerden und Bewegungseinschr. Kniegelenk. Bei Vorstellung in der Ambulanz F/E: 90° beginnende Gonarthrose und Innenmeniscusschaden wünscht ausdrücklich einen gelenkerhaltenden Vers. Indikation zu o.g. Eingriff wurde gestellt. Über die Risiken incl. persist. Bewegungseinschränkung sowie persist. Beschwerden wurde der Patient ausführlich informiert. Die Einverständniserklärung liegt schriftlich und mündl. vor.

Bemerkungen: Rückenlagerung, Blutleere 300mmHG hoch anliegend, seitl. Beinstütze, übliche präoperative Vorbereitung.

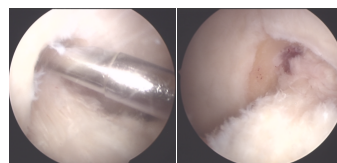
Schmerzen medial und peripatellar diffus, Beweglichkeit präOP F/E: 85-30-0° bei Untersuchung, in Spinalanästhesie: 120-30-0°

Universitätsmedizin Rostock



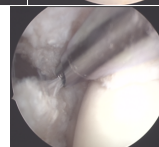
Notchplastik

54



Hoffarsektion
Rec. Suprapatellaris
Posteriore Kapsel

Post OP 135/5/0



Universitätsmedizin Rostock



Knee motion – what do we need?

56

Walking	65°
Walking stairs (height)	60°-85°
Chair rising	70°-110°
Biking	95°-105°

Aim: >115°

Range of motion
Stability

Universitätsmedizin Rostock

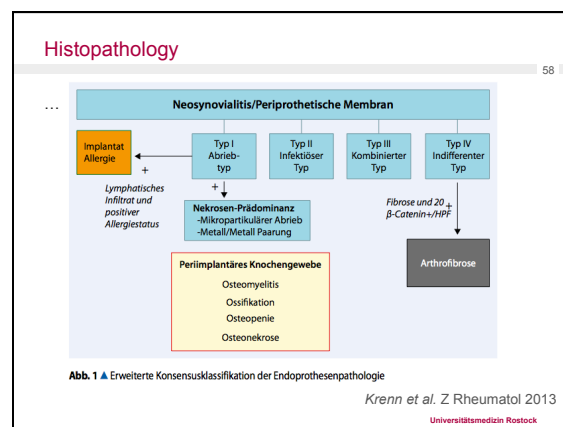
Definition „Arthrofibrosis“

- subsynovial fibrosis
- chronic inflammatory pathological extracellular proliferation of cells
- excessive & disorganized matrix proteins with proliferation of fibroblasts
- Phenotypes of chondrocytes & osteocytes
- generalized arthrofibrosis:
 - + extrasynovial & extracapsular pathology too

CD3 10x

CD20 5x

[Gollwitzer et al. 2006]



Histopathology

- Synovial hyperplasia and lymphocytäre infiltration
- Chronic inflammatory infiltration with pathological collagen expression
- Fibroblast proliferation

CD3 10x

CD20 5x

Gollwitzer et al. Orthopäde 2006

Universitätsmedizin Rostock

Indication for revision ?

N= 16 primary TKR
No failure of axis / ap, rotation

after revision:

Rom_{ave.}: 40° preop ... $\Rightarrow$ 73° postop.

...25% multiple revisions necessary

[Haidukewich et al., 2007]

Careful: risk of multiple revisions (\$) risk of op. without better result

Universitätsmedizin Rostock

Management of stiff arthroplasty

61

- MUA
- Arthroscopy
- Open Revision
- Revision Arthroplasty (partial vs. total replacement)

Conclusion:

open surgical release: highest increase in ROM, however Knee Society Score relatively consistent for all four treatments
methodological limitations (majority of papers were case series)
well-designed trials with blinded measurement of outcomes needed

Ghani et al. Knee 2012
Universitätsmedizin Rostock

Own data

- N= 26 consecutive cases / FU 2 yrs, prosp.
 - Criteria: **Chron. pain + ROM: Ext. -10° + Flex. $<70^\circ$**
 - 4 x Allergy
 - 1x Ni; 1x Ni & Co;
 - 1x Ni & Co & cement
 - 1x cement
 - 2 x Low grade-Infection
 - 18x „mechanical problem“ (
 - 4x osteophytes,
 - 2x size Femur*
 - 2x malrotation/ ST-Balance*
 - 5x Slope
 - 3x joint line tv
 - 2x combined *)
 - 2x not evident → Soft tissue impingement
- But there are pat. with mech. Problems without AF: why ?**
[Mittelmeier, Schmitz et al., 2008]

