



# Infection après PTG

## Place du changement en 2 temps

Sébastien LUSTIG MD, PhD,  
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Tristan FERRY MD, PhD  
Elvire SERVIEN MD, PhD

# *Un challenge ?*

*Journal of Orthopaedic Surgery 2008;16(1):58-65*

## **Quality of life after infection in total joint replacement**

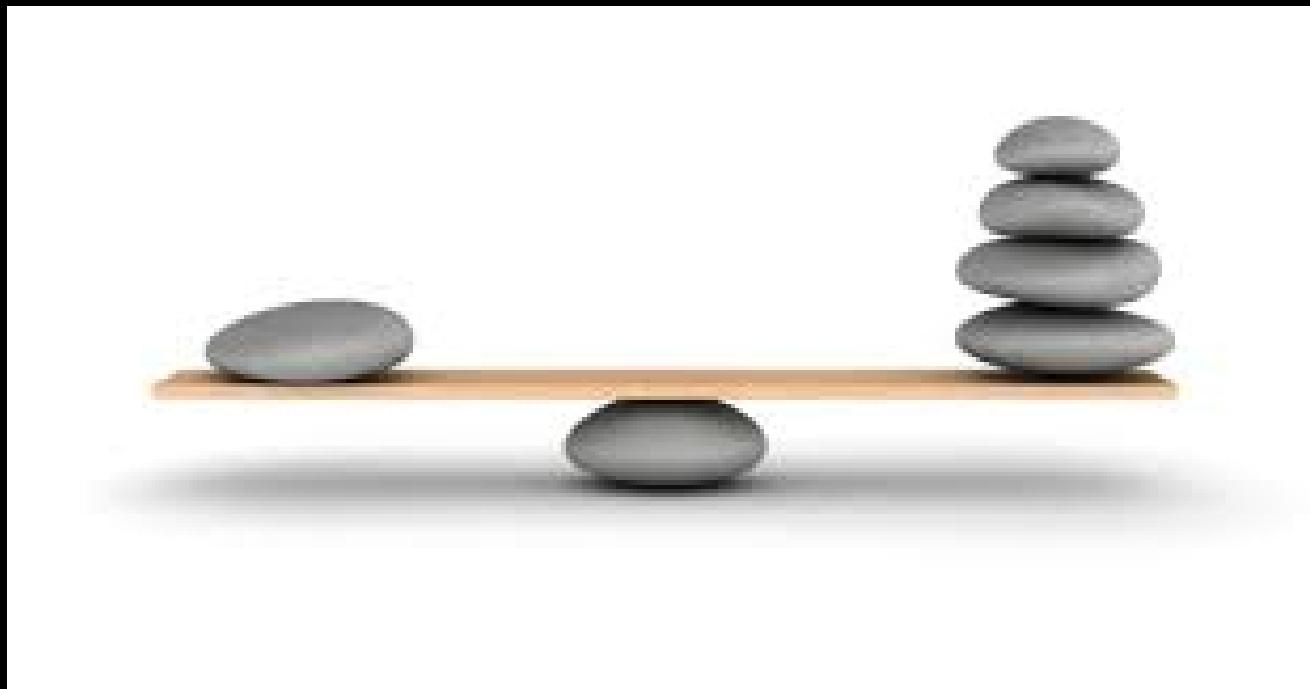
Cahill J, Shadbolt B, Scarvell J, Smith P.

**“...” Infection following TJR reduces patient satisfaction and seriously impairs functional health status and health-related quality of life.”...”**

# Le choix ....

1 step

2 steps



# 2 temps

- Indications → *Quand ?*
- Principles → *Pourquoi ?*
- Surgical technique → *Comment ?*
- Experience → *Resultats ?*

# Quand?

## Classification : Segawa

Type 1	Type 2	Type 3	Type 4
<b>Unexpected intraoperative positive culture</b>	<b>Early: within 4 weeks post operative</b>	<b>Acute hematogenous</b>	<b>Late: more than 4 weeks postoperative</b>

Segawa H, Tsukayama DT, Kyle RF, et al. Infection after total knee arthroplasty. A retrospective study of the treatment of eighty-one infections. J Bone Joint Surg Am . 81:1434-1445, 1999.

# Quand ?

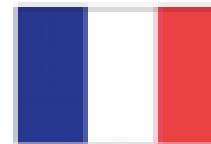
## Proceedings of the Second International Consensus Meeting on Musculoskeletal Infection

Chairmen:  
Javad Parvizi, MD, FRCS  
Thorsten Gehrke, MD



## 2<sup>nd</sup> International Consensus Group on Periprosthetic Joint Infection July 2018

**Thomas Jefferson University, Philadelphia**



### France

[Argenson, Jean Noël](#)  
[Bauer, Thomas](#)  
[Ferry, Tristan](#)  
[Jacquot, Adrien](#)  
[Jenny, Jean-Yves](#)  
[Lustig, Sébastien](#)  
[Mansat, Pierre](#)  
[Senneville, Eric](#)

# Quand ?

Question 2: What are the indications for two-stage exchange arthroplasty?

Consensus: ***Two stage-exchange arthroplasty is a reasonable option*** for the treatment of periprosthetic joint infection (PJI). Specific conditions where two-stage exchange may be indicated over one-stage exchange include:

- 1) patients with systemic manifestations of infection (sepsis)
- 2) the scenario where infection appears obvious but no organism has been identified;
- 3) preoperative cultures identifying difficult to treat and antibiotic-resistant organisms
- 4) presence of a sinus tract
- 5) inadequate and non-viable soft tissue coverage

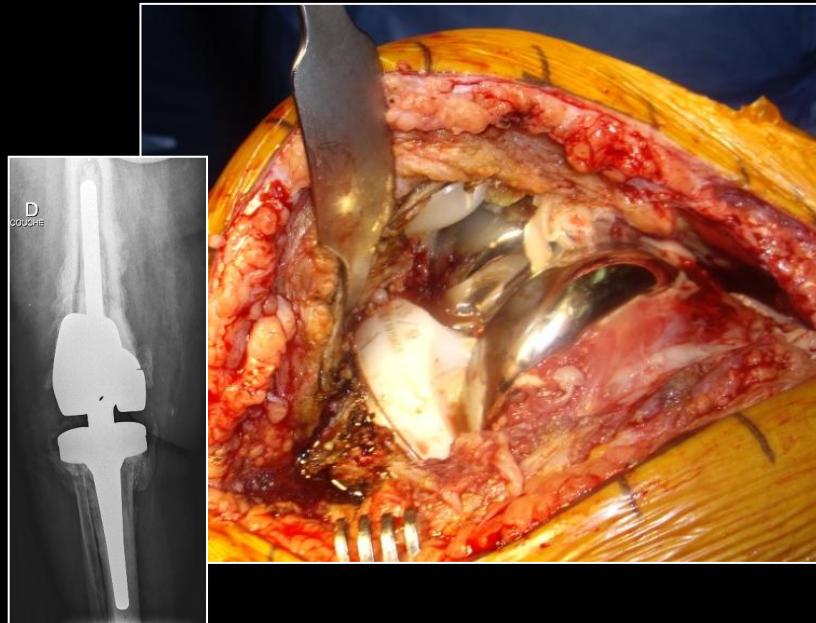
**Delegate Vote:** Agree: 93%, Disagree: 7%, Abstain: 0% (Strong Consensus)

