

CONGRESSO NAZIONALE DELLA  
**SOCIETÀ ITALIANA DELL'ANCA**

[www.societaitalianadellanca.eu](http://www.societaitalianadellanca.eu)



**19-20**  
settembre 2019

**BERGAMO**

Presidente Onorario  
**Paolo Cherubino**

Presidente  
**Claudio Carlo Castelli**

**CORSI DI ISTRUZIONE**



CONGRESSO NAZIONALE DELLA  
**SOCIETÀ ITALIANA DELL'ANCA**



**19-20**

settembre 2019

**BERGAMO**

**SALA A**

- 08.00** CORSO DI ISTRUZIONE 5  
**08.45** PLANNING NELLA PROTESI PRIMARIA  
Moderatore: **Paolo Prati** (Treviglio)
- 08.00** I principi: perché è indispensabile  
**Massimiliano Marcucci** (Fucecchio)
- 08.10** Acetato su radiologia digitale  
**Carlo Lauro Maria Trevisan** (Seriante)
- 08.20** Digitale 2D e 3D su radiologia digitale  
**Marco Villano** (Firenze)
- 08.30** Discussione

**VENERDÌ**  
**20 SETTEMBRE 2019**



Università degli Studi  
di Firenze

# Planning nella protesi primaria: perché è indispensabile



Universita' degli Studi di Firenze  
Prof. Massimiliano Marcucci





# PTA



La chirurgia è solo l'ultimo atto  
dell'intervento

Geometria  
dell'anca



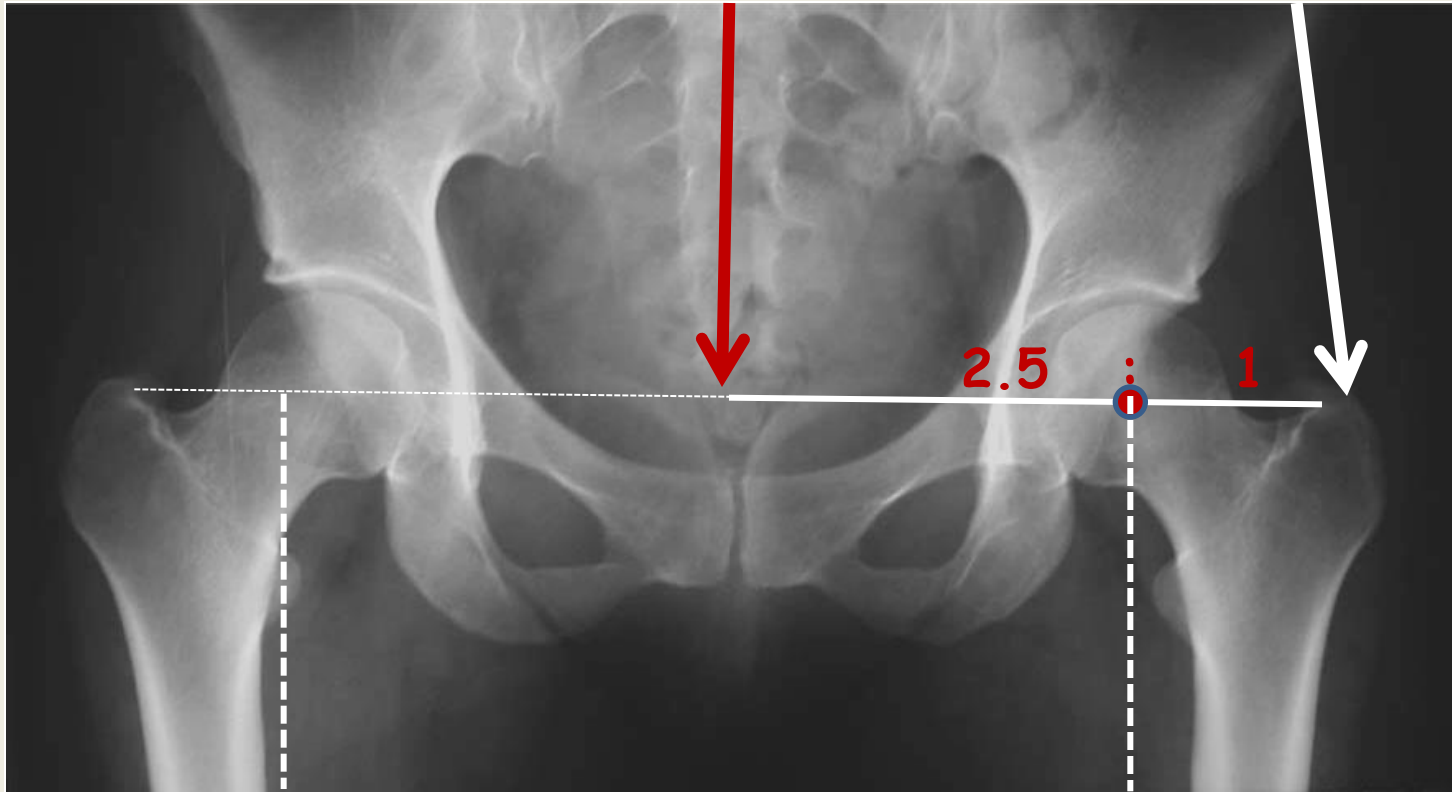
Equilibrio



# L'equilibrio

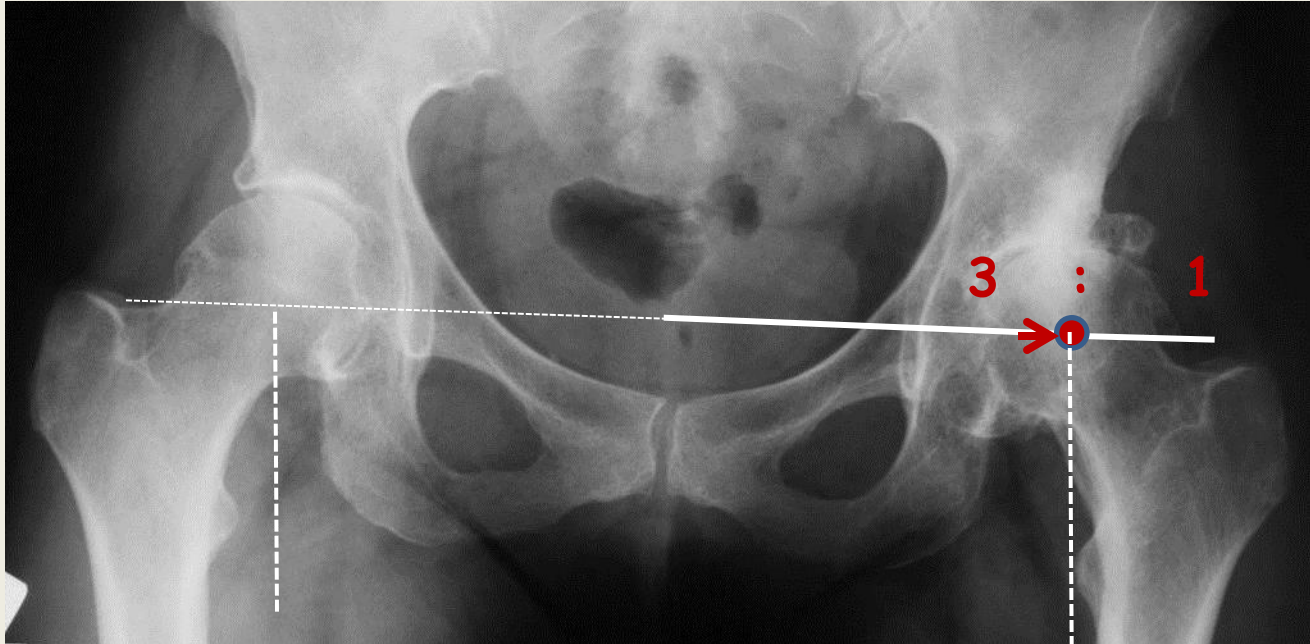
*Forza  
Peso*

*Forza  
muscolare*



Braccio di Leva  
Orizzontalità bacino

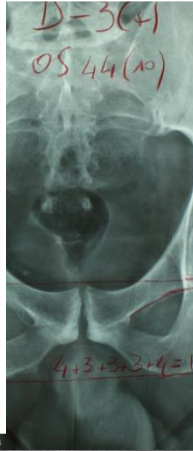
# Anca Artrosica



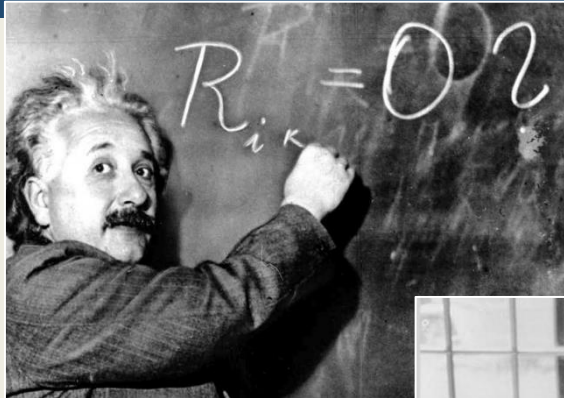
Alterazione leva  
Dismetria



# Ognuno ha il suo..

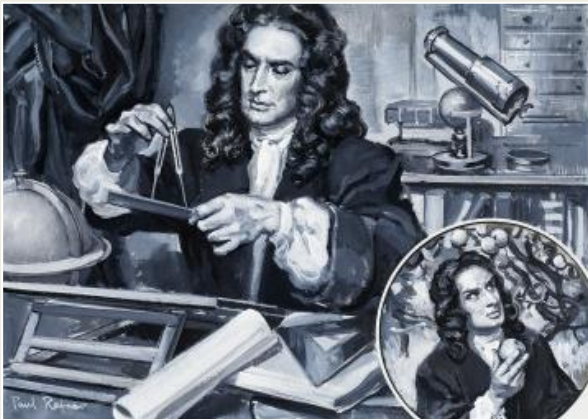


# Riproducibilità



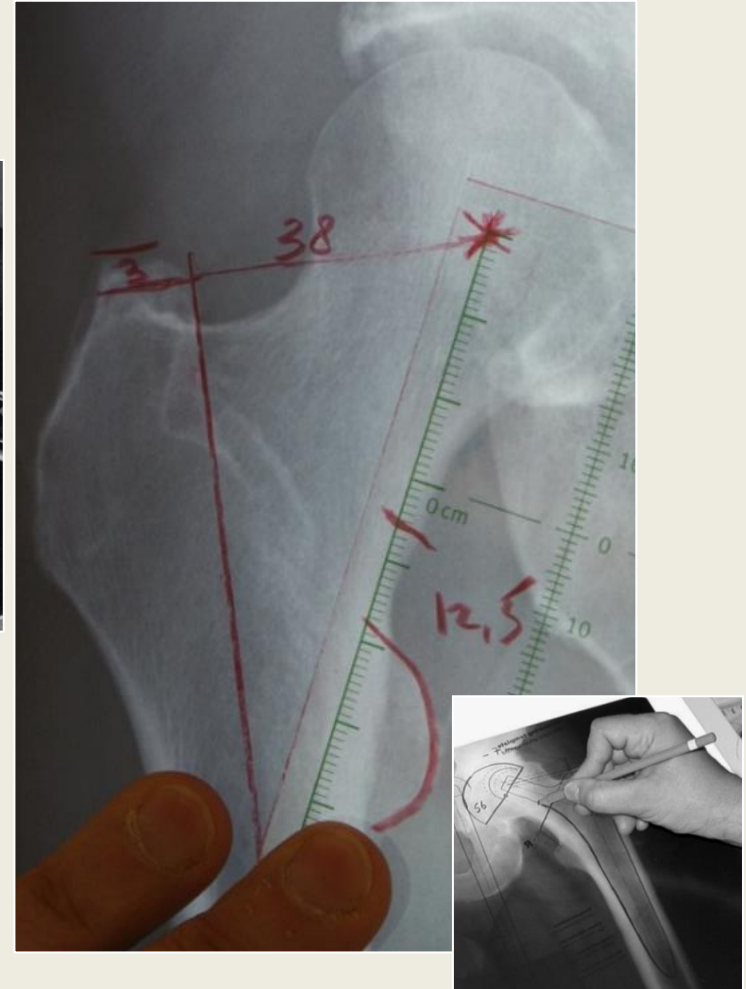
Scienziato  
Formule

Musicista  
Pentagramma



Fisico  
Metodologia

## Ortopedico?

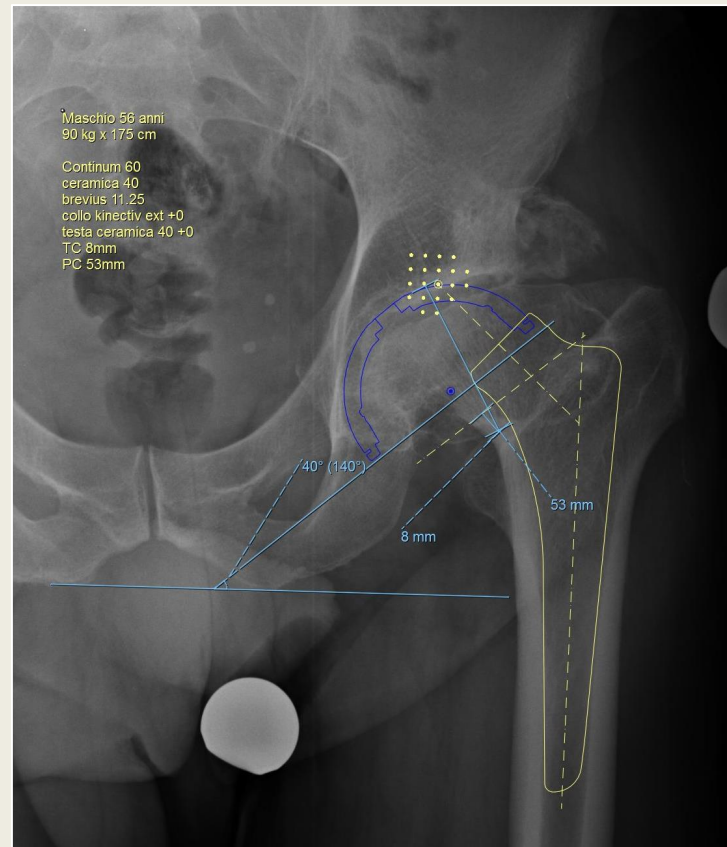


## Planning

# Planning

Strumento che  
aiuta a...