Therapy

63

Manipulation under anesthesia (+PDK)

→ careful, early, uncontrolled damage to tissue

Arthroscopic therapy

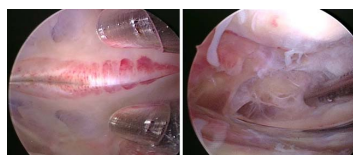
Open surgical therapy



Rupture of patellar ligament

Universitätsmedizin Rostock

• Arthroskopie (plus Schmerzkatheter)



Funktionsscore in 25 von 32 Fällen verbessert
ROM Flex.: 63° präop. versus 119° postop.

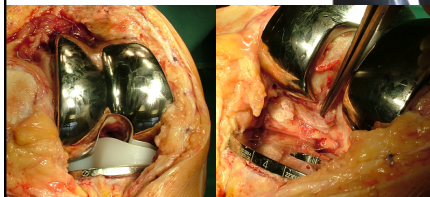
[Jerosch et al, 2007]

Universitätsmedizin Rostock

Which revision ?

• Komponentenwechsel ... va. PE-Inlay

• Cave: Instabilität
z.B. Impingement



semobilisation

Universitätsmedizin Rostock

Which revision

66

• Komponentenwechsel ... va. PE-Inlay/ od. Femurkomponente

- z.B. PE-Höhe
- PE-Design
- Femur-/ Tibiakomponente

[H...et al.,]

PE niedriger ??

→ Keine „Patentlösung!“

N=7 / ROM $38,5^\circ$ (15-60°)
12 Mon.nach 1.Op/ FU 4,2 J.

1 sept.Lockerung: Rerevision
1 asept.Lockerung: Rerevision
5 steif & schmerzhaft: ROM 58°

[Babis et al., 2001/
Mayo-Clinic]

PE niedriger ?? → **Keine „Patentlösung!“**

N=7 / ROM 38,5° (15-60°)
12 Mon.nach 1.Op/ FU 4,2 J.

1 sept.Lockerung: Rerevision
1 asept.Lockerung: Rerevision
5 steif & schmerzhaft: ROM 58°



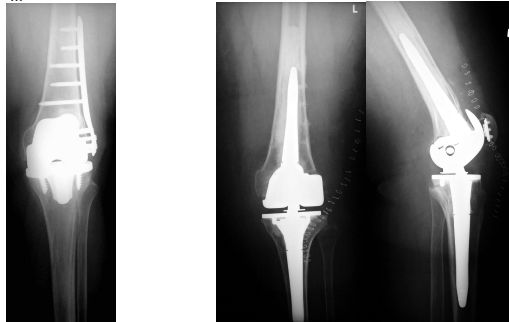
[Babis et al., 2001/
Mayo-Clinic]

Universitätsmedizin Rostock

Which revision

68

• **Komplettwechsel**



Which revision

69

• **Offene Revision** (evtl. mit Inlay-Wechsel)

↓

Septische Revision: spezielles „Thema“



[Maurer, Ochsner, 2006; Hofmann et al., 2006]

Universitätsmedizin Rostock

Revision necessary???

70

• N= 16
Ohne erkennbare Achsfehler”

[Haidukewich et al., 2007]

Nach REVISION:
Rom gem.: 40° präop → 73° postop.

.25% wiederholte Revisionen erforderlich

Indikation zu Revision differenziert stellen !

Universitätsmedizin Rostock

71

Universitätsmedizin Rostock

72

Universitätsmedizin Rostock

73

Präsentation von Abteilung von Rostock, Herbst 2011

Universitätsmedizin Rostock

Risk factors

Präop. Bewegungseinschränkung ?

N=1000 - konsekutiv
56 mit AF

Keine sign. Prävalenzfaktoren

Ausser: schlechte ROM präop.

[Kim et al., 2007]

Universitätsmedizin Rostock

Risk factors

Antikoagulation ?