# Pourquoi ?

2 problèmes

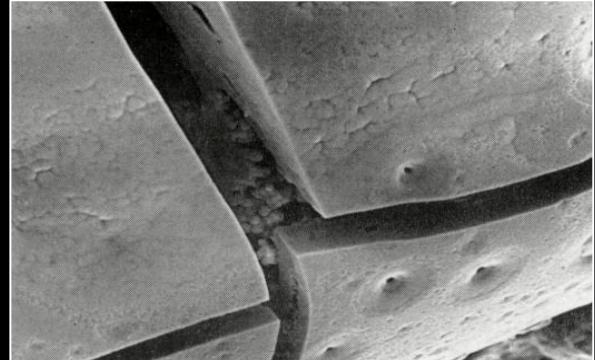
Guérir l' infection

Conserver la fonction

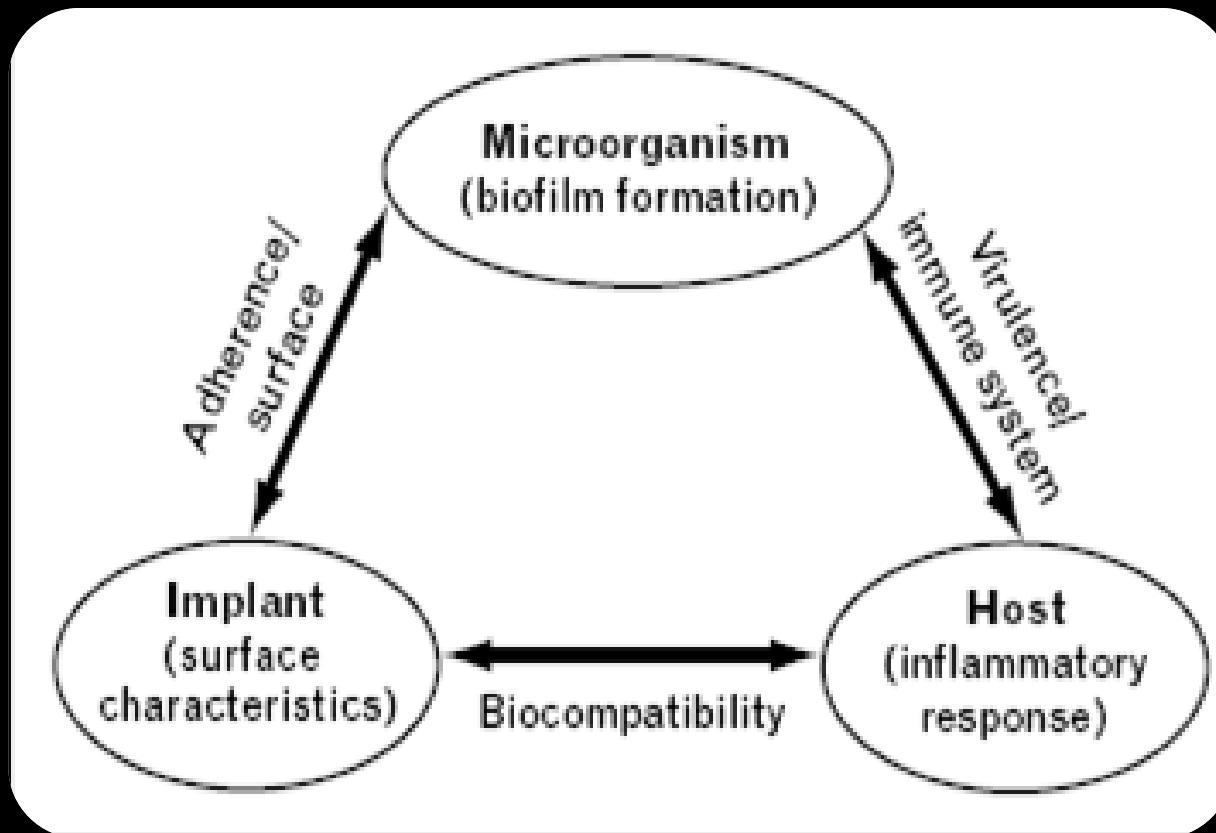


# Pourquoi ?

## Guérir l'infection



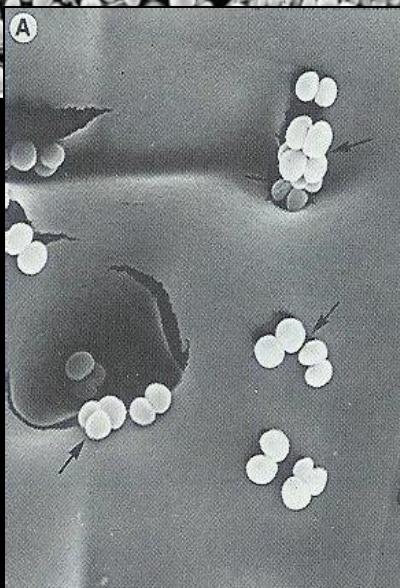
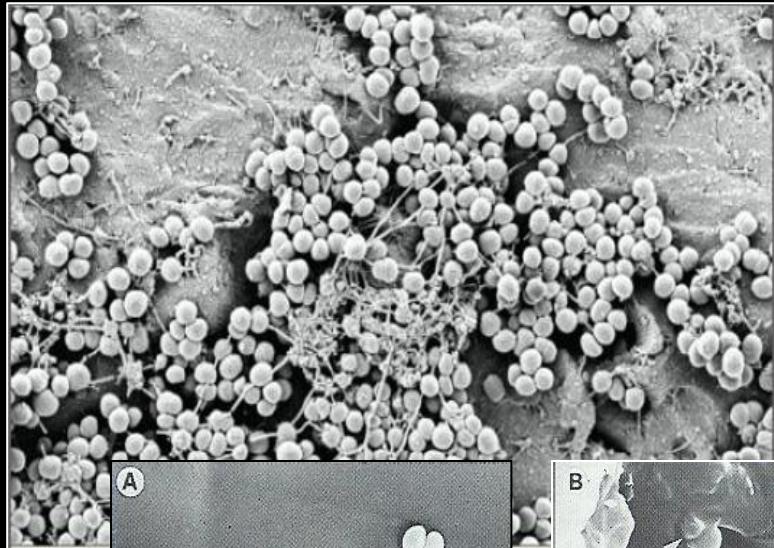
# Basic Principle of the pathogenesis of implant-associated infections



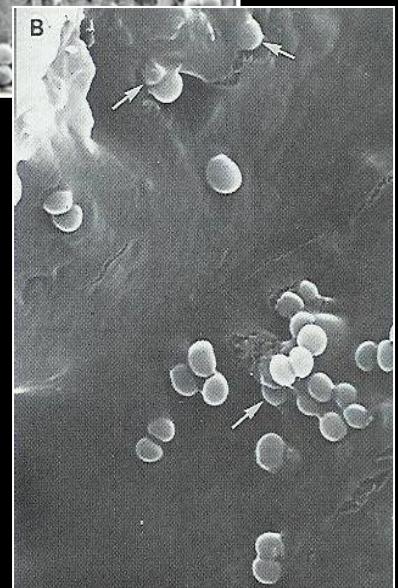
Interaction between the microorganism, the implant and the host

*Infection associated with orthopedic implant , Trampuz,  
Curr Opin Inf Dis, 2006*