- ripristinare fedelmente  
biomeccanica
- scegliere ed impiantare  
la protesi



# Senza Planning rischio di...

*Mancato recupero*

CR, Eterometria,  
Offset

*Errato posizionamento e  
dimensionamento*

Componenti

Conseguenze meccaniche  
impianto

Manifestazioni  
cliniche





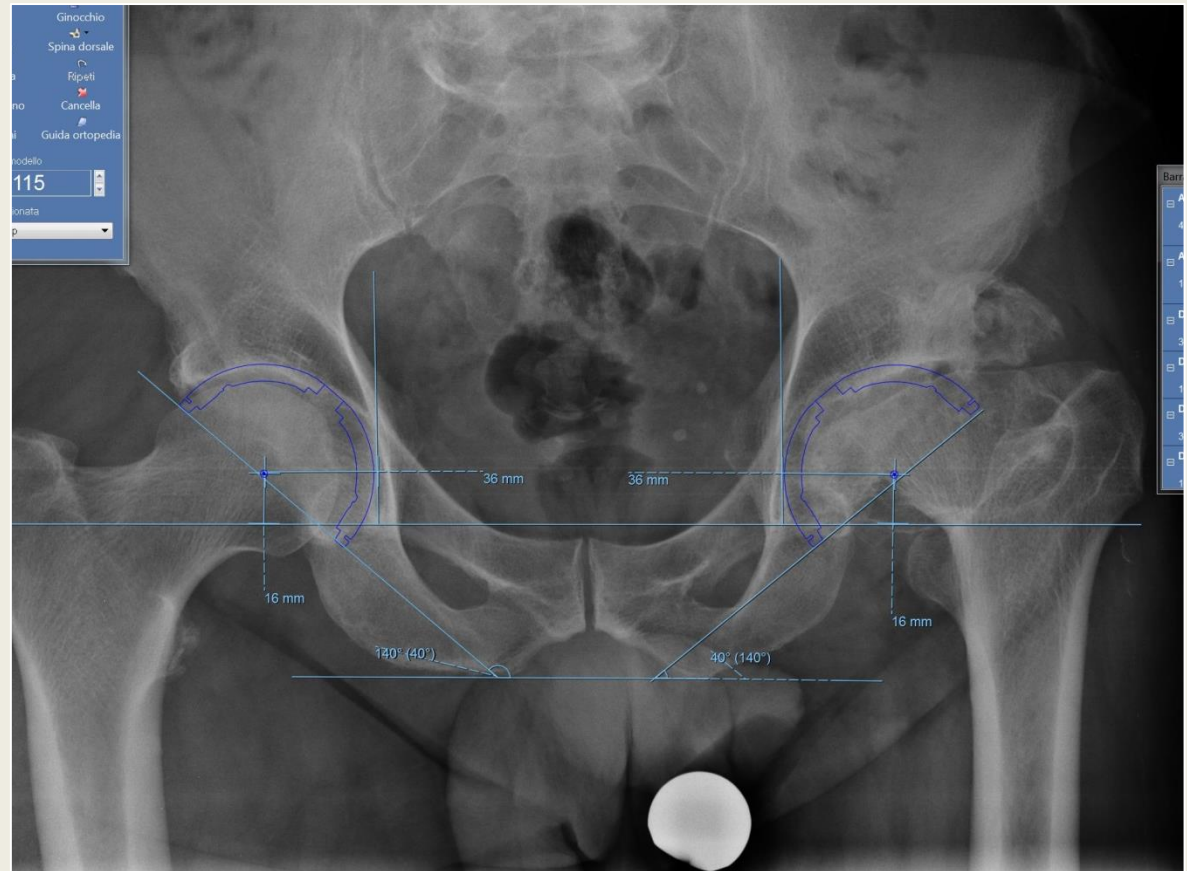
# Le variabili

Centro di  
Rotazione

Offset

Dismetria

Posizionamento  
componenti



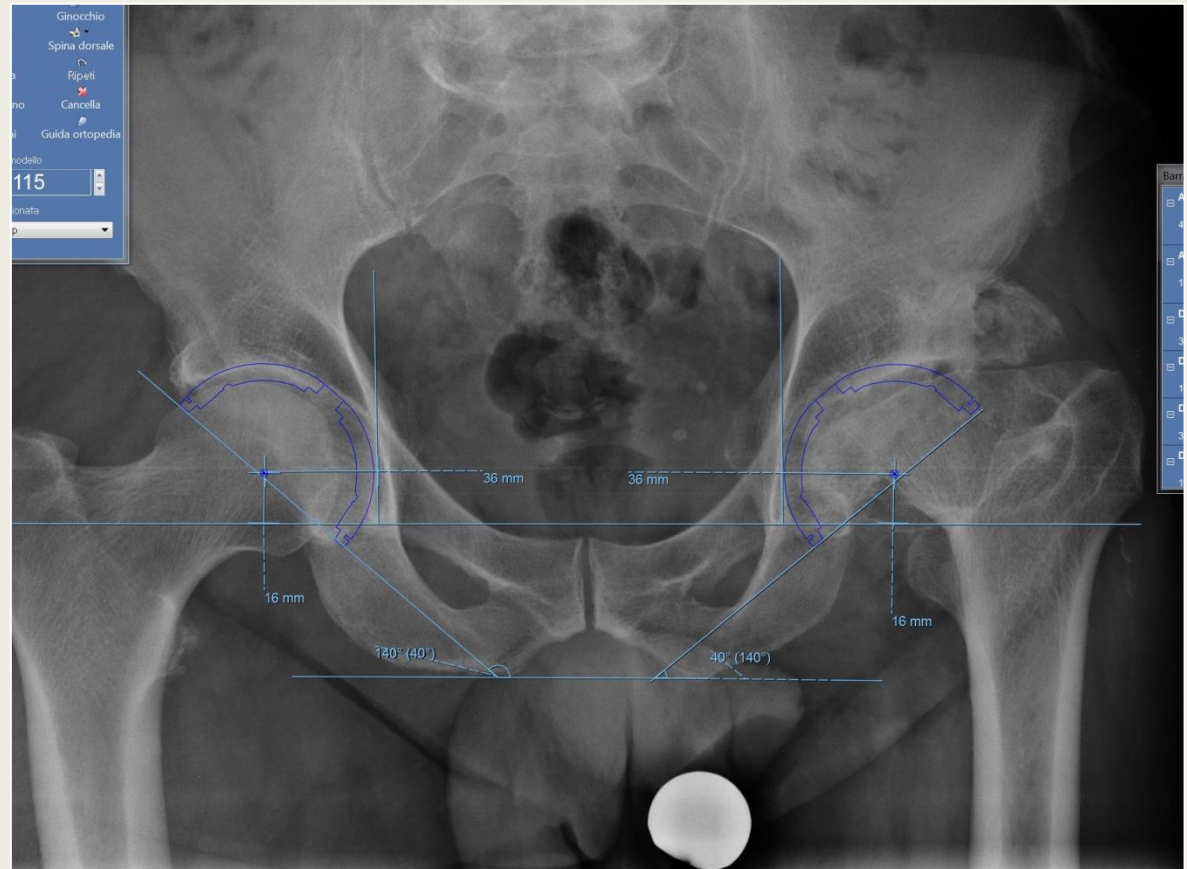
# Le variabili

Centro di  
Rotazione

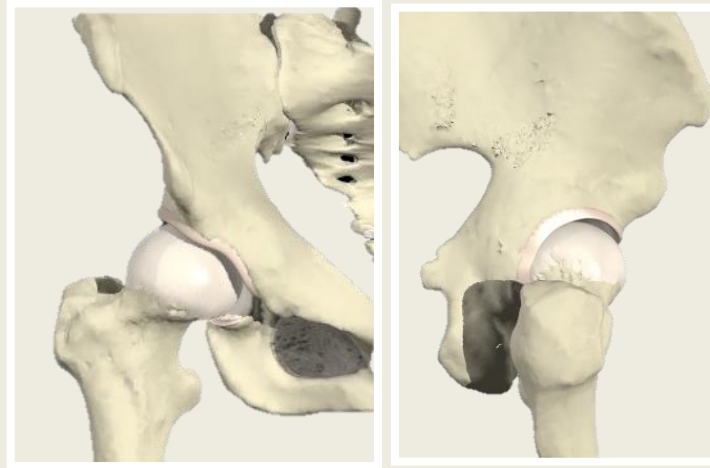
Offset

Dismetria

Posizionamento  
componenti



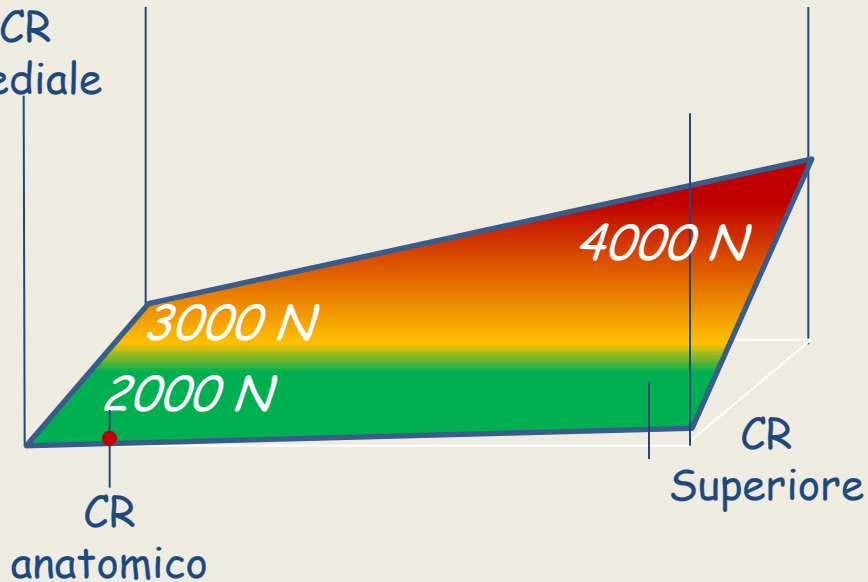
# Centro di Rotazione anatomico



*F.U. 10 anni*  
CR  
Laterale

CR  
Supero laterale

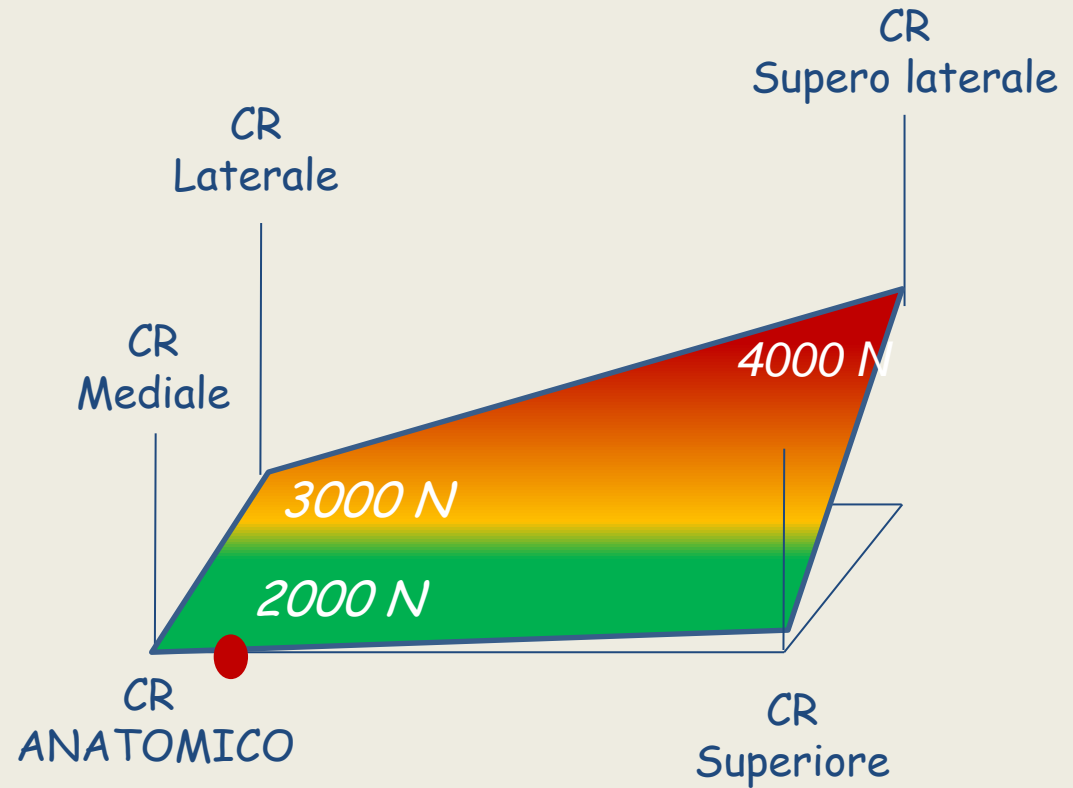
CR  
Mediale



*Stress Meccanico  
fisiologico  
(2000 Newton)*

*(Lengsfeld et Al, J. Arthroplasty 2000)*

# Posizionamento superiore



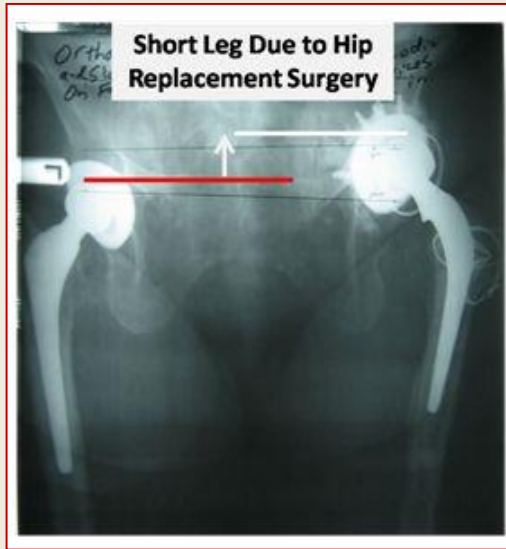
*CR più alto di 1cm : Hip Joint Force 2500 N*

*Stress biomeccanici contenuti*

*(Kelley et Al, J. Arthroplasty 1994)*



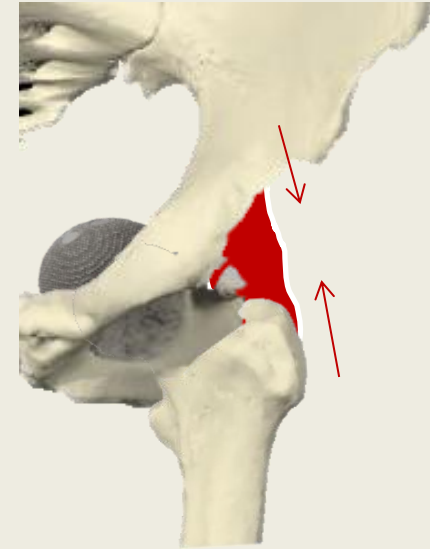
# Posizionamento superiore



*dismetria*



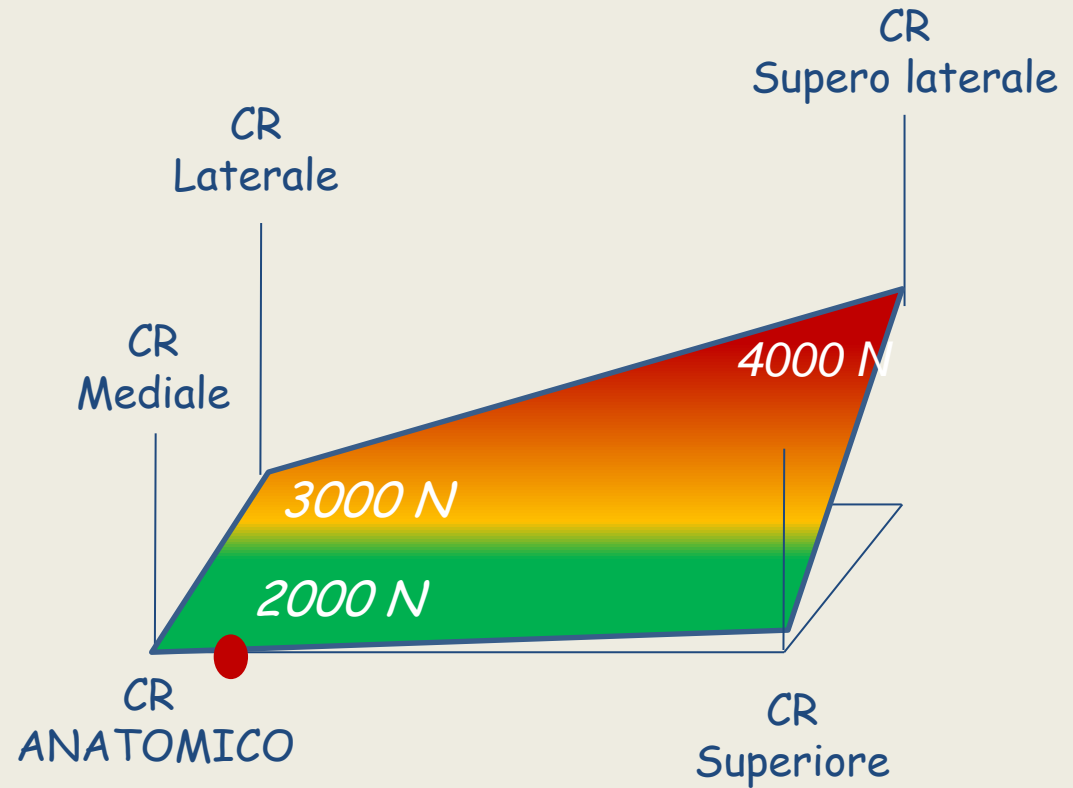
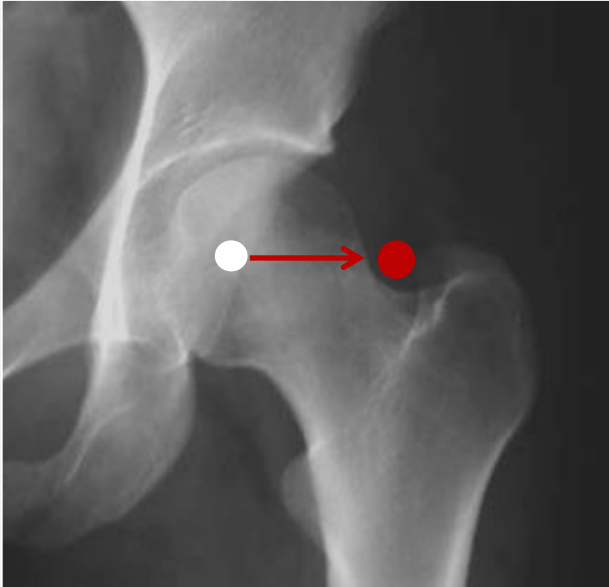
*Allentamento 2-5%*