874 prim. KnieTEP 1993 - 2002

9% Arthrofibrose / N.-Mobilisation erforderlich

26% der Warfarin-Gruppe (n=80)
9% Kontrollgruppe

[Walton et al., 2005]

Universitätsmedizin Rostock

Risk factors

Neuromuskuläre Erkrankungen ?

z.B. Parkinson

Beugekontrakturen häufiger -- (Tendenz)

Therapie: Botulinum Toxin + Anästhesie-Verfahren

[Shah et al., 2005]

Universitätsmedizin Rostock

Risk factors

Motivation / „Psycho-soziale“ Faktoren



„Knee loser“ ?

Cave !

[Nicholls DW et al, 1990]

Universitätsmedizin Rostock

Folgen: Waterhouse-Friderichsen-Sy.



Universitätsmedizin Rostock

Folgen: Waterhouse-Friderichsen-Sy.



Universitätsmedizin Rostock

Waterhouse Friedrich



Universitätsmedizin Rostock

81

Arthroscopy. 2013 Mar;29(3):556-65. doi: 10.1016/j.arthro.2012.09.005. Epub 2013 Jan 12.
The optimal timing for anterior cruciate ligament reconstruction with respect to the risk of postoperative stiffness.

Kwok CS, Harrison T, Servant C.

PURPOSE:

The aim of this meta-analysis was to compare the risk of stiffness between early and delayed anterior cruciate ligament (ACL) surgery in studies that use a modern accelerated rehabilitation protocol.

METHODS:

Medline, Embase, and the Cochrane library were searched for studies that compared outcomes for early and delayed ACL reconstruction with a modern accelerated rehabilitation protocol. Risk ratios for stiffness were pooled using random effects meta-analysis.

RESULTS:

A total of 8 studies were included in this review. The 3 randomized trials found no difference in the risk of postoperative stiffness at cutoff points of <2, <3, and <10 weeks between early surgery and delayed surgery. An analysis of the 7 studies whose outcomes could be pooled revealed no significant increase in risk of adverse outcomes with early surgery using a variety of cutoff points (1, 2, 10, 12, and 20 weeks). Sensitivity analysis of individual outcomes failed to show any significant difference between early and delayed surgery with respect to arthrofibrosis, stiffness, range of motion deficits, extension deficits, and flexion deficits.

CONCLUSIONS:

Universitätsmedizin Rostock

82

J Arthroplasty. 2013 Aug 30. pii: S0883-5403(13)00580-9. doi: 10.1016/j.arth.2013.07.046. [Epub ahead of print]

Clinical, Objective, and Functional Outcomes of Manipulation Under Anesthesia to Treat Knee Stiffness Following Total Knee Arthroplasty.

Issa K, Kapadia BH, Kester M, Khanuja HS, Delanois RE, Mont MA.

The purpose of this study was to determine the clinical outcomes of manipulation under anesthesia (MUA) in a cohort who had developed knee stiffness following total knee arthroplasty (TKA). One-hundred and forty-five TKAs in 134 patients who had undergone MUA were compared to the remaining 1973 TKAs in 1671 patients who did not develop this condition. At a mean follow-up of 51 months (range, 24 to 85 months), the mean gains in flexion in the MUA cohort were 33° (range, 5° to 65°). The final range-of-motion in the MUA cohort was lower than the comparison cohort (114° versus 125°) however, this would meet the required flexion for activities of daily living. There were no differences in the Knee Society objective and functional scores between the two cohorts. It is encouraging that MUA cohort outcomes were comparable to outcomes of patients who did not develop knee stiffness.

Präsentation von: Abteilung für: Rostock, Nord 2013

Universitätsmedizin Rostock

„Low grade“-Infektion

•2%

•Wilson MG et al., 1990:

4171 Fälle

•0.43%

•Peersman G, Laskin R et al., 2001:

6120 Fälle

•Revisionseingriffe doppelt so hoch

•Craig EV. 1999

20-80% nach „Sanierung“ rezidivfrei

Thabe et al. 2007

Universitätsmedizin Rostock

Wann Revision ? < 2 Jahre ?



Fehlrotation = mechanisch

32% mit Instabilität

36% niedrige ROM

[Incavo et al., 2007]

Funktionsscore verbessert

< 6 Mon.?

< 6 Wo.??

Kein „Idealzeitpunkt“

Universitätsmedizin Rostock