# Role of Biofilm = Basic Survival Mechanism for Microorganism



2 h



4 h

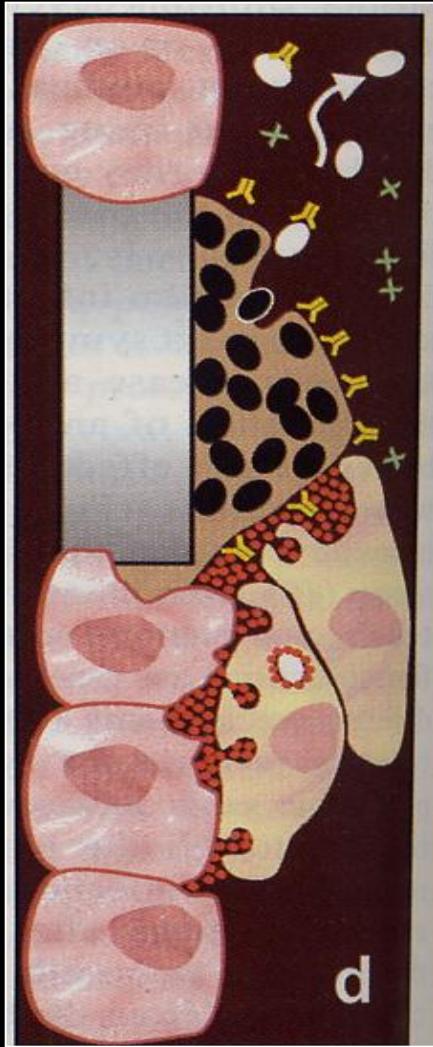


8 h



24 h

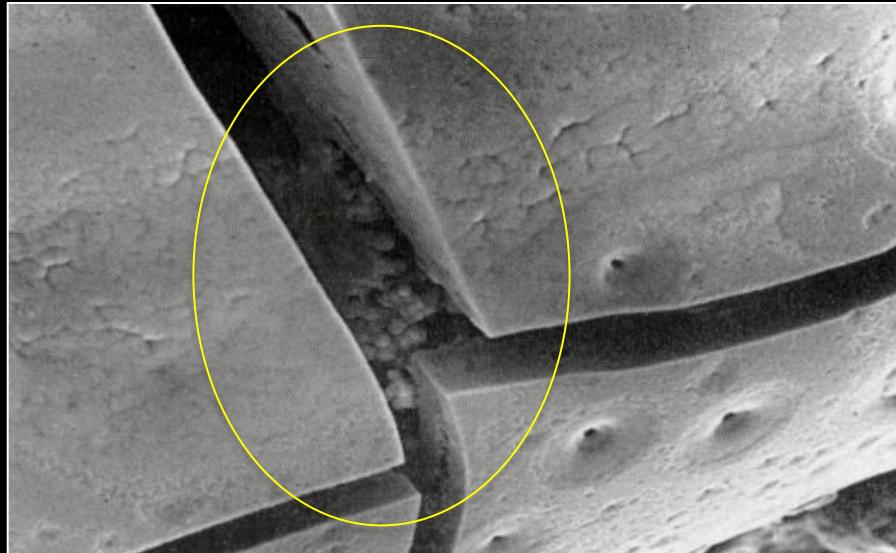
# BioFilm



Courtesy F Laurent

# Pourquoi 2 temps ?

«...» *Give time to the ATB  
to sterilize infected bone  
around the implant «...»*



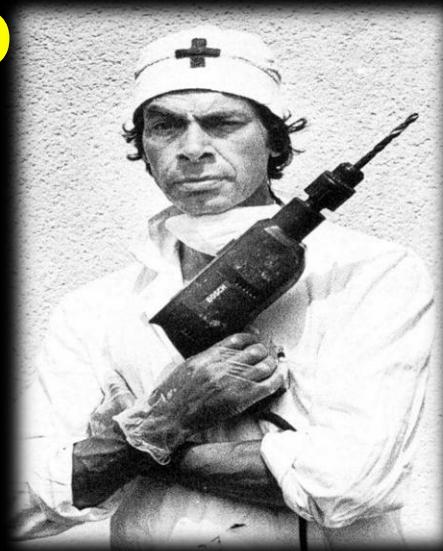
1 temps ...



*Less extensive bony  
resection...*

# Comment ?

## *Approche multidisciplinaire*



Surgical team  
Arthroplasty surgeon

IOA



Microbiologist  
Diagnostic

Medical Team  
ID Specialist



# Comment ?

*2 temps*

“...” Initial prosthesis removal and débridement followed by a period of intravenous antibiotics and later reimplantation. “...”

“Gold Standard”

Insall 1983

6 weeks of intravenous antibiotics, followed by reimplantation.

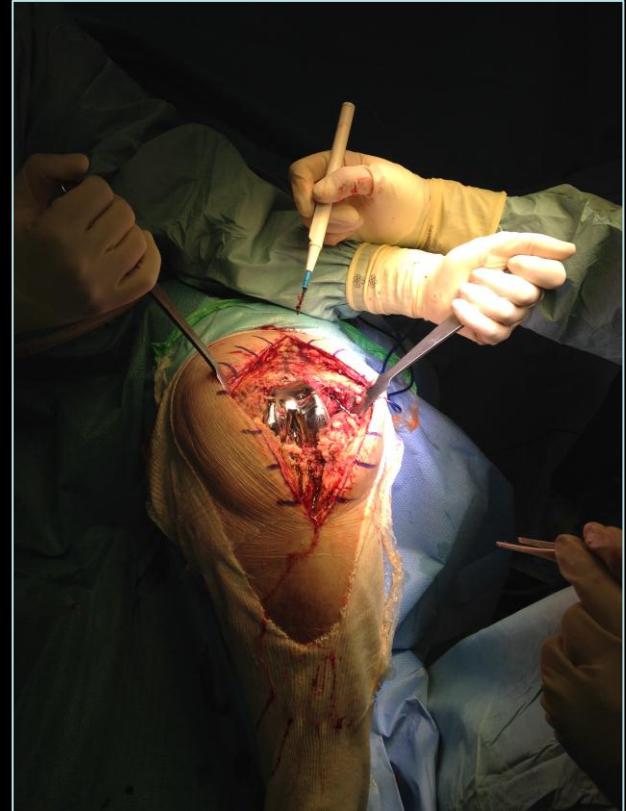
Insall JN, Thompson FM, Brause BD: Two-Stage reimplantation for the salvage of infected total knee arthroplasty, J Bone Joint Surg 65A: 1087,1983

# Comment ?

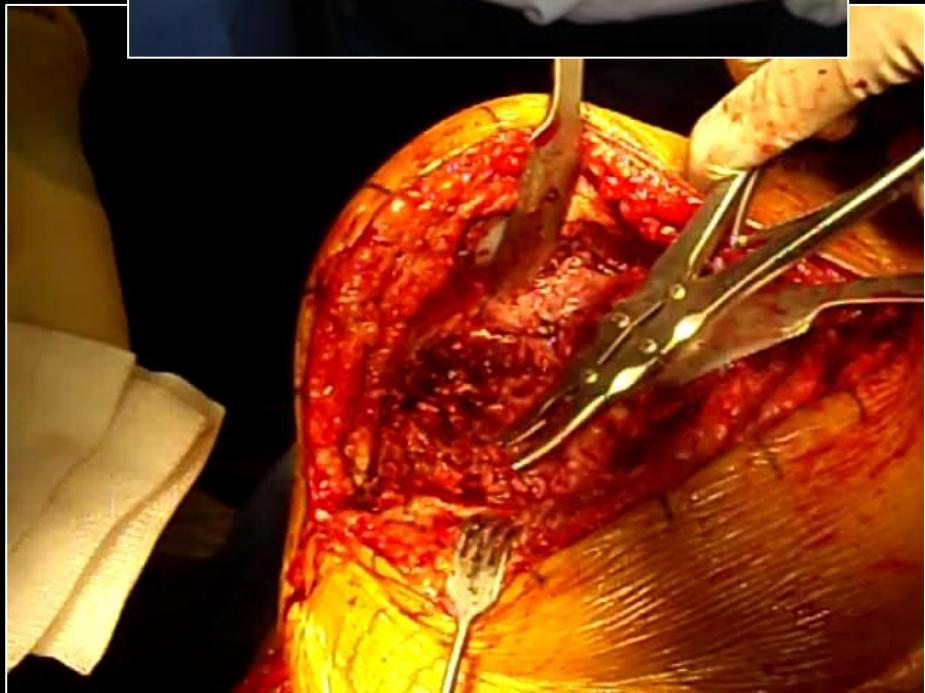
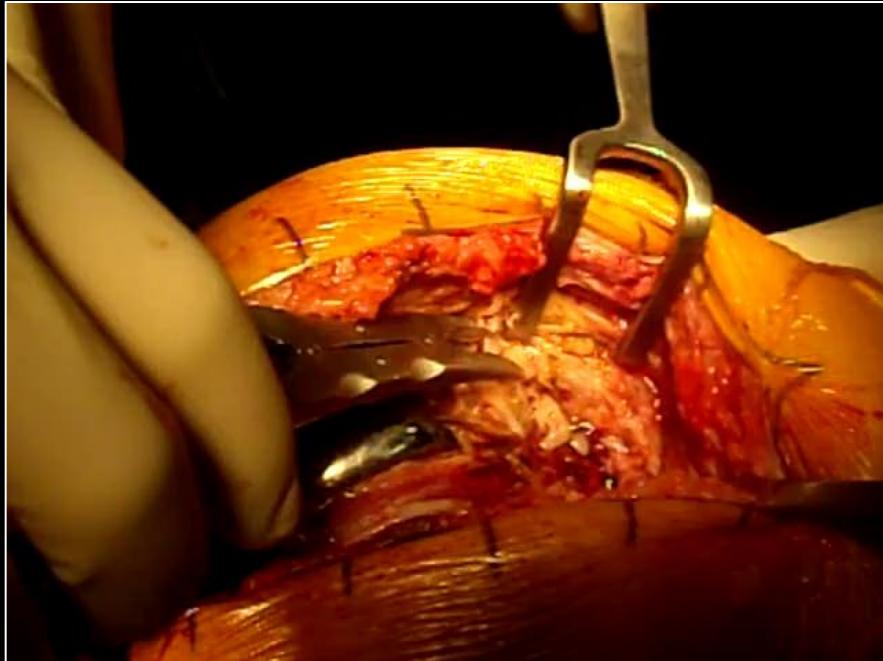
Premier temps :  
tout enlever et spacer