*Trendelenburg per  
ipostenia abduttori*

*(Kelley et Al, J. Arthroplasty 1994)*

# Posizionamento laterale

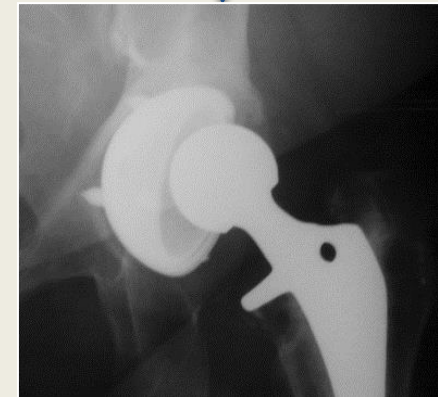


*Stress biomeccanici aumentati a 3000 N*

*(Kelley et Al, J. Arthroplasty 1994)*

# Posizionamento laterale

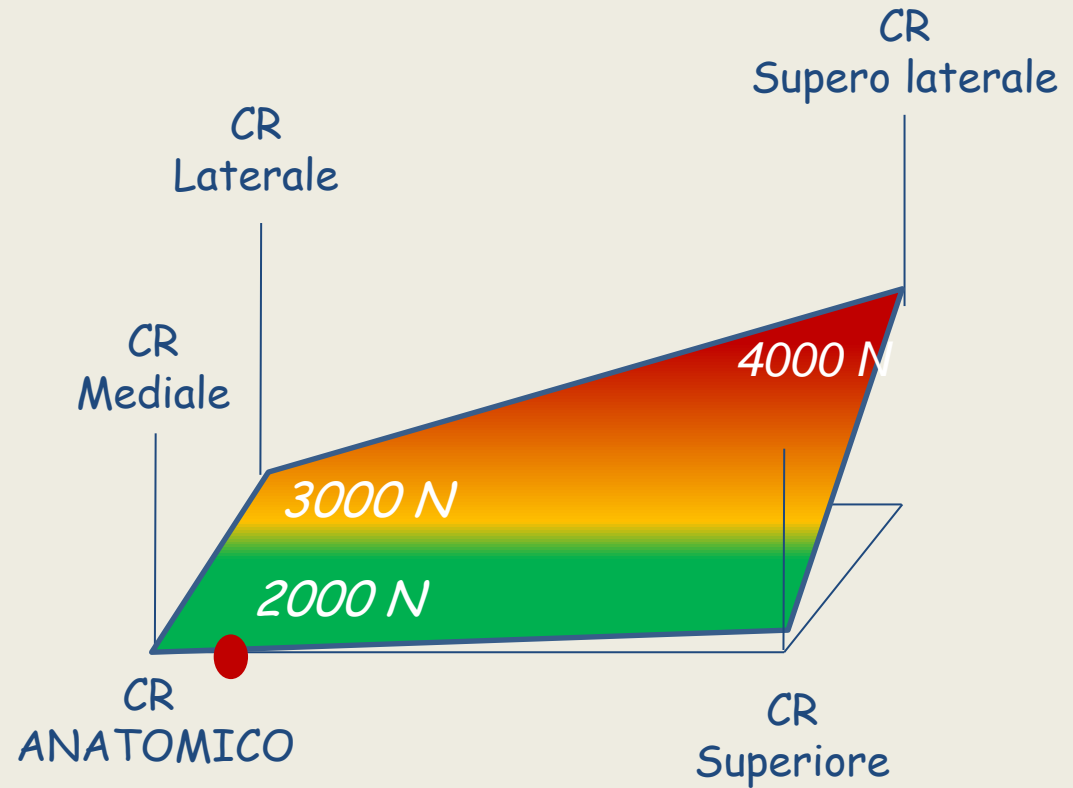
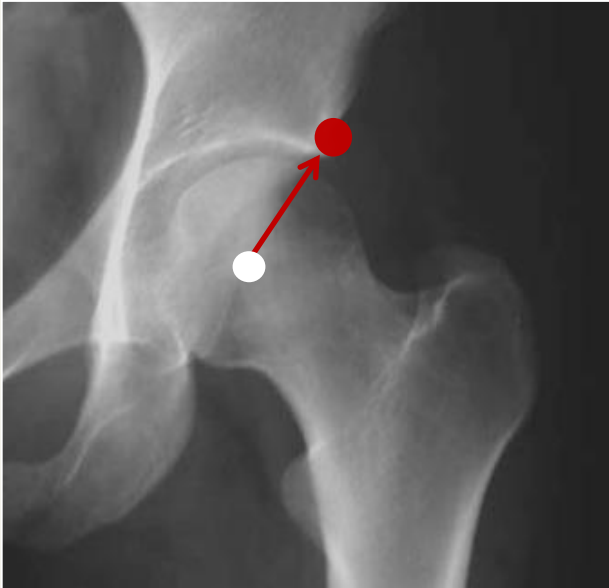
Offset acetabolare	Abduzione cotile	Forza Torzionale (Nm)
4	45	3.86
4	65	6.26
4	65	6.37
4	65	6.53
10	45	9.65
10	65	15.64
10	65	15.92
10	65	16.32



*Allentamento 7%  
F.U. 4 yrs*

*(Giori, J. Arthroplasty 2003)*

# Posizionamento superolaterale



*Stress biomeccanici aumentati a 4000 N (+100%)*

*(Kelley et Al, J. Arthroplasty 1994)*



# Posizionamento superolaterale



*Necessario incremento F del 116%*



*Trendelenburg ++*

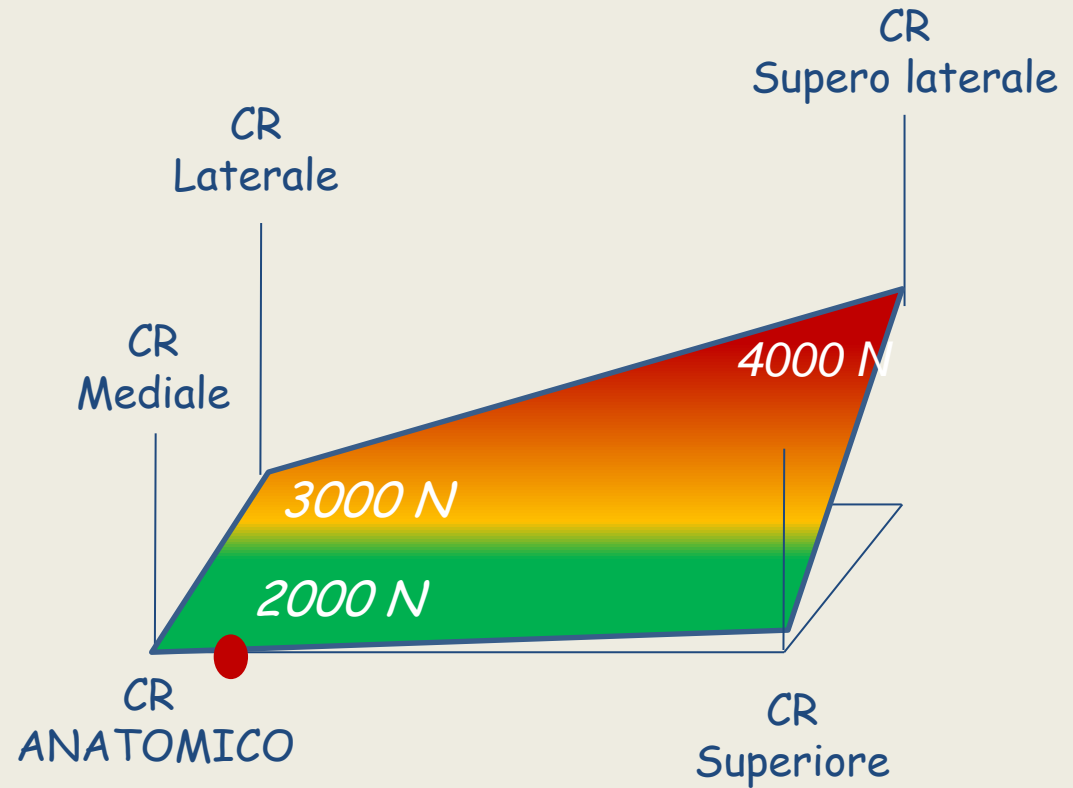
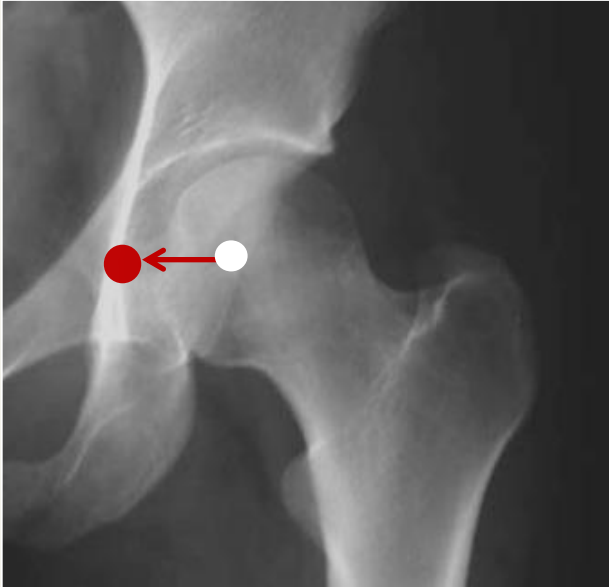


*Fallimenti  
(14%-45%)*



*Lussazione  
(20-48%)*

# Posizionamento mediale

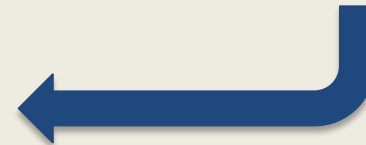
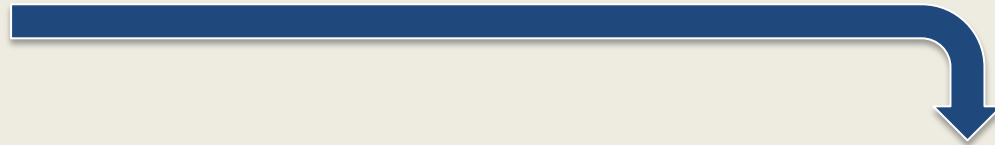
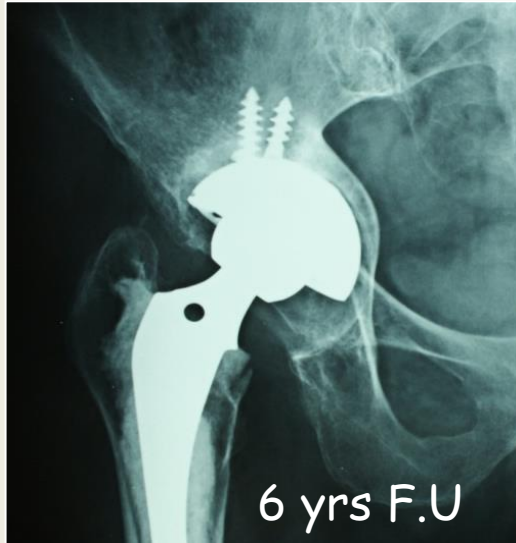


*Stress biomeccanico si riduce a 1500 N  
(ma anche minire resistenza ossea)*

*(Kelley et Al, J. Arthroplasty 1994)*

# Posizionamento mediale

minore resistenza ossea!



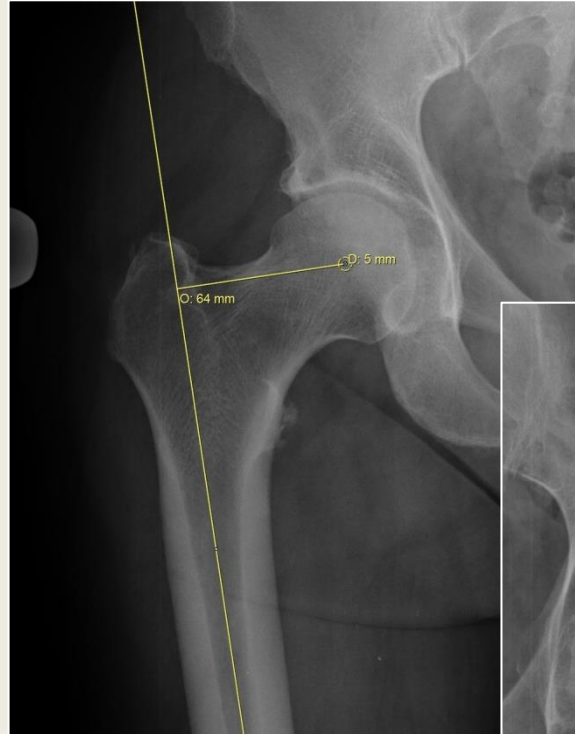
# Le variabili

Centro di  
Rotazione

Offset

Dismetria

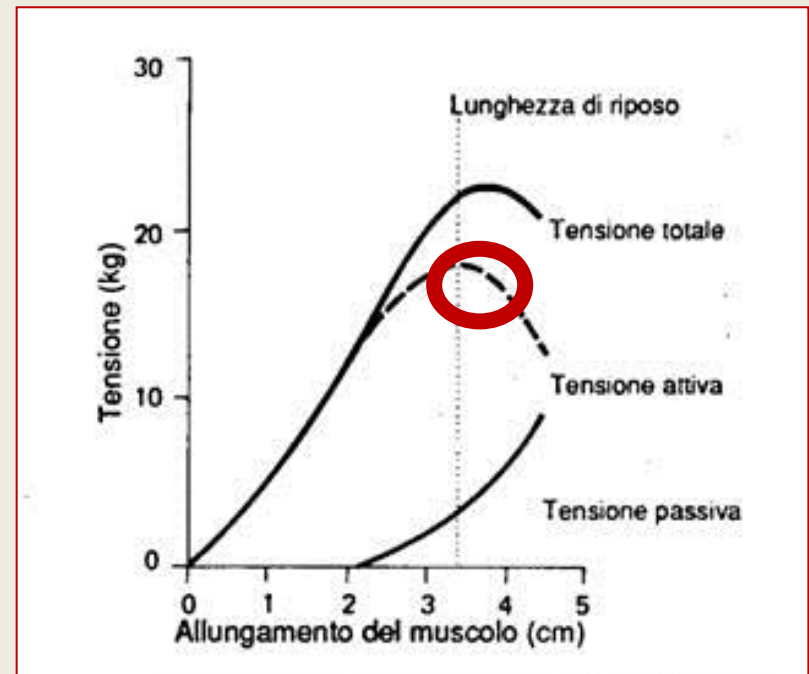
Posizionamento  
componenti



# Offset eccessivo



Rapporto tra i bracci di leva  
vantaggioso ma eccessiva  
tensione muscolare





# Offset eccessivo



Incremento stress  
interfaccia stelo cemento  
(Gruen 6 e 7)



Incremento stress articolare



Borsite g.t.

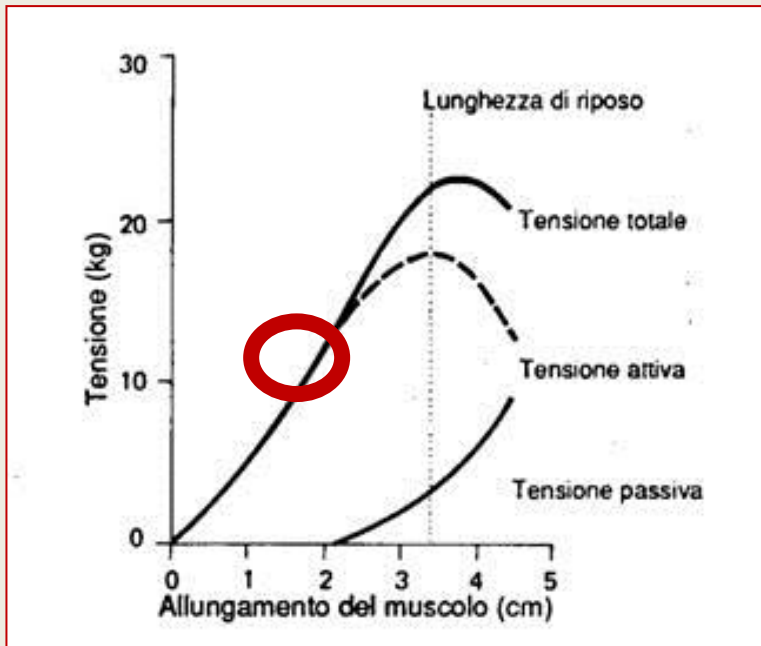


Incremento stress impianto  
(rottura da fatica)