2<sup>e</sup> temps : interval sans PTG

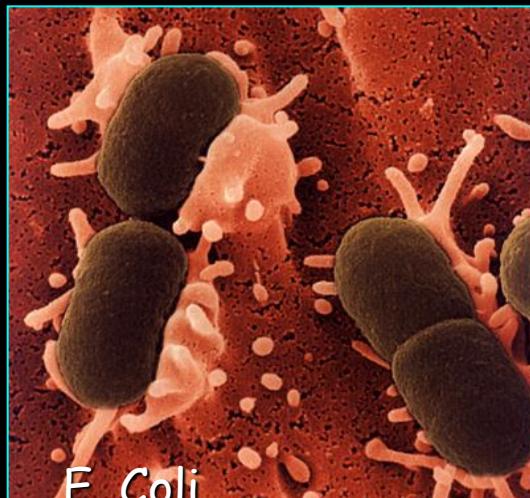
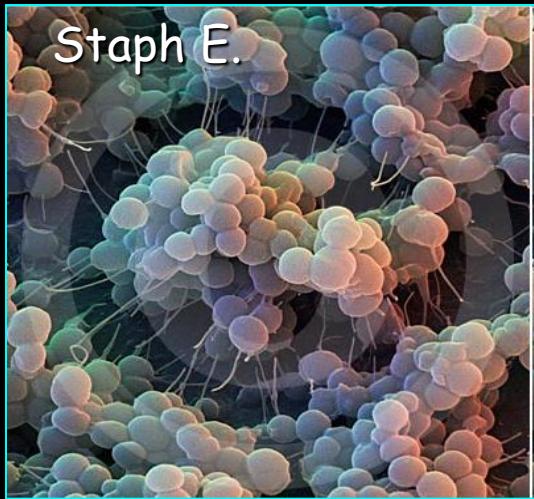
3<sup>e</sup> temps : reimplantation



# Avoir les prélèvements adaptés

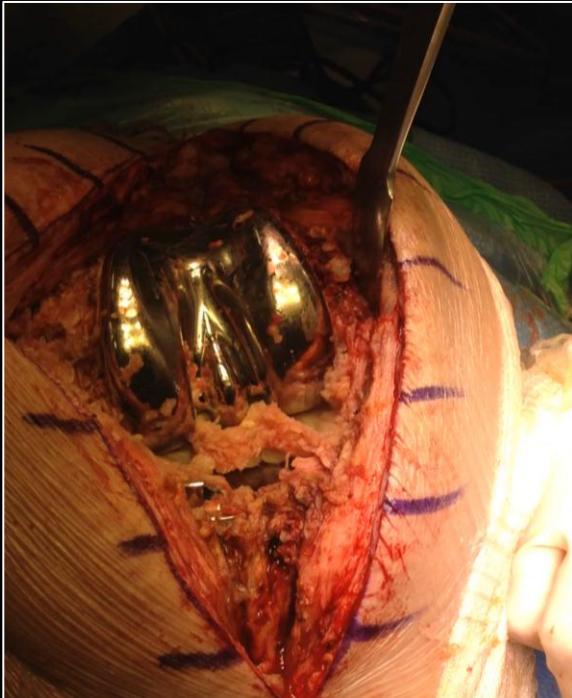


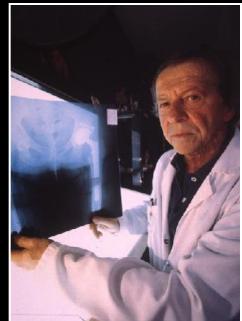
# Step 1



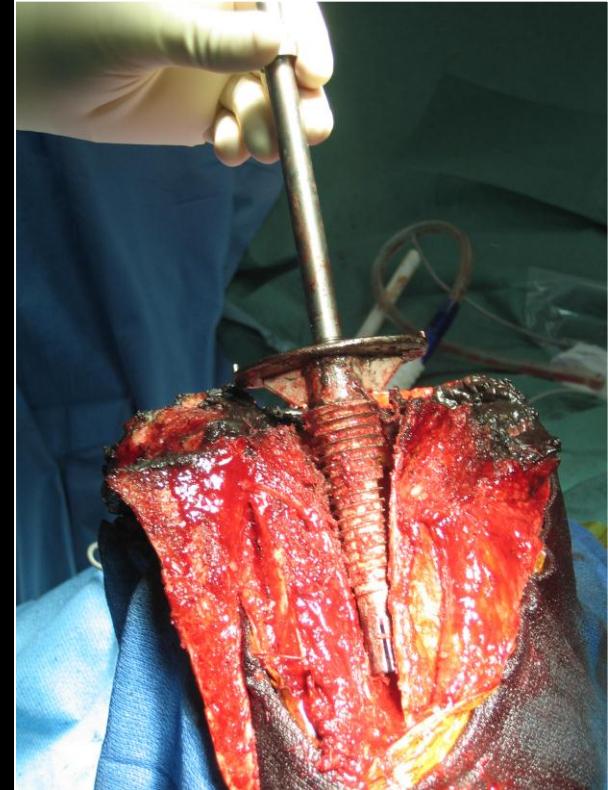
# Abaltion des implants et du ciment

Parfois  
très simple...





# Mais pas toujours un « slam dunk » ....



**IF TODAY IS THE WORST  
DAY OF YOUR LIFE**



**THEN YOU KNOW  
TOMORROW WILL BE  
BETTER**



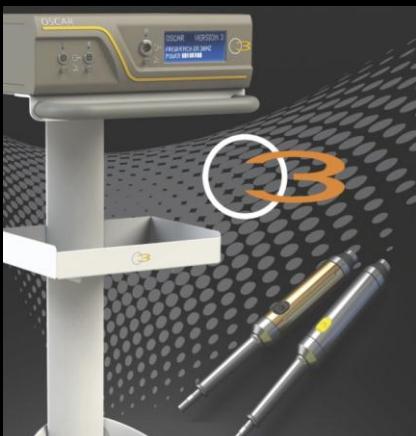
# Ciment ...



Ultrasonic  
driven tool

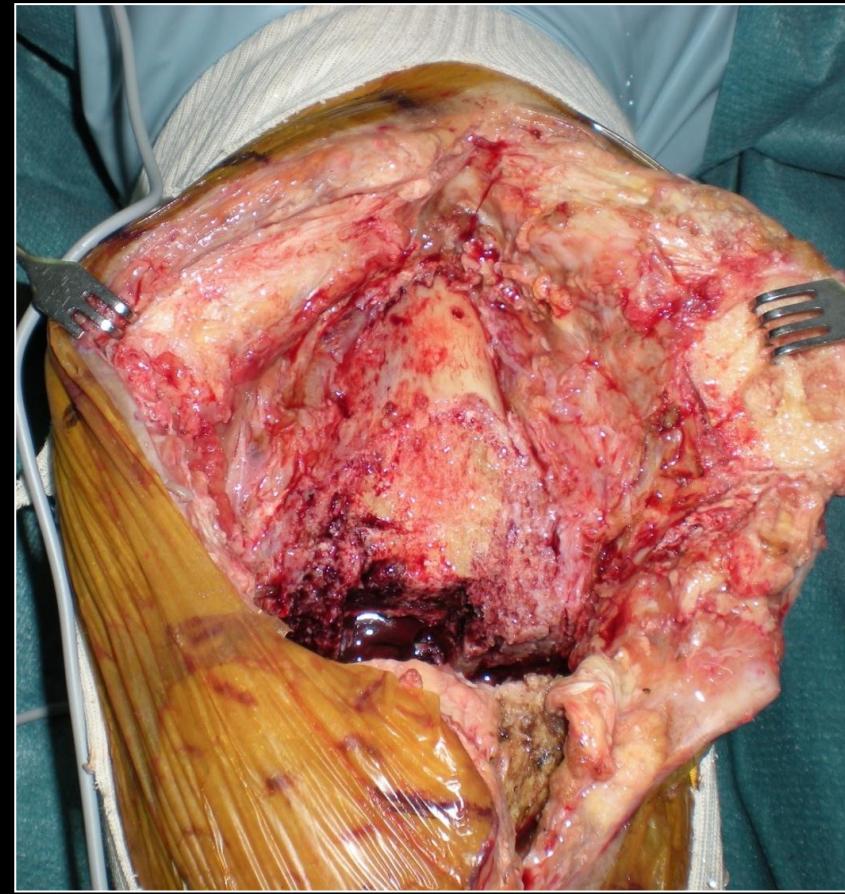


50 —  
45 —



Revision total hip arthroplasty using ultrasonically driven tools. A clinical evaluation. Gardiner R, Hozack WJ, Nelson C, Keating EM. J Arthroplasty. 1993 Oct;8(5):517-21.