# Offset ridotto

Rapporto dei bracci di leva  
svantaggiosi

Ridotta tensione muscolare



-12% (5mm): astenia

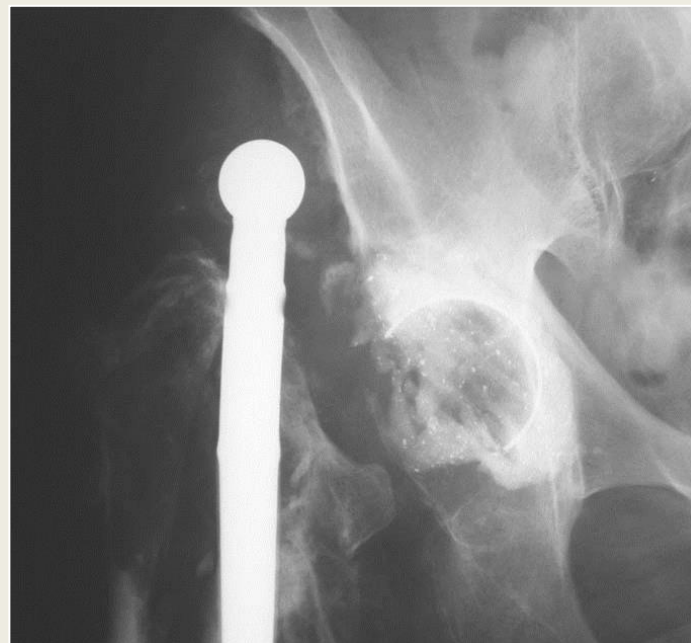
-28% (11,7mm): scompenso

*(Asayama, J. Arthroplasty 2005)*

# Offset ridotto



Impingement



Aumentato rischi lussazione  
*16% 3 mesi FU*

# Offset ridotto

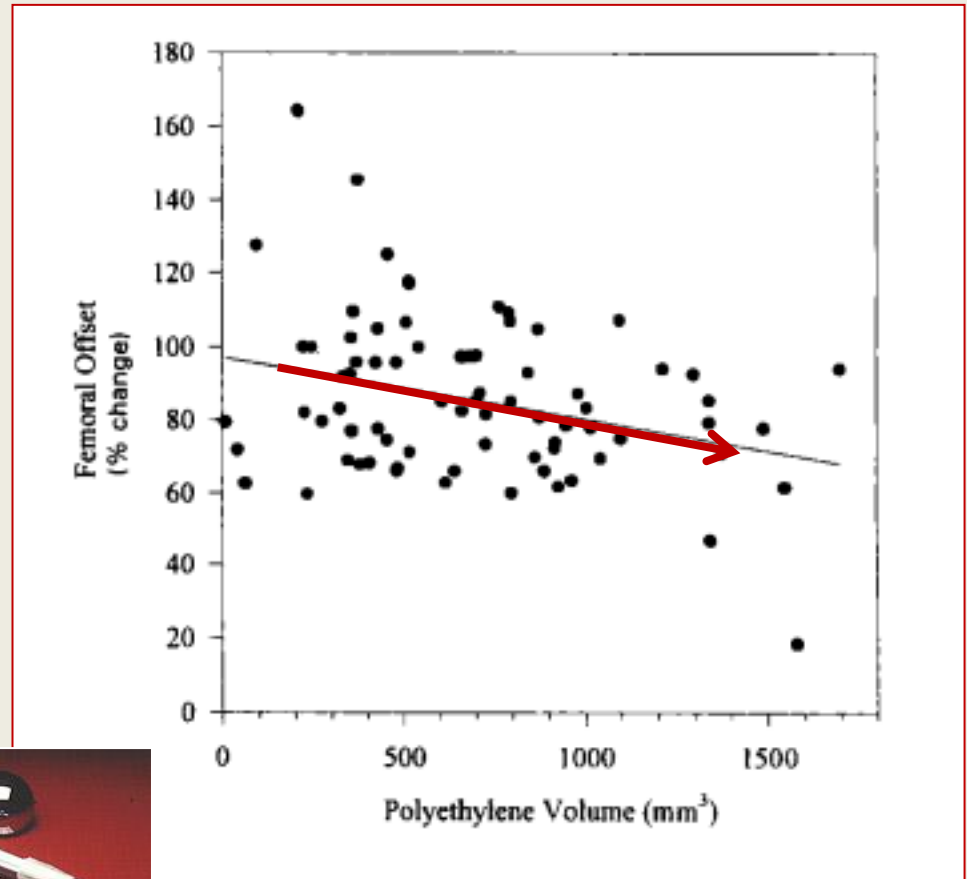
*Ginocchio valgo*



# Offset ridotto

Incremento wear

Fino a 150 mm<sup>3</sup>cubi/anno



*(Devane, Clin Orthop 1999)*



# Le variabili

Centro di  
Rotazione

Offset

Dismetria

Posizionamento  
componenti

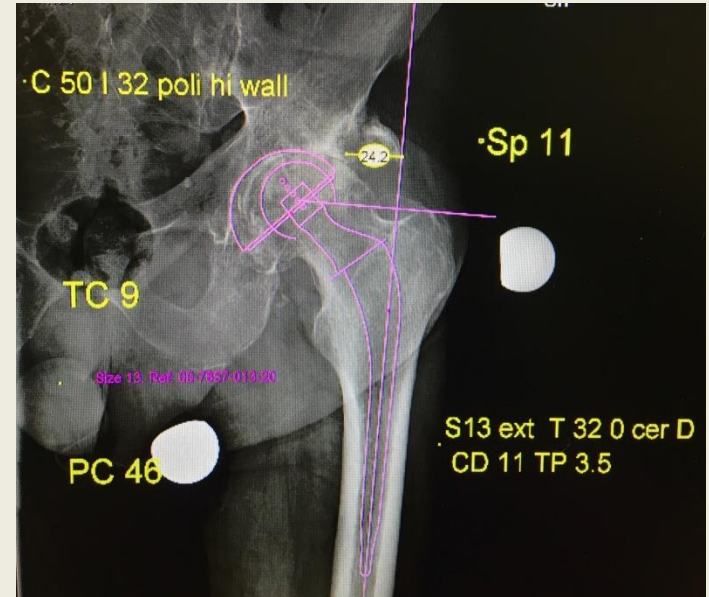


# Dismetria

## valutazione



VS



Manuale intraoperatoria

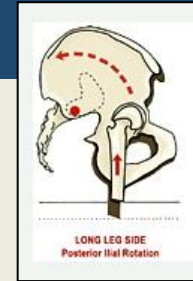
Planning

*Scarto medio 8mm*

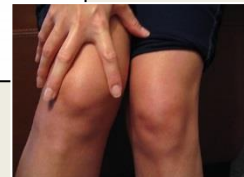
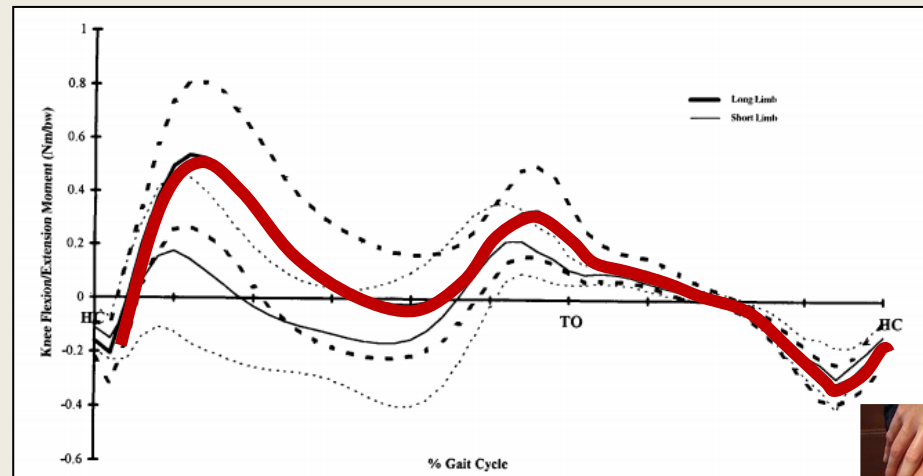
*Neyret, Rev Chir Orthop 2003*

# Ipermetria

Deambulazione  
con obliquità pelvica  
(rotazione esterna)



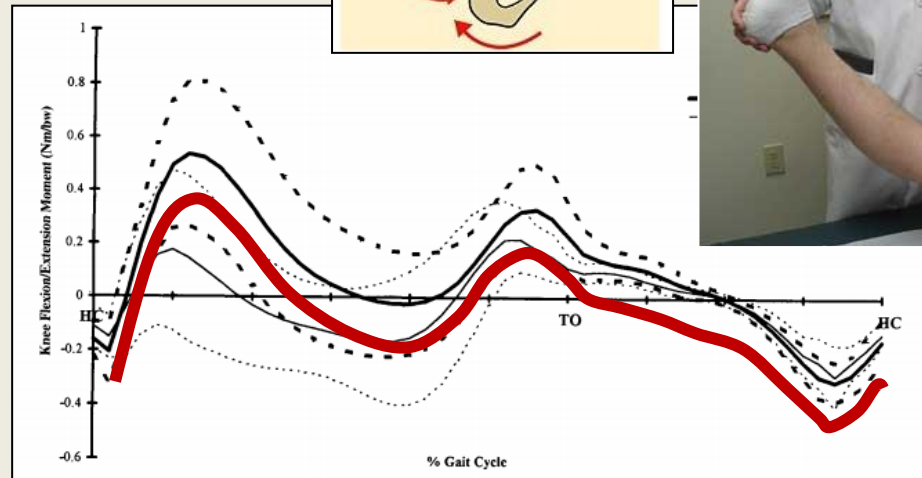
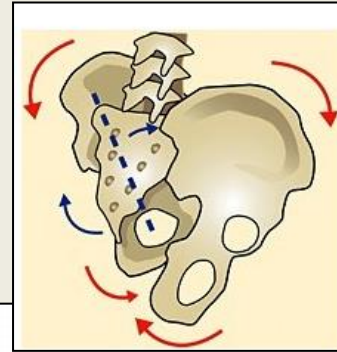
Ginocchio  
omolaterale  
flesso  
(alterazione del passo)



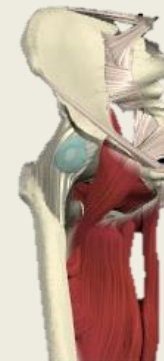
# Ipometria

Deambulazione  
compensata con obliquità pelvica  
(rotazione interna/flessione)

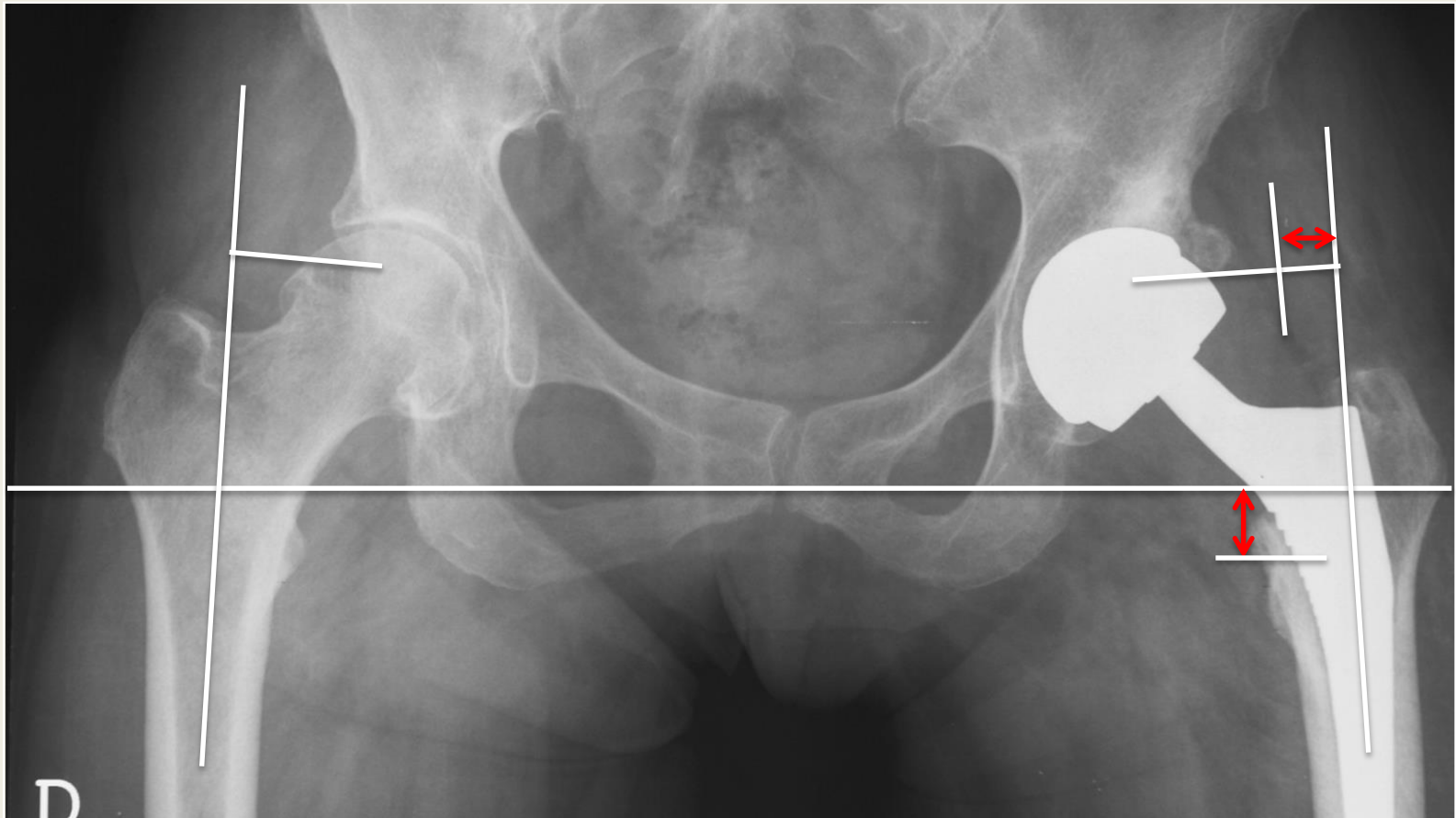
Ginocchio  
omolaterale  
iperesteso  
(alterazione del passo)



Parziale insufficienza del  
quadricipite ileopsoas  
glutei



# Condizione peggiore



Allungamento + ↑ Offset



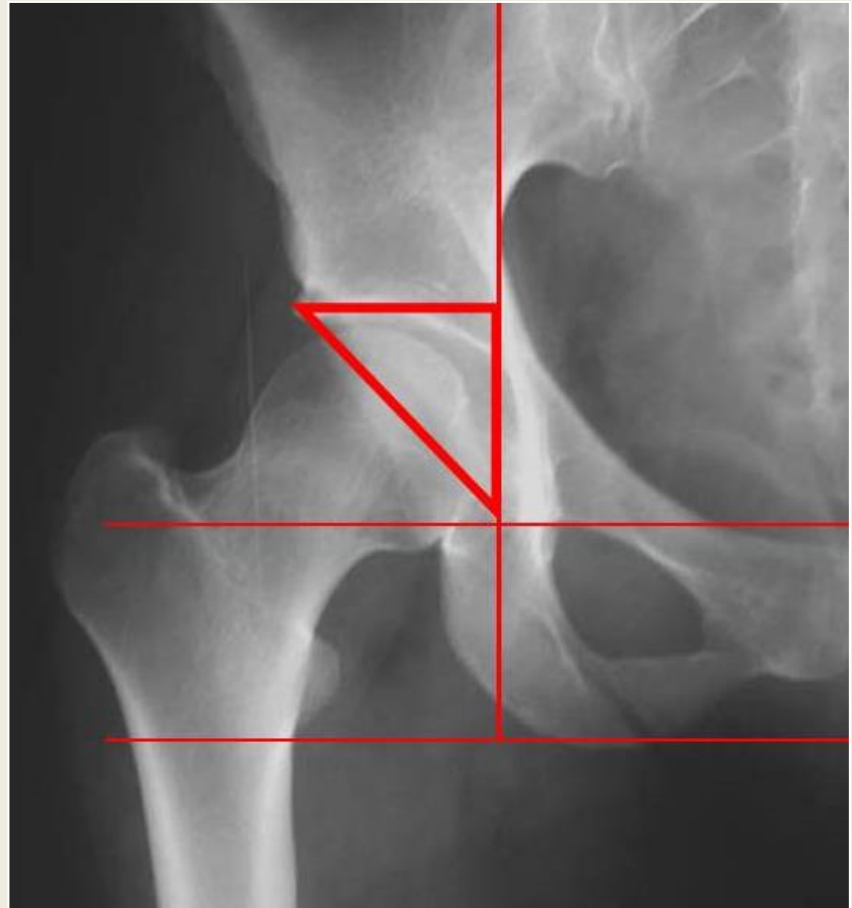
# Le variabili

Centro di  
Rotazione

Offset

Dismetria

Posizionamento  
componenti



Triangolo Ranawat

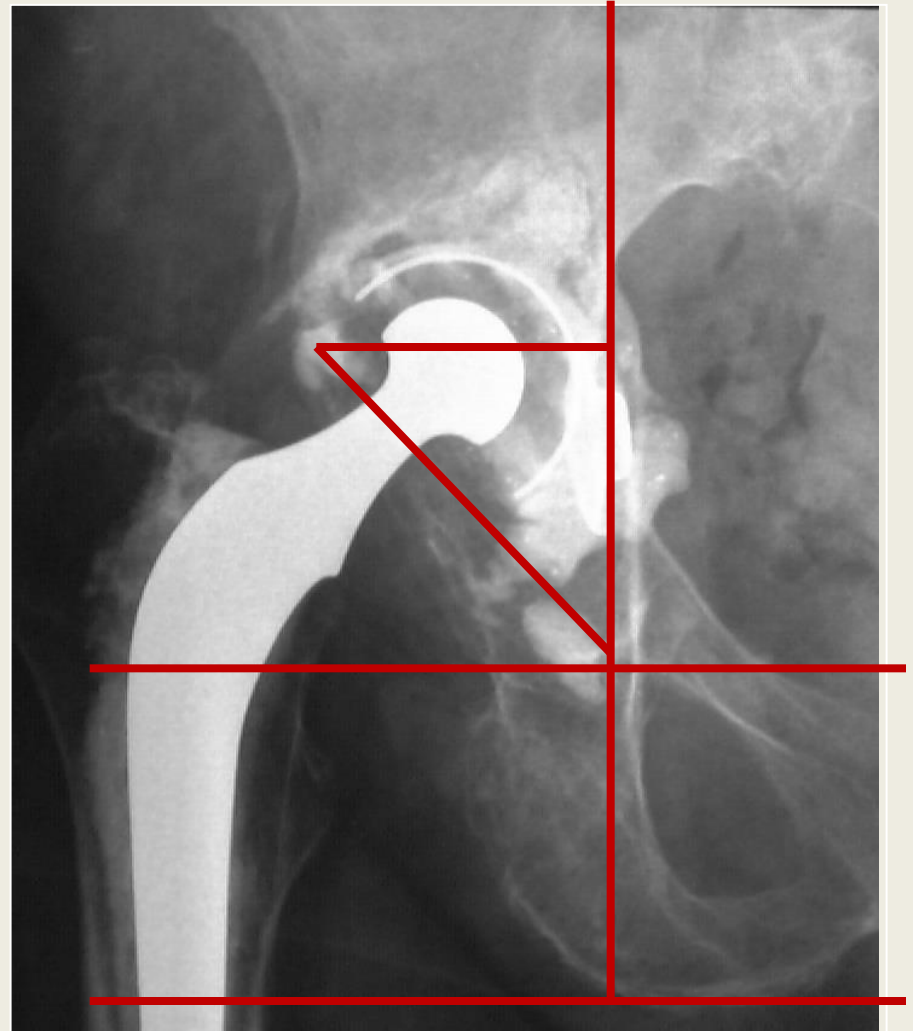
*(Ranawat, JBJS-A, 1980)*

# Difetti Posizione

Fuori  
triangolo Ranawat

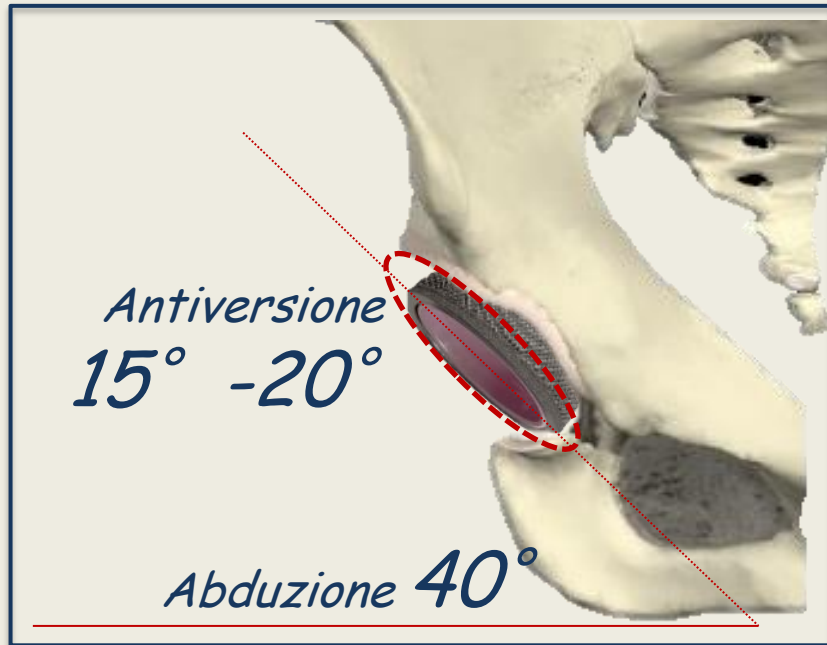
Incremento stress 100-  
200%

Elevata incidenza  
fallimento



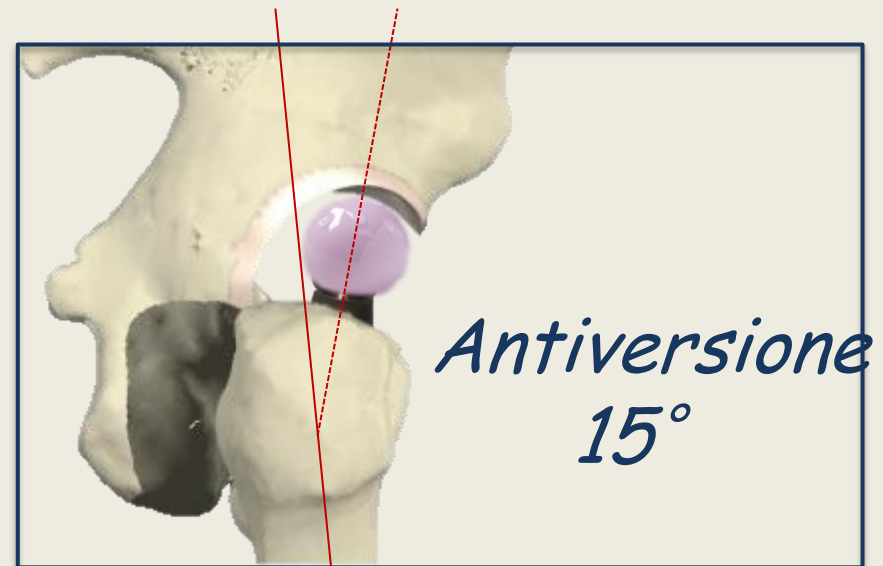
(Marcucci et Al. Arch. Putti, 1997  
Hirakawa, Clin Orthop, 2001)

# Posizione

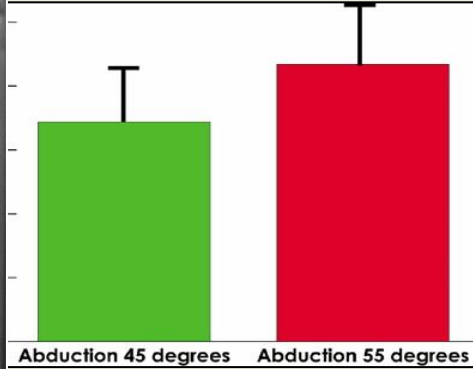


Componente  
Femorale

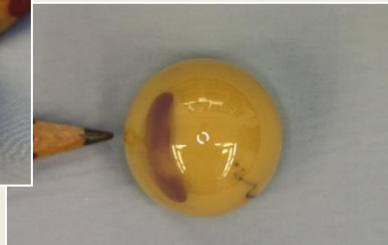
Componente  
Acetabolare



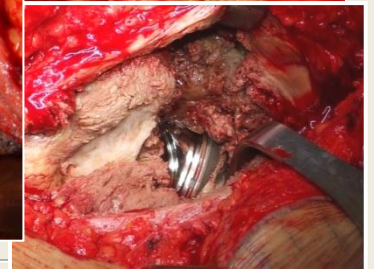
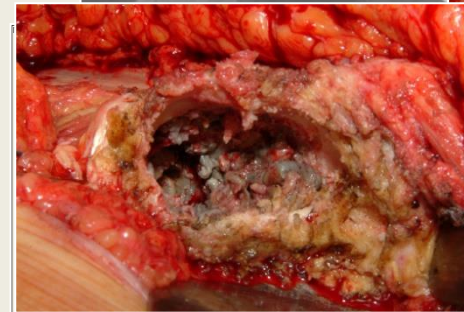
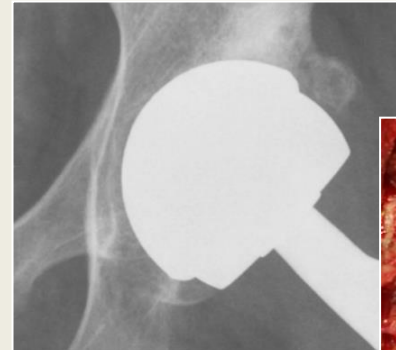
# Difetti Orientamento



Polietilene  
*Incremento wear*



Ceramica  
*Squeaking*



Metallo  
*Metallosi - Sindrome Alval*

(Shantanu, JBJS Am, 2003)

# Difetti Orientamento



Impingement  
componenti



Lussazione



Considerazioni

Conclusive

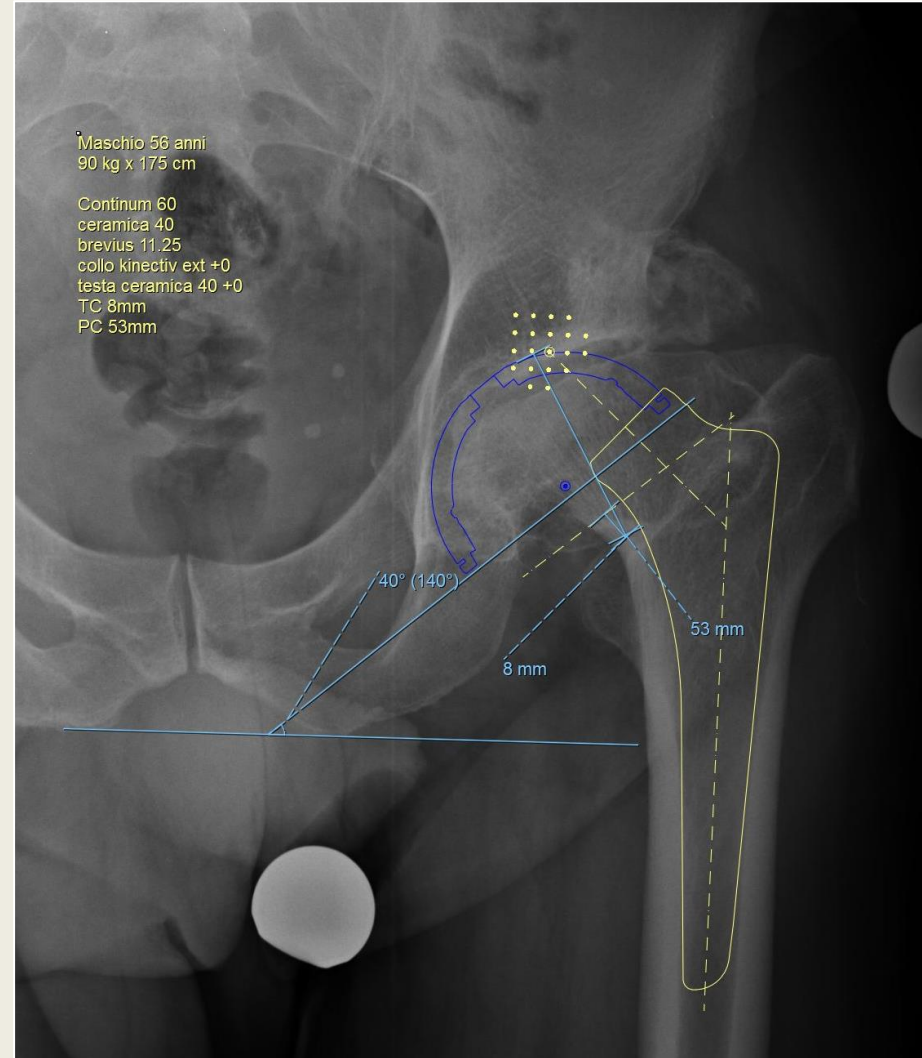
# Planning

Strumento che  
~~aiuta a...~~

è indispensabile a

-ripristinare fedelmente  
biomeccanica

-scegliere ed impiantare  
la protesi



# Senza Planning rischio di...

*Mancato recupero*

CR, Eterometria,  
Offset

*Errato posizionamento e  
dimensionamento*

Componenti

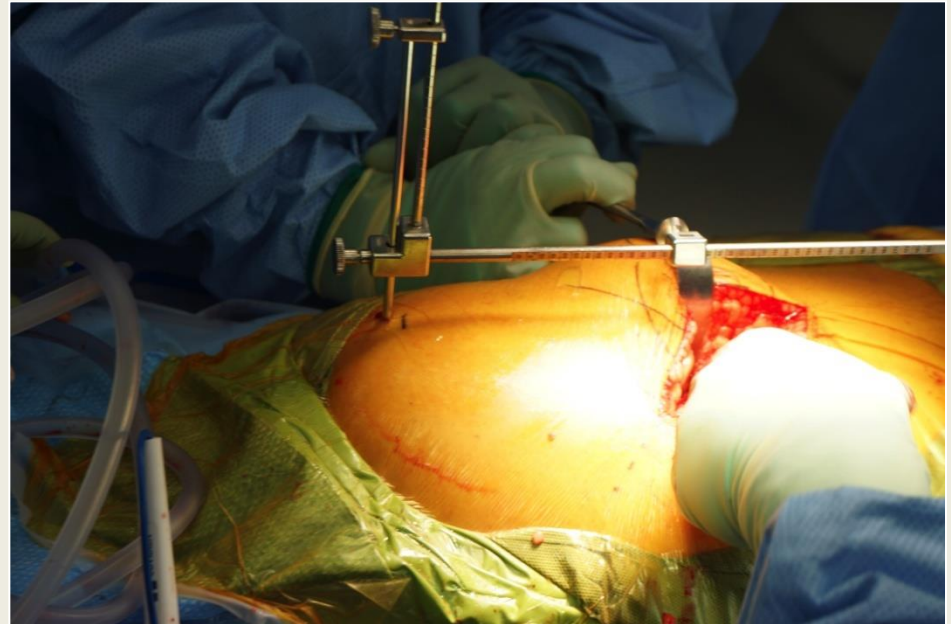
Conseguenze meccaniche  
impianto

Manifestazioni  
cliniche



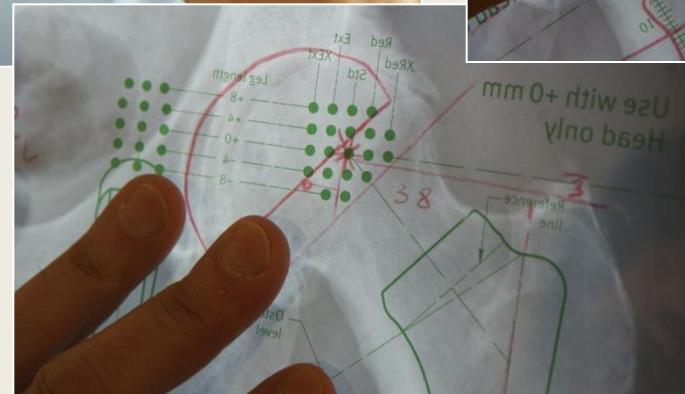
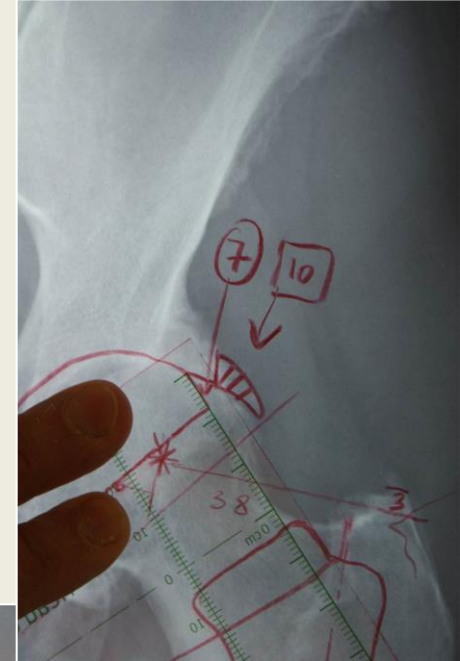
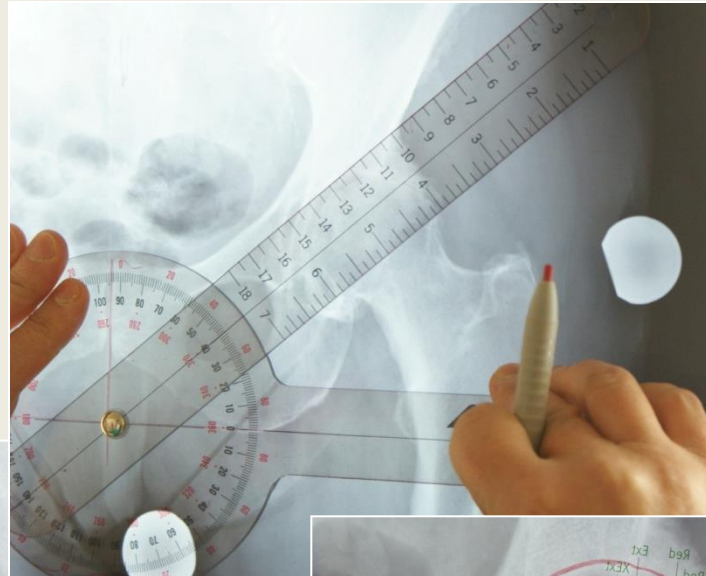
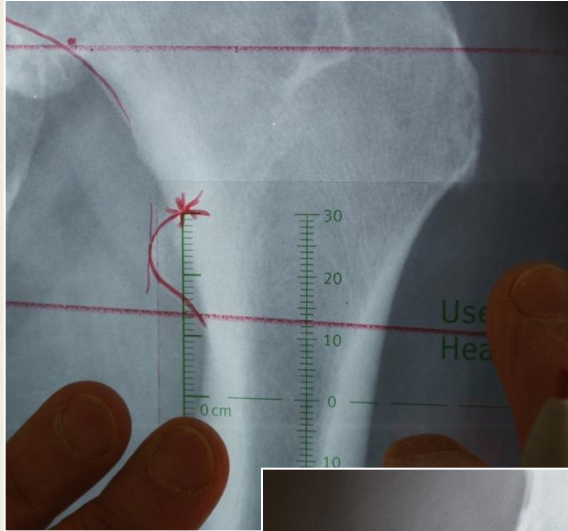
# L'altro Ieri