Un objectif : tout enlever ....



# Spacer articulé chargé aux ATB

(Masri, 1994, Hofmann,  
1995, Fehring, 2000)



# Objectif

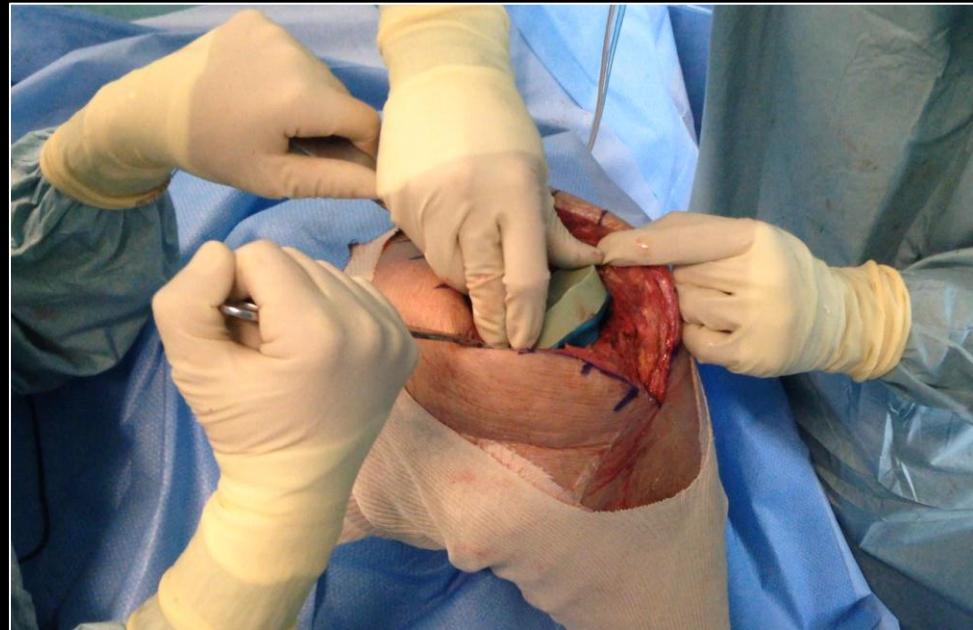
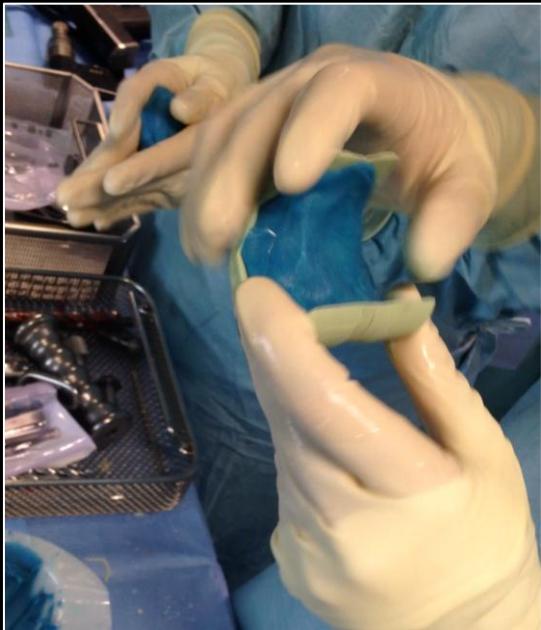
## Antibiotic-impregnated PMMA spacers

“Maintain soft tissue tension of the articulation during the interval between débridement and reimplantation in two stage procedures.



Durbhakula SM, Czajka J, Fuchs MD, et al: antibiotic-loaded articulating cement spacer in 2-stage exchange of infected total knee arthroplasty. J Arthroplasty A9:768,2004

# Stabilité du Spacer



# Espace antérieur





# Spacer

Articulating spacers provide better function and is especially preferred for patients who are likely to have spacer in place for longer than 3 months.

There is a non-significant trend in range of motion improvement with articulating compared to non-articulating spacers, but the panels believes that this is still of value to the patient

No difference in terms of infection control

Non articulated spacers when too much bone loss

**Consensus 3: reimplantation is easier with articulated spacers**

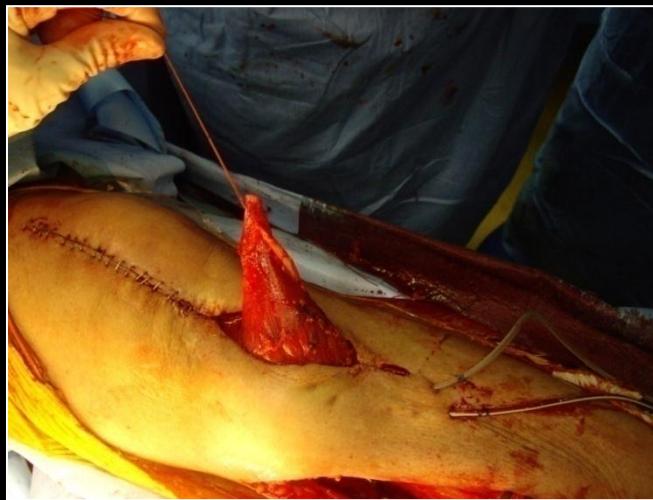
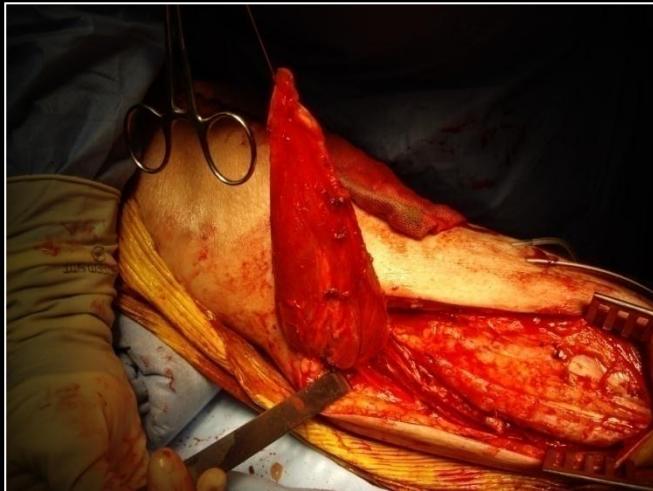
# PROSTALAC

Prosthesis with Antibiotic-Loaded Acrylic Cement

- **Antibiotic loaded tibial and femoral components**
- **Metal-on-polyethylene articular surface**
- **Haddad (2000):**
  - 45 pts followed for 48 months
  - Eradication of infection in 41 (91%)
  - Better ROM, less pain, better function and easier exposure for revision



# Parties molles ...

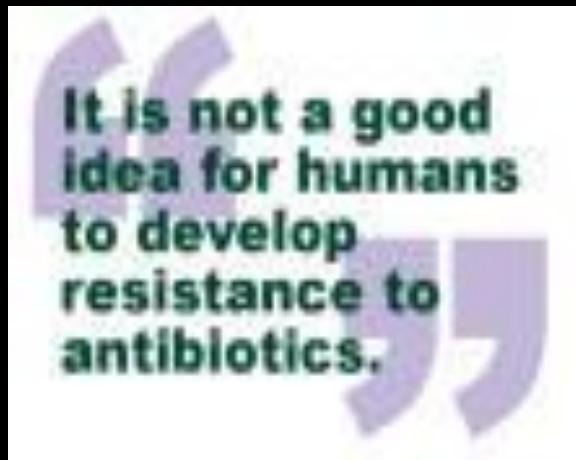


# 2<sup>e</sup> étape

- Confirm microbiologic diagnosis
- Antibiotic adaptation
- Rehabilitation
- Check normalization of biologic parameters

Antimicrobial-Related Severe Adverse Events during Treatment of Bone and Joint Infection Due to Methicillin-Susceptible *Staphylococcus aureus*

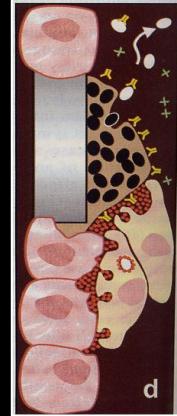
Florent Valour,<sup>a,b</sup> Judith Karsenty,<sup>a</sup> Anissa Bouaziz,<sup>a</sup> Florence Ader,<sup>a,b</sup> Michel Tod,<sup>c</sup> Sébastien Lustig,<sup>d</sup> Frédéric Laurent,<sup>b,e,f</sup> René Ecochard,<sup>g</sup> Christian Chidiac,<sup>a,b</sup> Tristan Ferry,<sup>a,b</sup> on behalf of the Lyon BJI Study Group



# Adaptation des ATB

## BIOFILM ACTIVE ANTIBIOTICS

- Optimal type and length of antibiotic therapy is not absolutely clear
- Most studies: 4-6 week regimen
- Longer duration for MRSA, multi-drug resistant, enterococci, fungi
- Antibiotics selected based on the results of culture & sensitivity



**J AAC**  
Journal of Antimicrobial Agents and Chemotherapy

**Antimicrobial-Related Severe Adverse Events during Treatment of Bone and Joint Infection Due to Methicillin-Susceptible *Staphylococcus aureus***

Florent Valour,<sup>a,b</sup> Judith Karsenty,<sup>a</sup> Anissa Bouaziz,<sup>a</sup> Florence Ador,<sup>a,b</sup> Michel Tod,<sup>c</sup> Sébastien Lustig,<sup>d</sup> Frédéric Laurent,<sup>b,a,f</sup> René Ecochard,<sup>b</sup> Christian Chidrac,<sup>a,b</sup> Tristan Ferry,<sup>a,b</sup> on behalf of the Lyon BJI Study Group

Service des Maladies Infectieuses et Tropicales, Hôpitaux Civils de Lyon, Lyon, France<sup>a</sup>; Université Claude Bernard Lyon 1, INSERM U1111, International Center for Research in Infectious Diseases, Lyon, France<sup>b</sup>; Pharmacie Hospitalière et Pharmacovigilance, Groupe hospitalier Nord, Hôpitaux Civils de Lyon, Lyon, France<sup>c</sup>; Chirurgie Orthopédique, Groupe hospitalier Nord, Hôpitaux Civils de Lyon, Lyon, France<sup>d</sup>; Laboratoire de Bactériologie, Groupe hospitalier Nord, Hôpitaux Civils de Lyon, Lyon, France<sup>e</sup>; Centre National de Référence des Staphylocoques, Hôpitaux Civils de Lyon, Lyon, France<sup>f</sup>; Service de Biostatistiques, Hôpitaux Civils de Lyon, Lyon, France<sup>g</sup>

# « In between » ?

## Chaque situation est différente



- Partial weight bearing
- Begin early ROM exercises
- PICC line



# How long « in between »?

**Consensus:** There is no definitive evidence in the literature as to the optimal time interval between the two stages. Reports **vary from 2 weeks to several months.**

More than 6 months:  
sub-optimal functional results

Proceedings of the International  
Consensus Meeting on  
Periprosthetic Joint Infection

Chairmen:

Thorsten Gehrke MD

Javad Parvizi MD, FRCS



# 3<sup>e</sup> étape : reconstruction

Manage

Approach

Implant, cement or TM removal

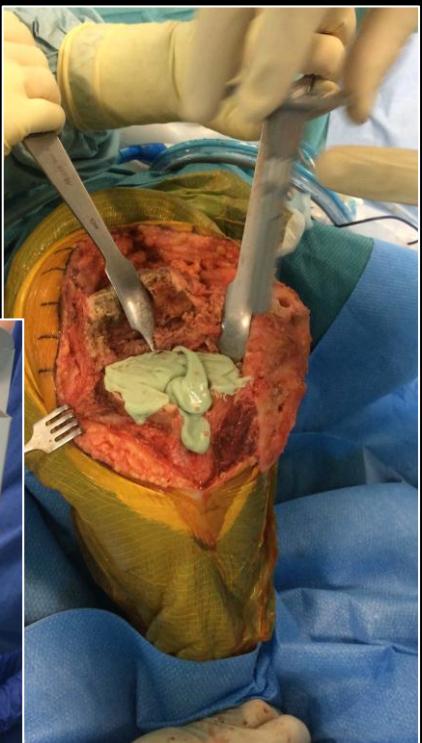
Joint line, alignment and stability

Bone loss

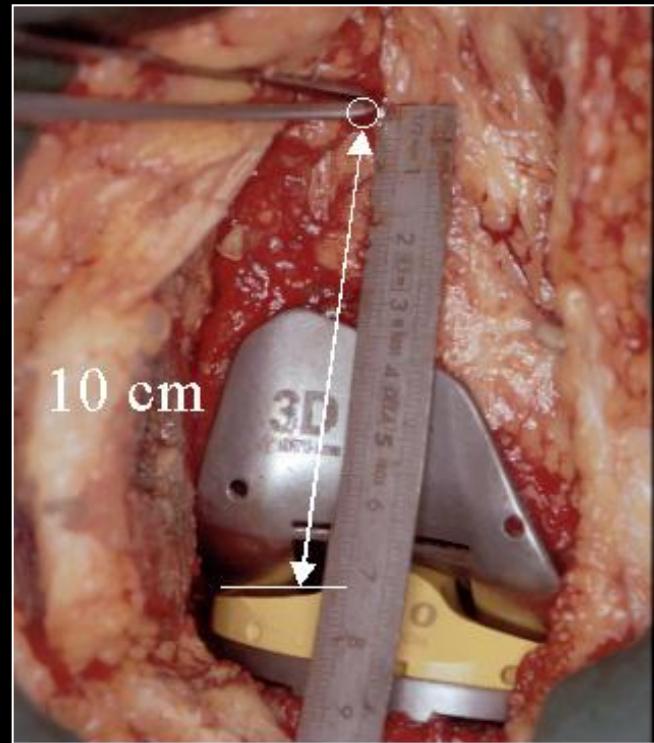
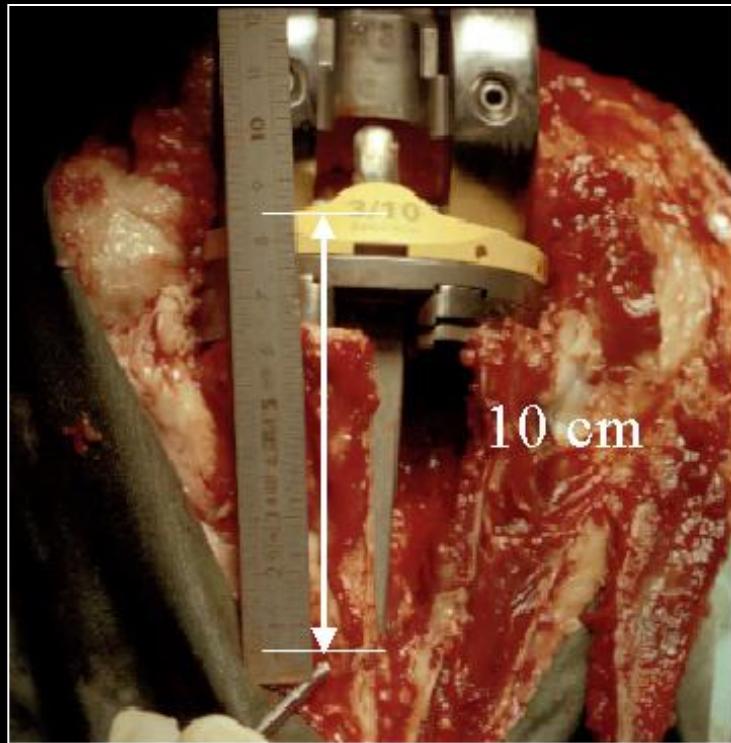
Extenseur mechanism

Skin

# « Simple as Surgery »



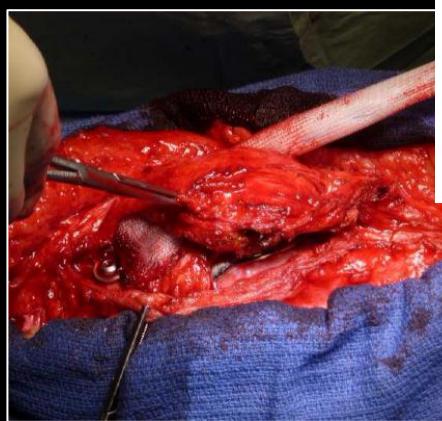
# Interligne articulaire ++



Dojcinovic, Selmi, Neyret, Fithian. Restoring the joint line using drill-hole pinpointing in revision total knee arthroplasty. Tech Knee Surg 2008, 7, 126-130.