## Pianificazione intraoperatoria



# Ieri/Oggi

## Pianificazione manuale



ricerca del dettaglio



# Oggi

## Pianificazione Preoperatoria Computer Assistita

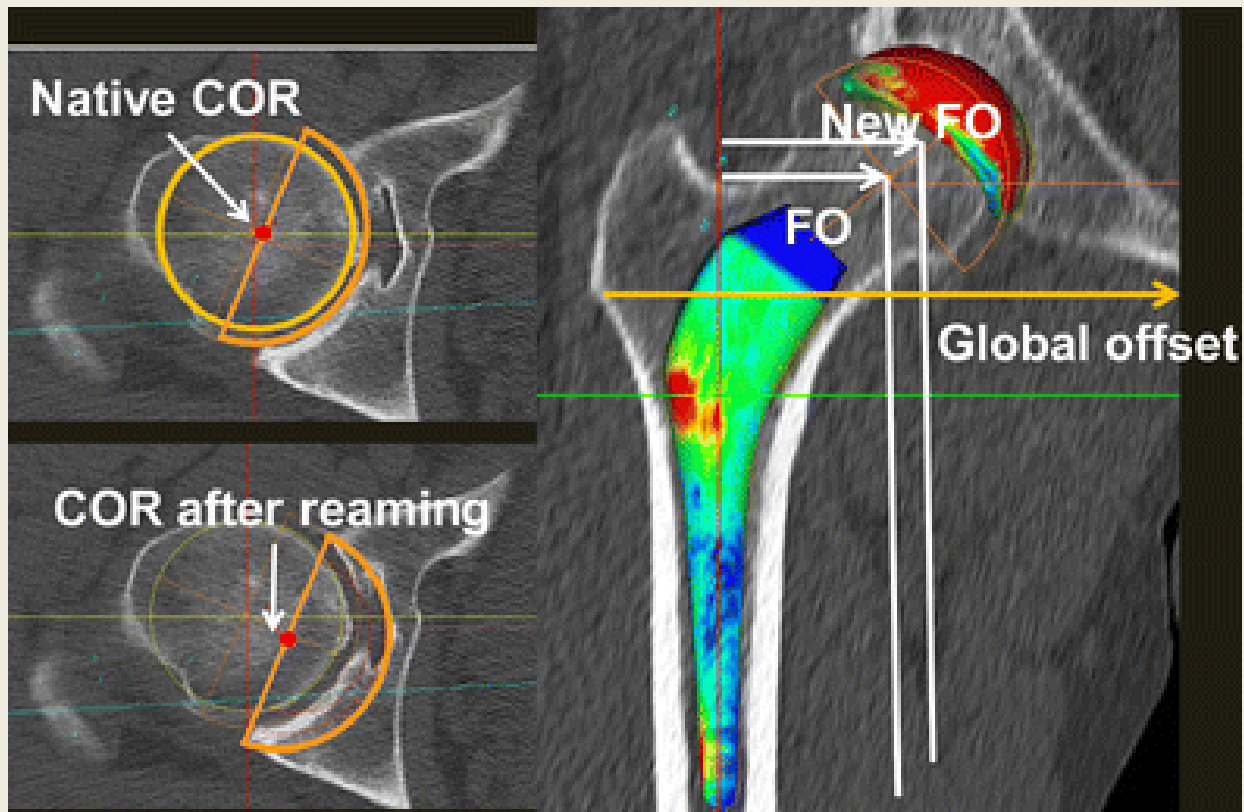


ricerca del dettaglio

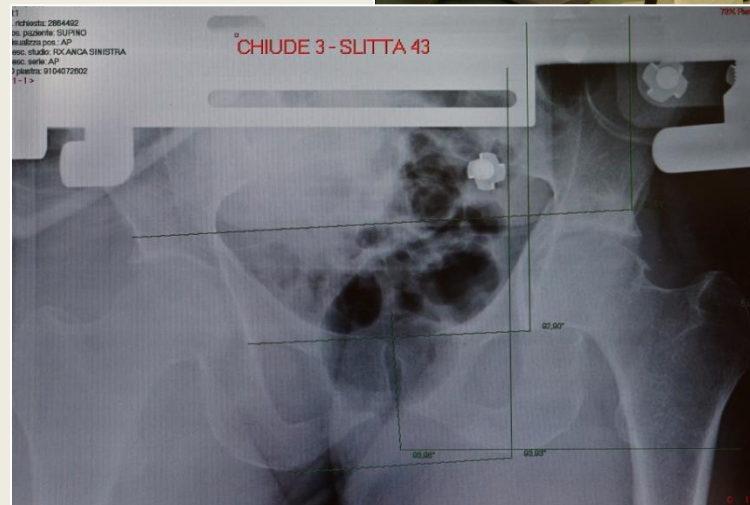
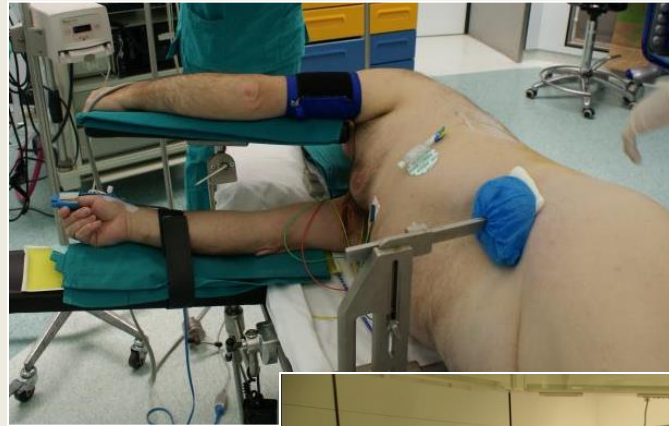


# Oggi/Domani

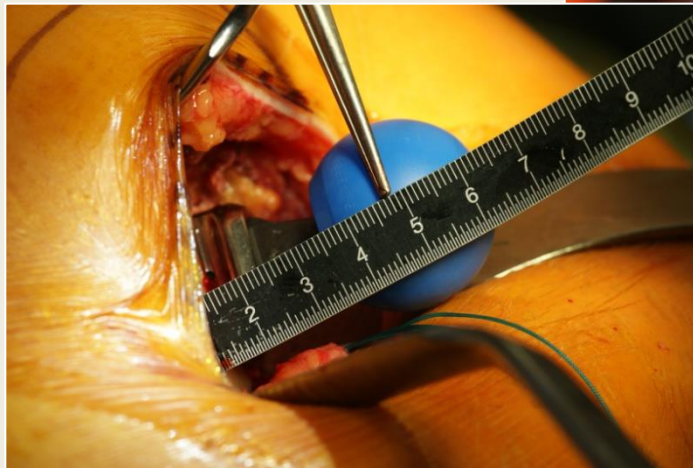
## Pianificazione Preoperatoria 3D



associata ad  
altrettanta  
accuratezza  
e check  
pre-operatori.....

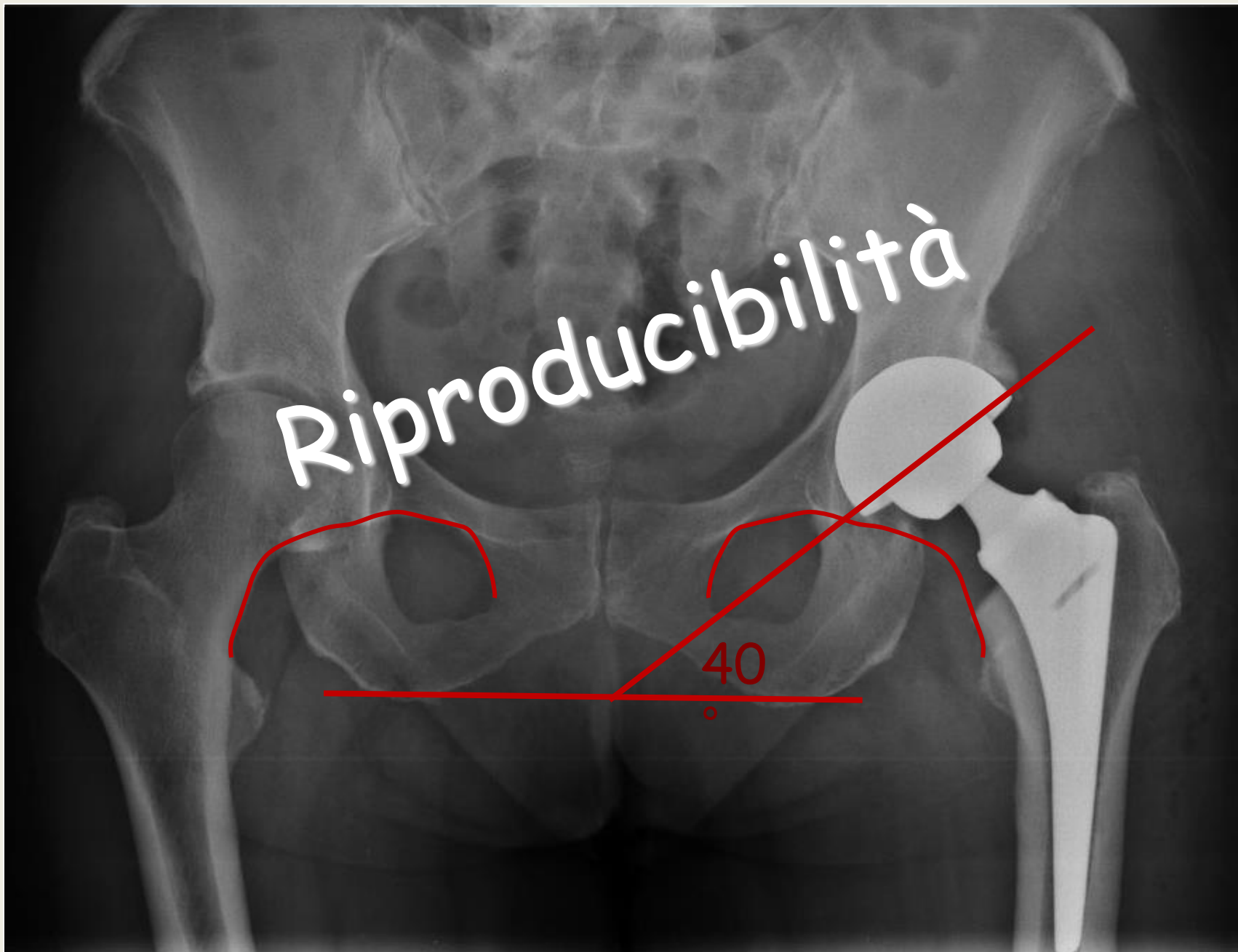


.. e intra-operatori



Riproducibilità

40°

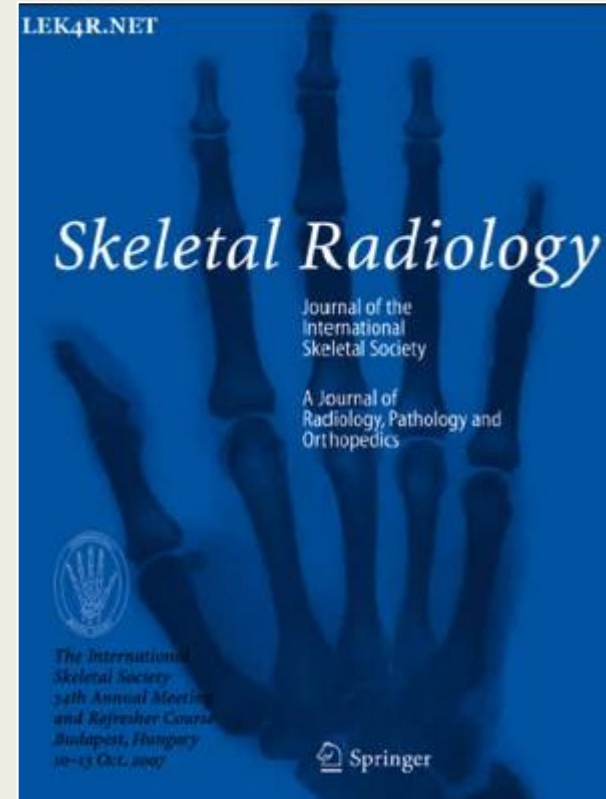


# Pianificazione Preoperatoria

## *Nostra Esperienza*

Ripristino CR *	98,2%
Recupero dismetria*	97,8%
Recupero Offset*	95,4%
Mismatch acetabolo	1,5%
Mismatch stelo	0,9%

\* sensibilità: scarto entro 2 mm



(Marcucci et Al. Skel.Rad, 2013)



# Pianificazione Preoperatoria

*La nostra esperienza nei primi 4 aa di CESAT*

Apertura  
impropria  
delle componenti

*letteratura*      *Protocollo  
CESAT*

*3%*

*0%*







GRAZIE

## **DIGITALE 2D E 3D SU RADIOLOGIA DIGITALE**

**Marco Villano**

**Clinica Ortopedica**  
CTO, Azienda Ospedaliero-Universitaria Careggi, Firenze, Italia

CONGRESSO NAZIONALE DELLA  
**SOCIETÀ ITALIANA DELL'ANCA**

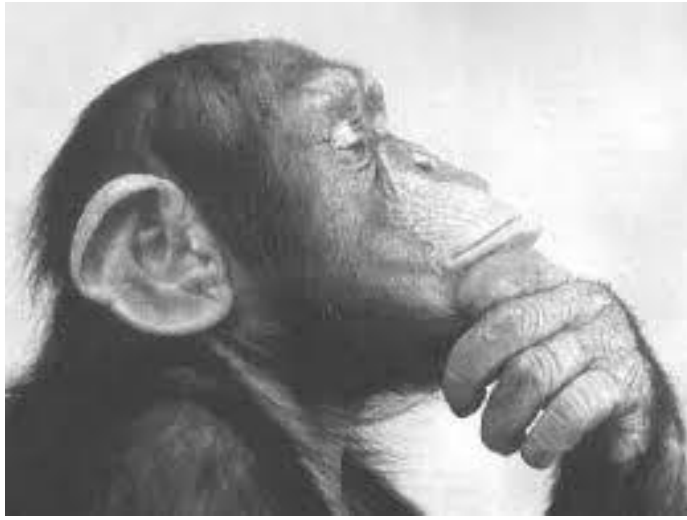


**19-20**  
settembre 2019

**BERGAMO**

**20 Settembre 2019**

# Planning nella protesi primaria

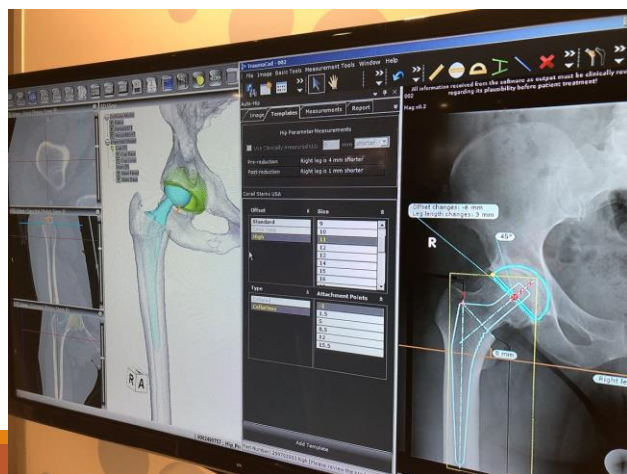


**COSA fare?**

**COME fare?**

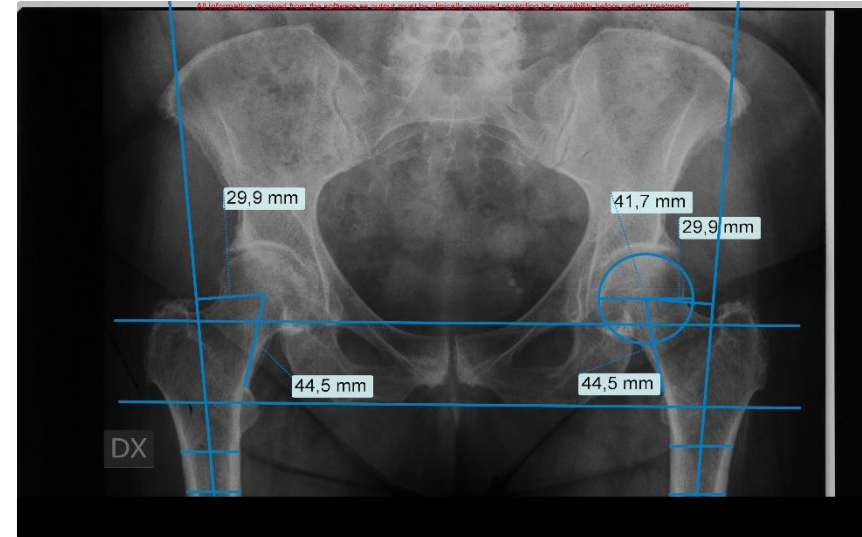


# Software per Planning digitale 2D e 3D



# Misurazione digitale = Planning più agevole

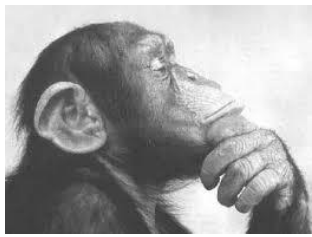
- Centro di rotazione
- Offset globale (OF + OA)
- Dismetria anca / arti inferiori
- Inclinazione acetabolare
- Angolo cervico-diafisario
- Taglia delle componenti
- Versione acetabolare e femorale



**ACCURATEZZA !!**



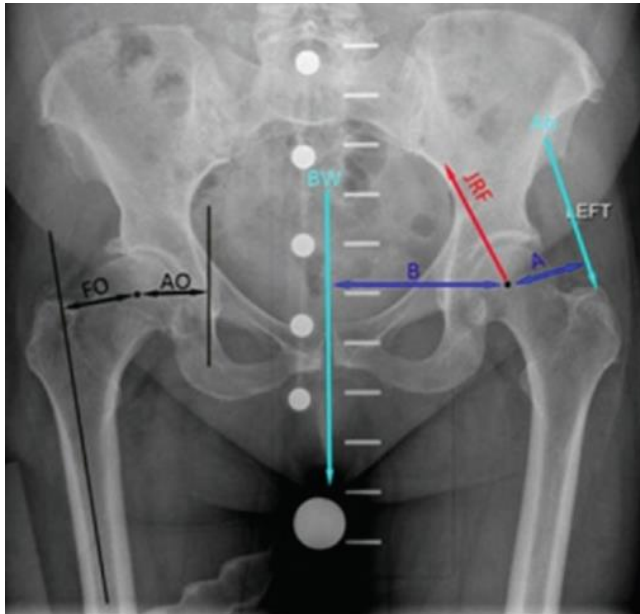




# Planning digitale 2D

## CENTRO DI ROTAZIONE / OFF SET GLOBALE

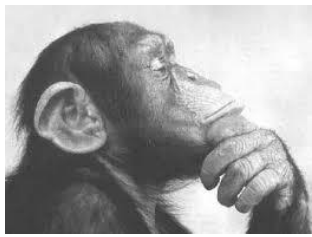
$$JRF = BW \times B - Ab \times A$$



Posizione mediale tra 2-5 mm:

- ↓ l'OA ... necessario aumentare l'OF
- ↑ il braccio di leva degli abduttori
- ↓ Joint Reaction Force minor rischio di usura







# Planning digitale 2D

## CENTRO DI ROTAZIONE

### Posizione superolaterale oltre i 5mm:

-  l'OA...necessario diminuire OF
-  il momento abduttore con maggior tasso di usura