# Appareil extenseur

Hanssen



## Extensor Mechanism Rupture

Nicolaas C. Budhiparama, Nadia N. Ifran, Sébastien Lustig,  
Michel Bonnin, and Sébastien Parratte

20

Arthrodesis



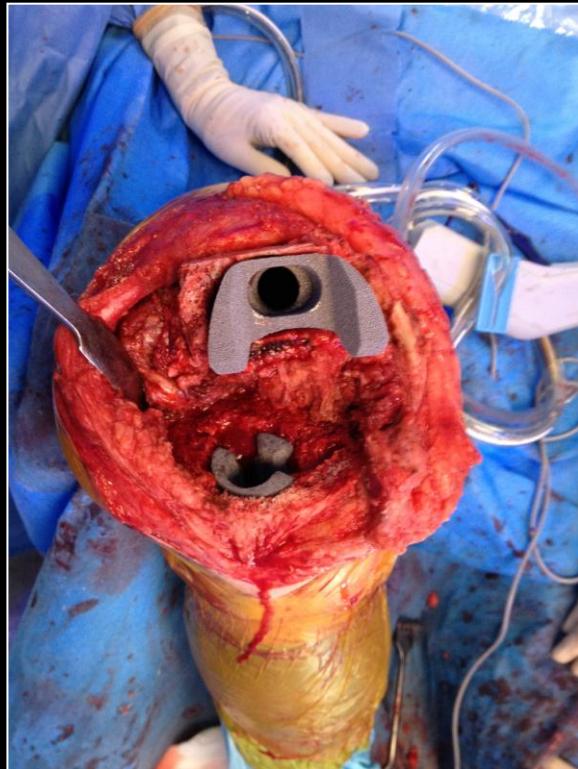
Allograft



# Pertes osseuses

Megaprosthesis

Courtesy S Parratte



Trabecular metal



Clin Orthop Relat Res (2009) 467:485–492  
DOI 10.1007/s11999-008-0329-x

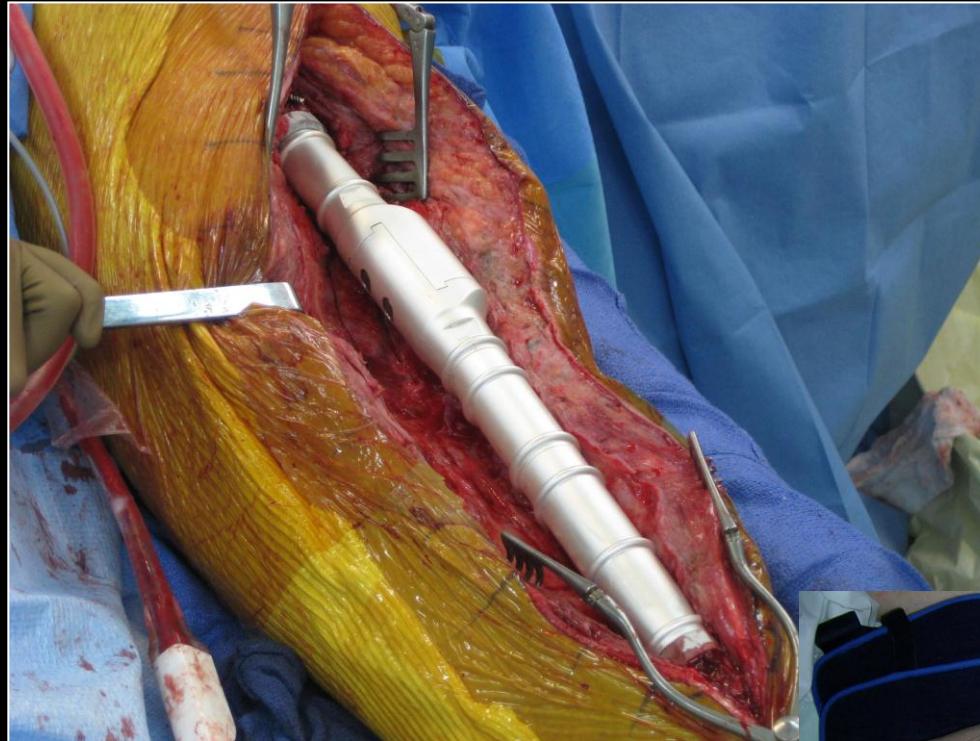
ORIGINAL ARTICLE

**Distal Femoral Replacement in Nontumor Cases with Severe Bone Loss and Instability**

Keith R. Berend MD, Adolph V. Lombardi Jr. MD, FACS



# Silver-coated Implants



# Wound closure



# Resultats

Gacon RCO 1997	82% (n=24)
Parvizi CORR 2009	60% (n=127)
Bauer RCO 2007	66% (n=77)
Haleem CORR 2004	90% (n=96)
Segawa JBJS Am 1999	83% (n=29)
Whiteside Clin Orthop 1994	85 % (n=33)
Goldman Clin Orthop 1996	91% (n=64)
Wasielewski J Arthroplasty 1996	90% (n=76)
Mahmud CORR 2012	85% (n=253)

60 to 90% success

SYMPOSIUM: PAPERS PRESENTED AT THE 2010 MEETING OF THE MUSCULOSKELETAL  
INFECTION SOCIETY

## **Two-stage Exchange Arthroplasty for Infected Total Knee Arthroplasty: Predictors of Failure**

S. M. Javad Mortazavi MD, David Vegari MD,  
Anthony Ho BA, Benjamin Zmistowski BS,  
Javad Parvizi MD, FRCS

« ... » In conclusion, two-stage revision is associated with a considerable failure rate (28%) when reinfection and/or recurrence are taken into account as failure « ... »

# Notre experience



**Lyon metropolis**  
2,000,000 inhabitants

2011 – 2013

Revision  
Arthroplasty for  
infection  
Database

n=202 revision THA  
n =174 revision TKA

Rhône-Alpes Auvergne region  
7,500,000 inhabitants

Most of cases referred are  
« salvage procedures... »