Clin Orthop Relat Res (2011) 469:429–436  
DOI 10.1007/s11999-010-1554-7

SYMPOSIUM: PAPERS PRESENTED AT THE HIP SOCIETY MEETINGS 2010

#### Hip Offset in Total Hip Arthroplasty

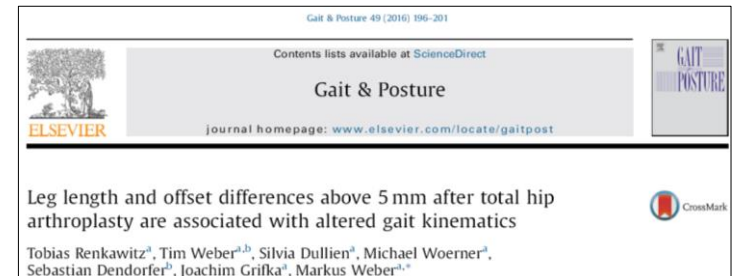
Quantitative Measurement with Navigation

Manish Dastane MD, Lawrence D. Dorr MD,  
Rupesh Tarwala MD, Zhinian Wan MD

**Manish, CORR 2010**

### Posizione prossimale + di 3mm e medialmente + di 5mm:

- problemi nel ripristinare un offset globale e lunghezza corretti

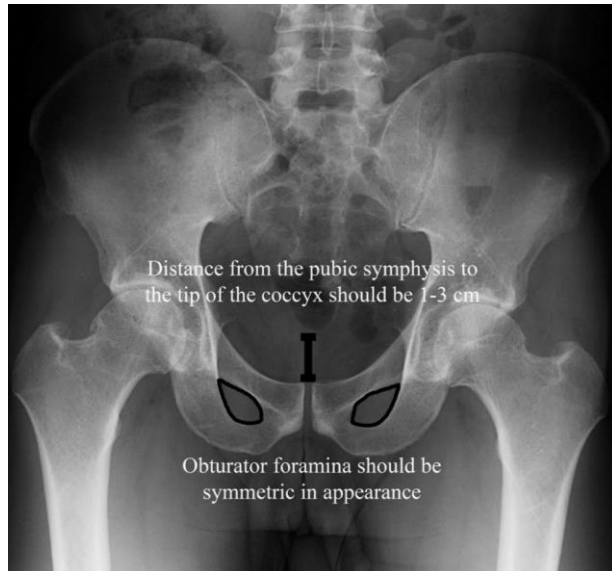


**Renkawitz, 2016**

# ACCURATEZZA: da dove partire?

## RX corrette

### Bacino per anche in ortostasi



- Anche intraruotate di 15°
- Coccige in linea con la sinfisi pubica
- Forami otturatori simmetrici
- Tubo rad. a 1,15m dalla lastra
- Calibro mediale o laterale

### Laterale vera (cross-table)

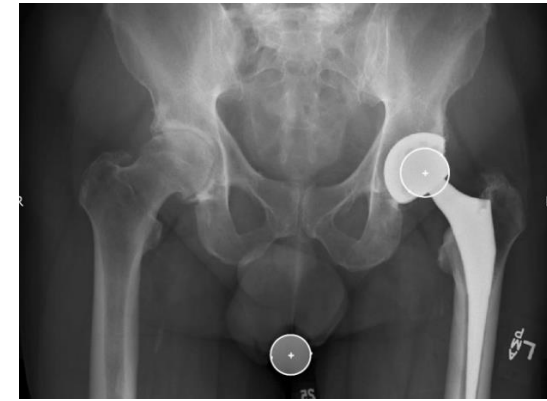


- Lastra a 45° rispetto l'asse long
- Tubo rad. mediale perpendicolare
- Rotazione dell'anca in funzione del collo femorale da visualizzare

# CALIBRO

## utile nel planning ma...

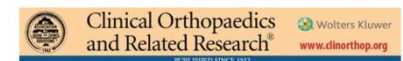
100 pazienti con PTA



Misurazione con software digitale della magnificazione  
“vera” (testina protesica) vs “misurata” (calibro)

- Inaccuratezza con il calibro (sottostima media del 6%)
- Migliore accuratezza con magnificazione standard del 20%

Measurement method	Using magnification marker	Using a standard 20% magnification*
Measurement within 2% of “true magnification”	20/100	64/100
Measurement greater than 4% deviation from “true magnification”	59/100	4/100



*Clin Orthop Relat Res.* 2016 Aug; 474(8): 1812–1817.  
Published online 2016 Jan 21. doi: 10.1007/s11999-016-4704-8

PMCID: PMC4925406  
PMID: 26797909

Inaccuracies in the Use of Magnification Markers in Digital Hip Radiographs

Michael J. Archibeck, MD,<sup>1,4</sup> Tamara Cummins, RT,<sup>1</sup> Krishna R. Tripuraneni, MD,<sup>1</sup> Joshua T. Carothers, MD,<sup>1</sup>  
Cristina Murray-Krezan, MS,<sup>2</sup> Mohammad Hattab, PhD,<sup>3</sup> and Richard E. White, Jr, MD<sup>1</sup>

**Archibeck et al, 2016**

### Variabile distanza ed angolazione dal raggio incidente

Boese AI, 2015

# Planning digitale 2D

CONSIDERARE LA CORRETTA ROTAZIONE FEMORALE

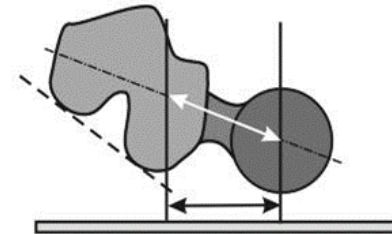
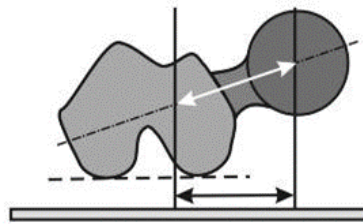
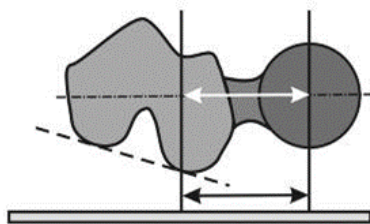
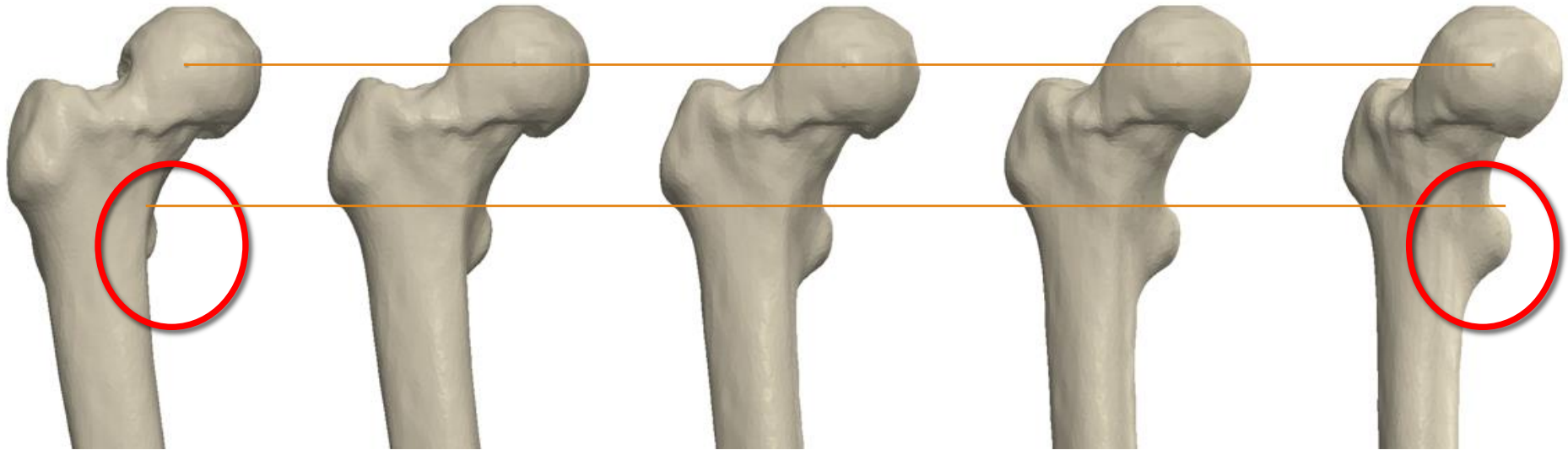
30° Int