n=100

2 steps revision TKA

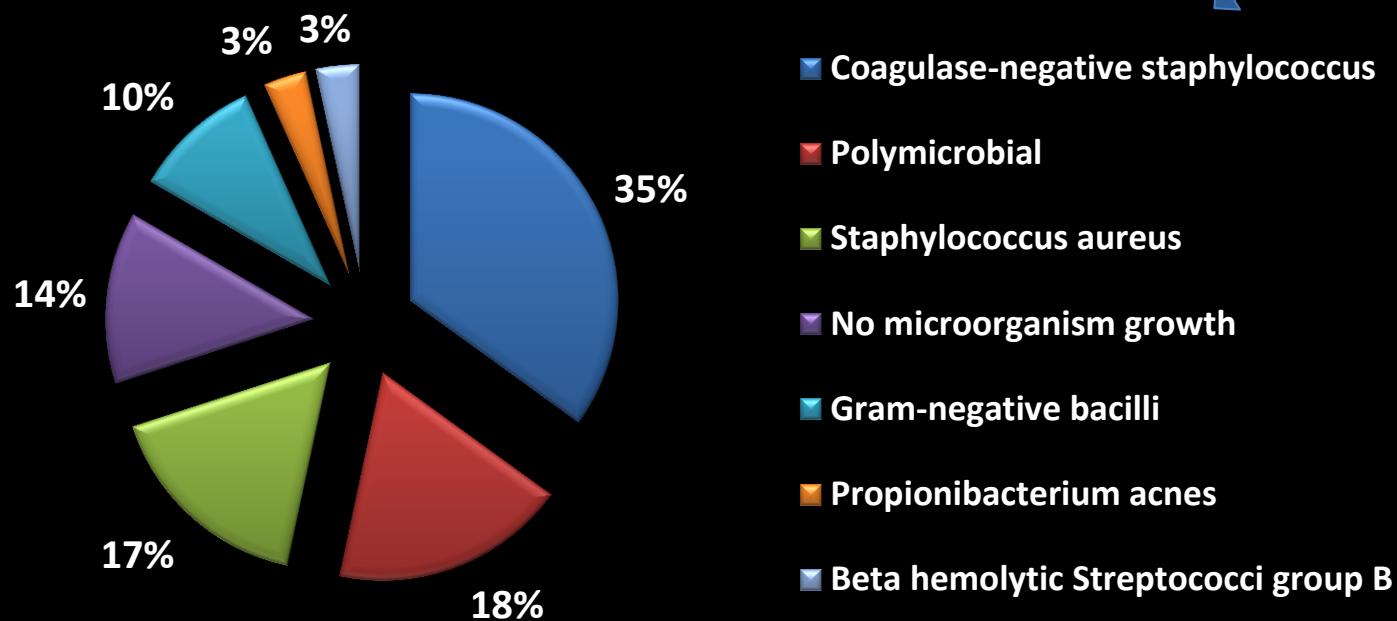
n=11

1 step revision TKA

n=66

irrigation - debridement

2011 – 2013

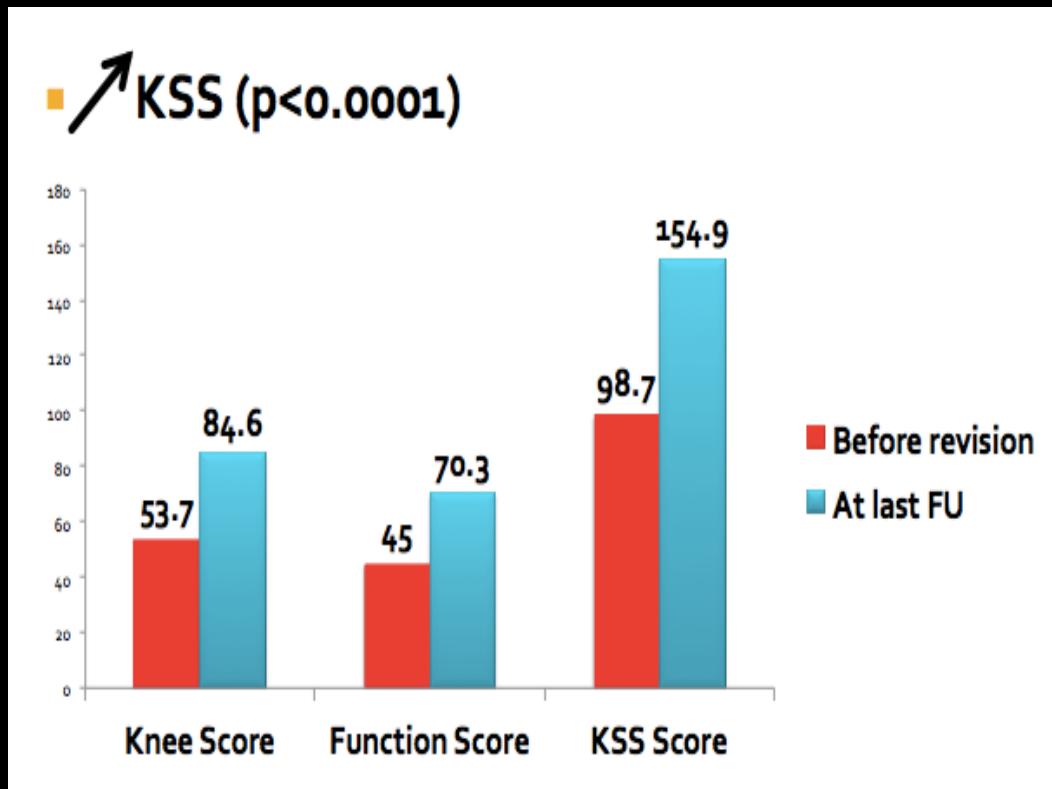


# Our experience

n=100

2 steps revision TKA

2011 – 2013



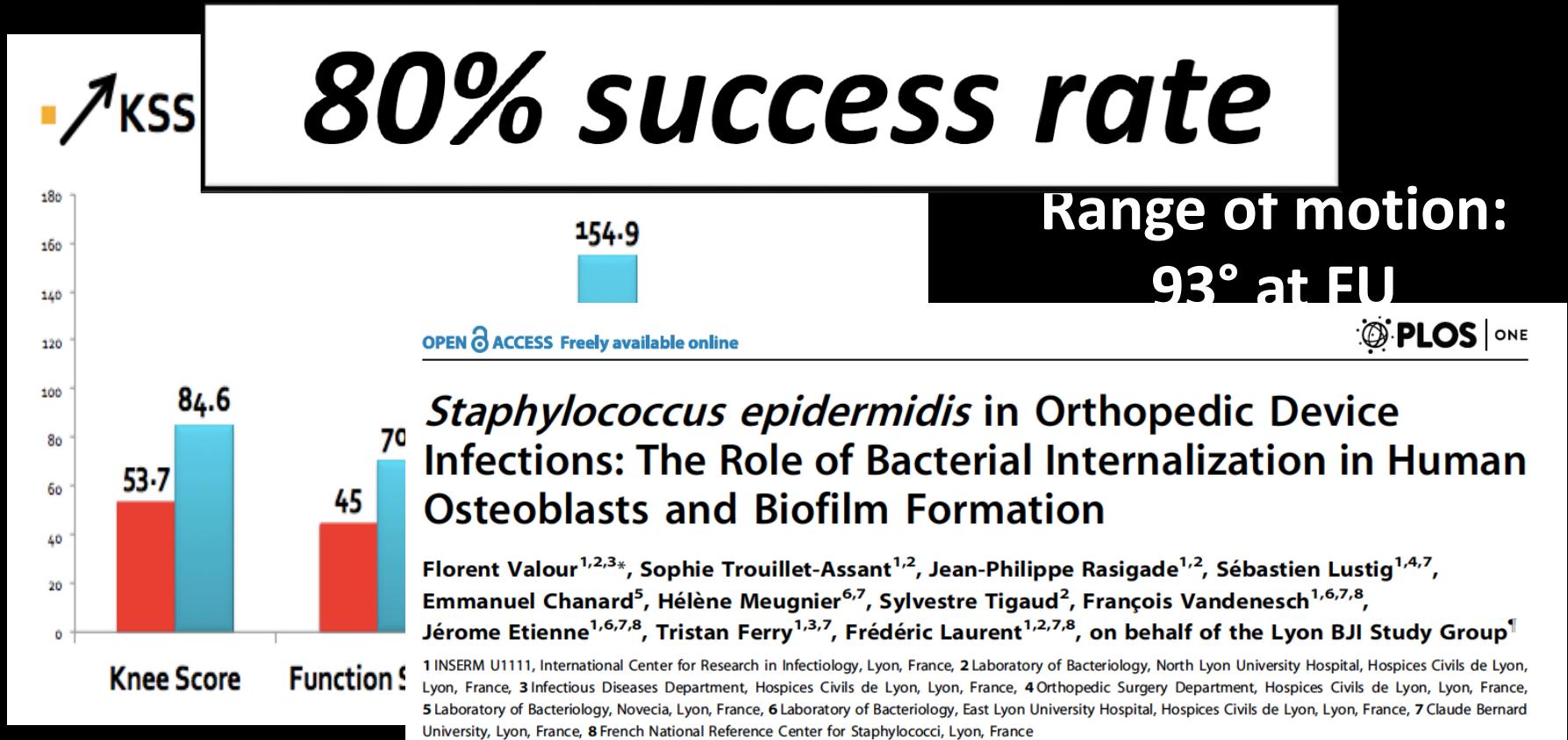
Range of motion:  
93° at FU

(vs 108°  
for 1 step RTKA,  
p<0.005)

n=100

2 steps revision TKA

2011 – 2013



# Take Home Message

**Consensus Philadelphia 2018**

**Travail d'équipe**

**2 étapes chirurgicales**

**« In between » : crucial**