15° Int°

Coronal

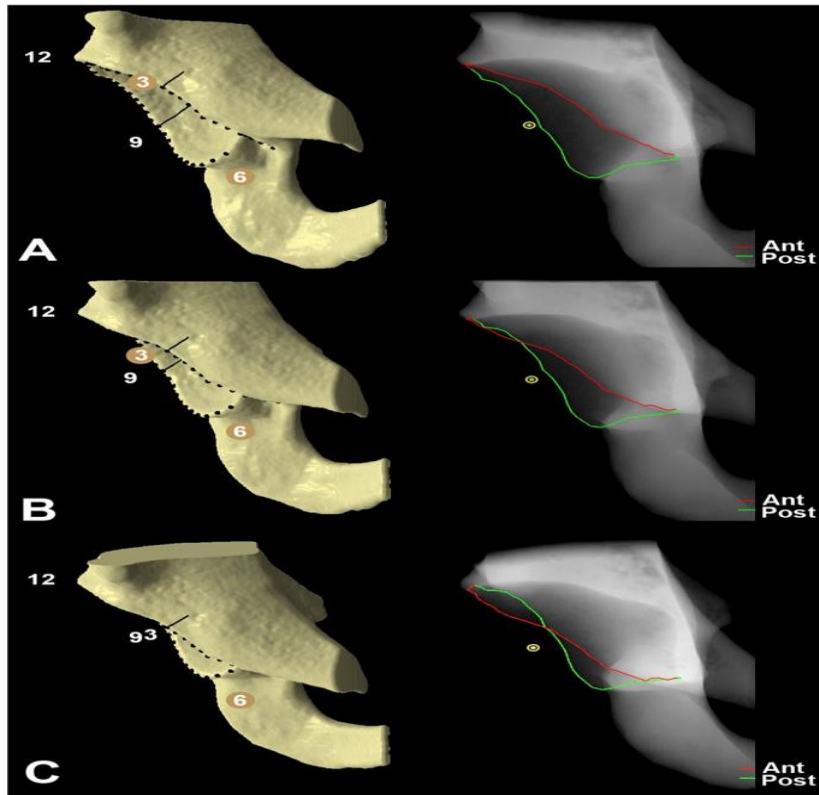
15° Ext

30° Ext

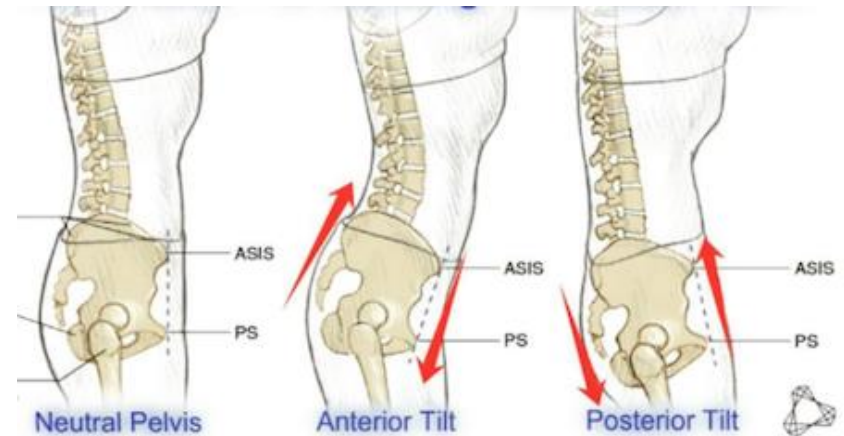


# Planning digitale 2D

## CONSIDERARE IL TILT PELVICO



Cambia la Versione e  
l'Inclinazione acetabolare



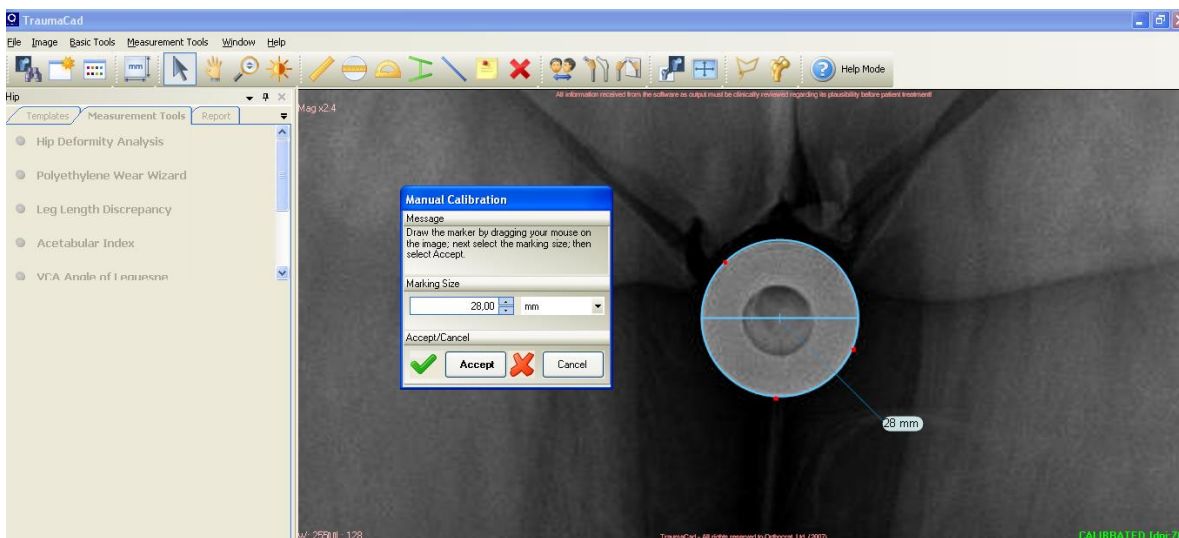


# Planning digitale 2D

## PLANNING “SISTEMATICO”

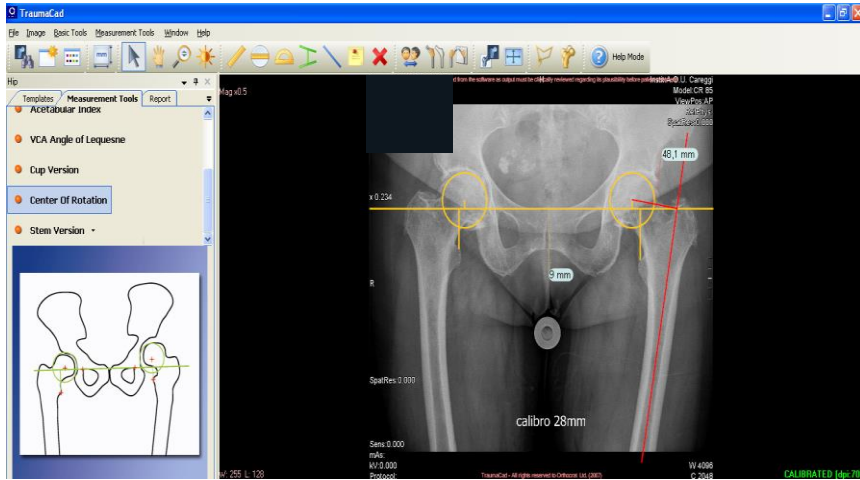


Elaborazione software  
dell'immagine digitale

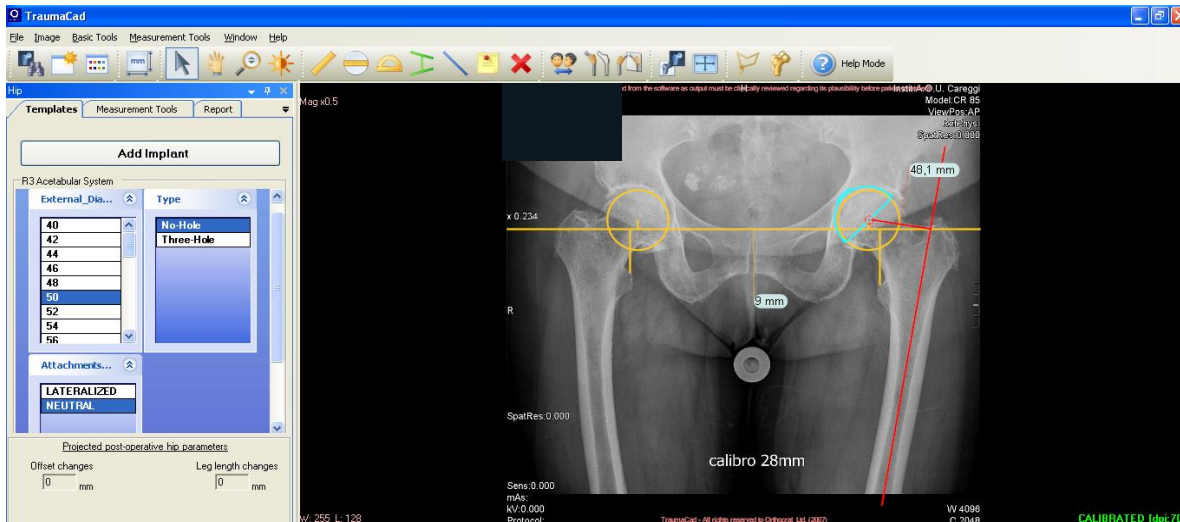


Calibrazione

# Planning digitale 2D



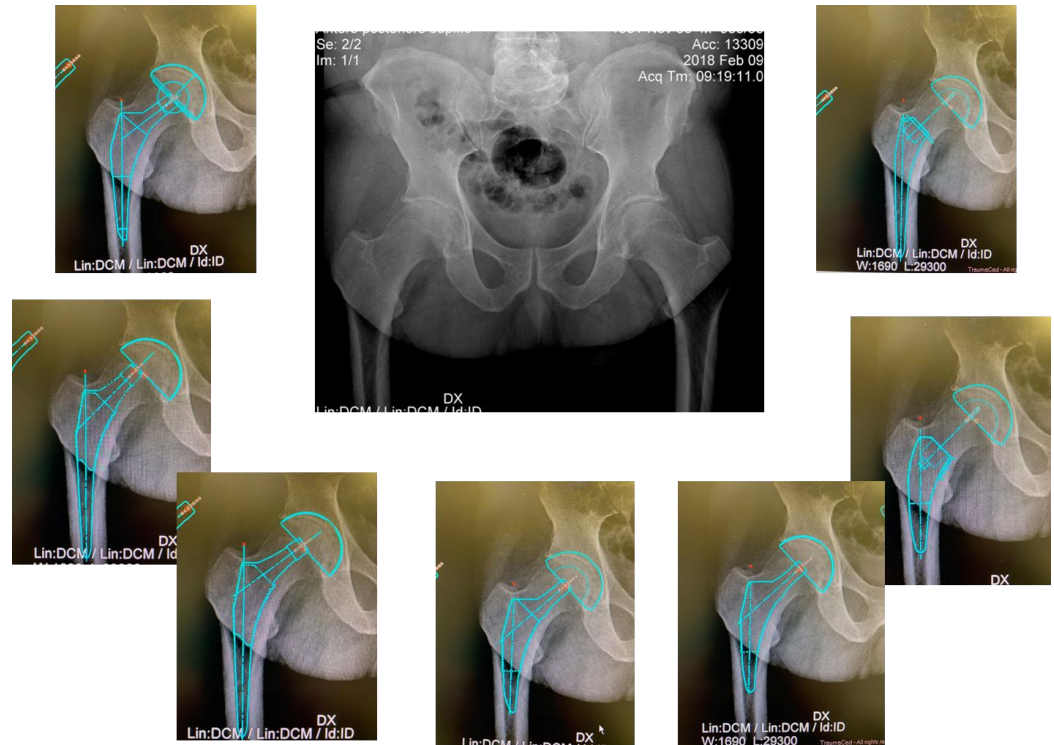
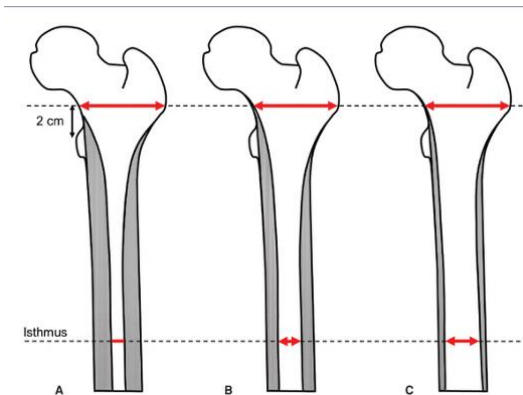
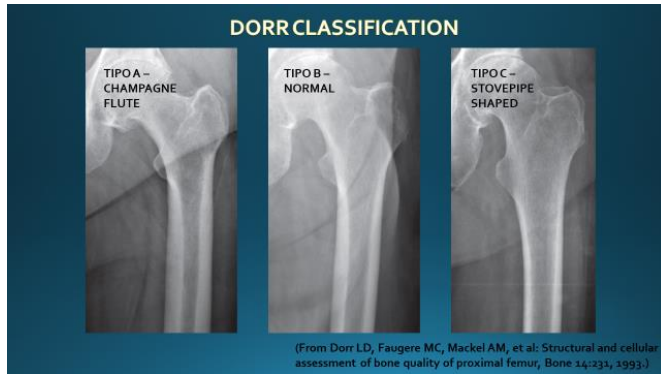
Definire  
centro di rotazione ed off-set  
ed eventuali dismetrie



Scelta della taglia  
acetabolare

# Planning digitale 2D

Scelta dello stelo più idoneo alla forma del canale...



# Accuratezza del Planning digitale 2D nella pianificazione delle componenti

+/- 1 TAGLIA

- Coppa: 16-62%
- Stelo: 30-69%

Della Valle, Int Orthop 2008

- |         |          |     |           |     |
|---------|----------|-----|-----------|-----|
| • Coppa | DIGITALE | 52% | ANALOGICO | 64% |
| • Stelo |          | 66% |           | 52% |

The B, Acta Orthop 2005

**RISULTATI MOLTO VARIABILI**

# Accuratezza del Planning digitale 2D

**+/- 1 TAGLIA**

- 632 pazienti
- coppa: 79%
  - stelo: 87%



	Stem size		Cup size	
	Occurrence	Percentage	Occurrence	Percentage
Implant size				
Perfect match	264	42.0	231	37.0
+/- 1 size	283	45.0	263	42.0
+/- 2 size	67	10.6	99	15.7
+/- 3 sizes and more	18	2.8	39	6.2

	Adequate femoral planning		Adequate acetabular planning	
Planner's experience				
Consultants	547	87.6	281	75.7
Residents	325	85.1	214	82.0
	$z = -2.11; p = 0.035$		$z = 0.64; p = 0.52$	
BMI				
Underweight	Eliminated because of low occurrence			
Normal weight	165	91.2	147	81.2
Overweight	233	73.5	216	77.4
Obese	147	87.0	130	76.9

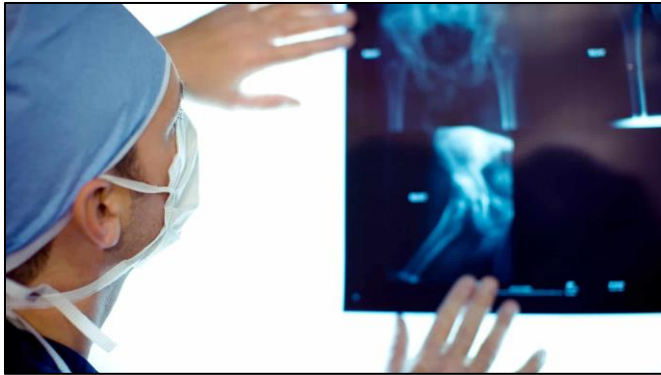
- Risultati variabili
  - per esperienza del chirurgo
  - in pazienti con elevato BMI

Holzer et Al, 2019



# *Planning nella protesi primaria*

2D



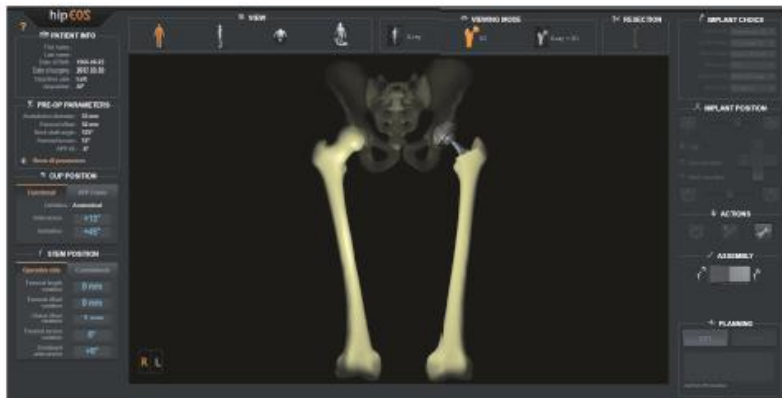
Vs

3D



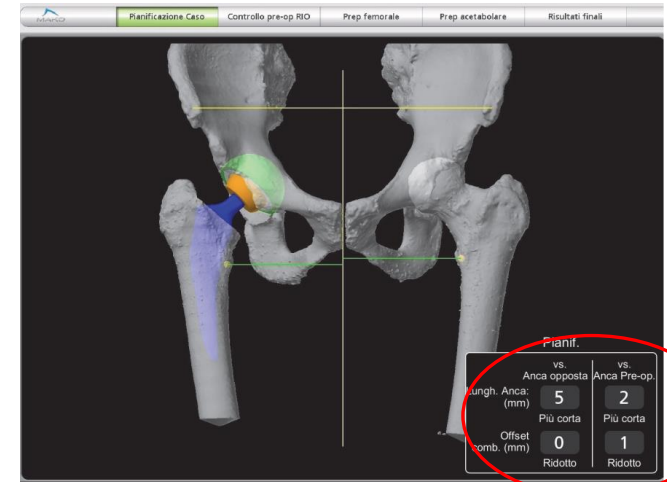
# Planning digitale 3D

RX sotto carico – dipendente



Vs

TC - dipendente



# Planning digitale 3D

## Vantaggi e Svantaggi

RX sotto carico  
dipendente

Vs

TC  
dipendente

- Simulazione 3D attraverso 2 proiezioni stereo-radiografiche a bassa esposizione
  - Possibilità acquisizione immagini in posizioni funzionali (posizione eretta, seduta e squat)
  - Non integra la robotica
- Modello 3D fedele
  - Integrazione Robotica con possibilità di modificare i parametri del planning durante la procedura chirurgica
  - Non permette analisi di posizioni funzionali

# digitale 3D - Rx dipendente vs digitale 2D

- Maggiore accuratezza nel predire taglia componenti, OF e LLD

Mainard, *BioMed Research International* 2019

- Più accurato e riproducibile in maniera significativa nel predire la taglia dello stelo

Mainard, OTSR 2017

- Permette di ottenere misurazioni di offset più accurate e affidabili con bassa esposizione alle radiazioni.

Lazennec, Int Orth 2014

# digitale 3D - Rx dipendente vs digitale 2D

## RIPRODUCIBILITA' ANALOGA

		Stem	Cup	
	Operators	ICC		Type
2D	Op_1 - Op_2	0.91	0.71	Inter
3D	Op_1 - Op_2	0.88	0.84	Inter
	Op_1	0.88	0.91	Intra
	Op_2	0.92	0.96	Intra

Ripetizione 3D delle misurazioni:  
stessa taglia

**STELO in 19/31 (61%)**

**COPPA per 18/30 (60%).**

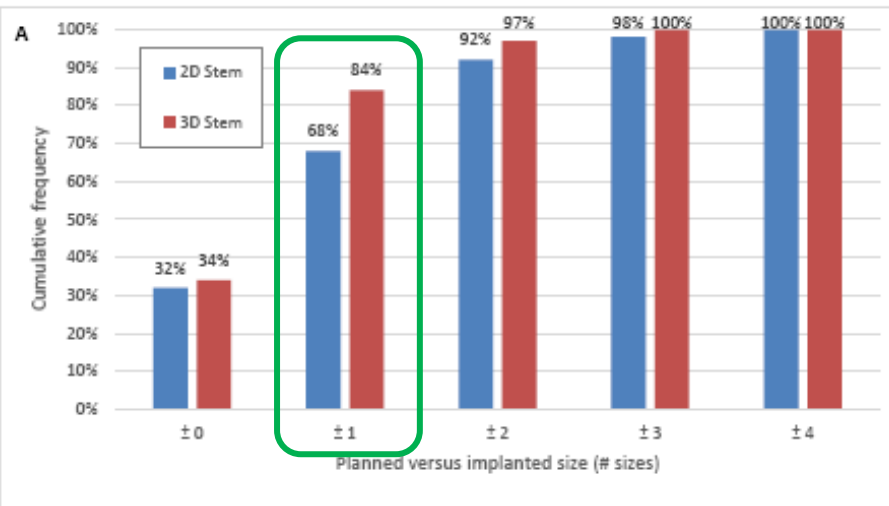


# digitale 3D - Rx dipendente vs digitale 2D

**MIGLIORE ACCURATEZZA**

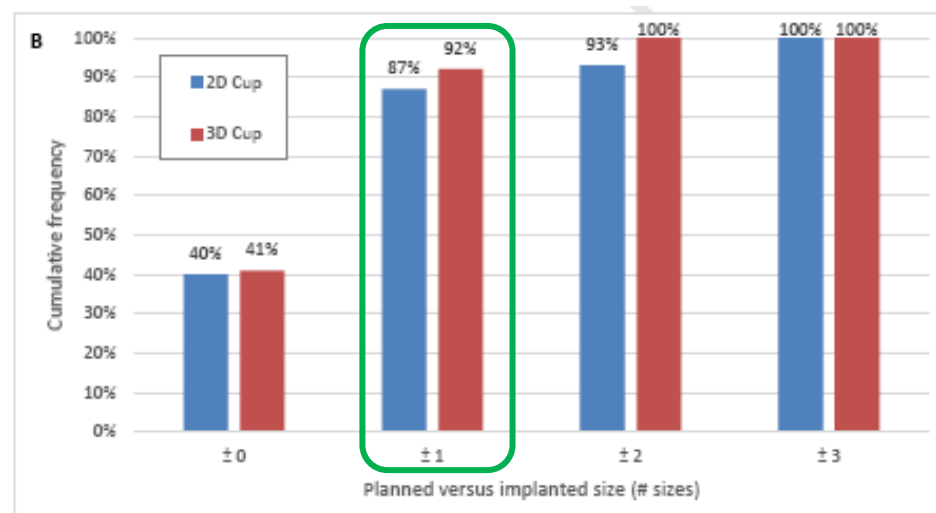
Significativa per lo stelo

STELO - P=0.04



Non significativa per la coppa

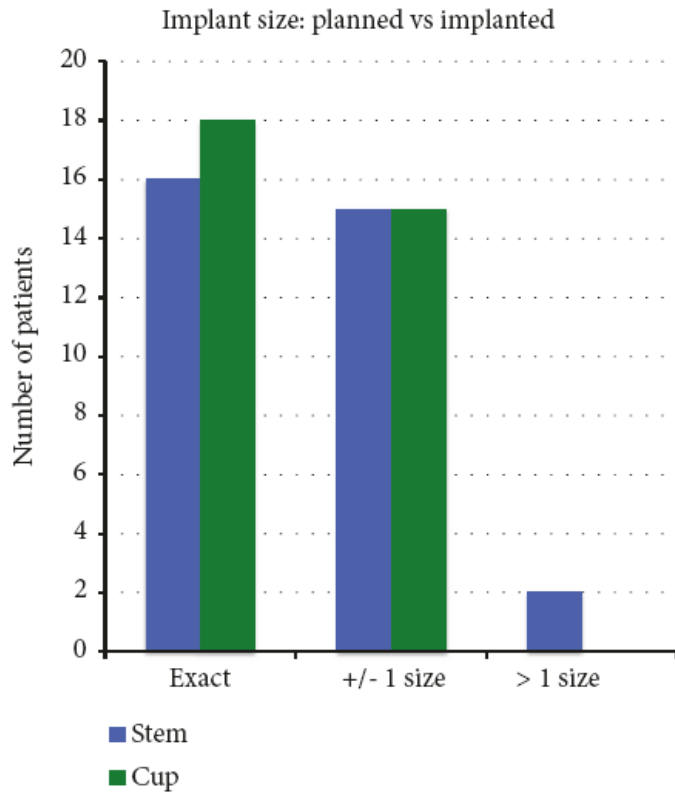
COPPA - P=0.30



Mainard, OTSR 2017

# Planning digitale 3D - TC dipendente

**ELEVATA ACCURATEZZA**



## TAGLIA COMPONENTI

**STELO 94% (31/33) entro una taglia**

**COPPA 100% (33/33) entro una taglia**

**Mainard, BioMed Research International 2019**

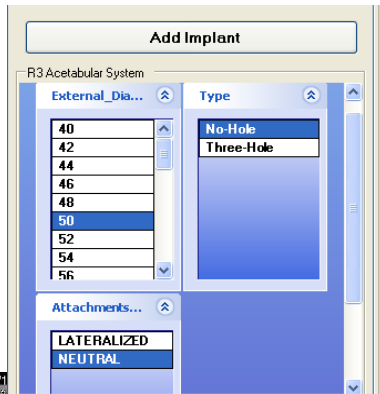
# Planning digitale 3D - TC dipendente vs digitale 2D

## PREVISIONE TAGLIA COMPONENTI (+/- 1)

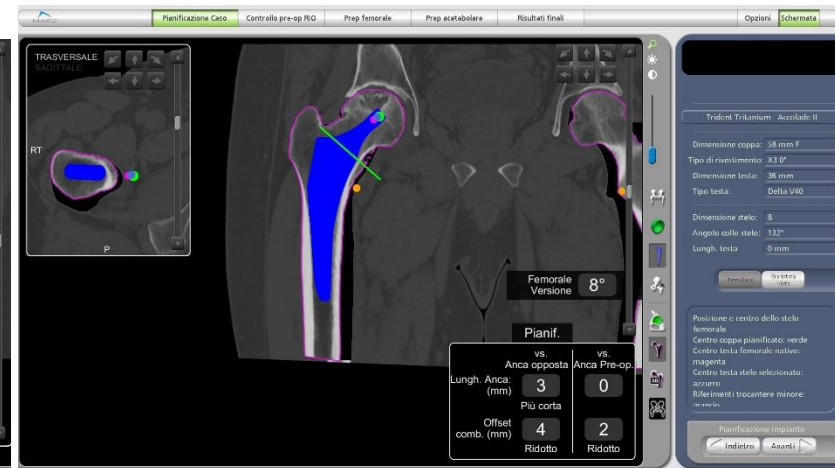
	3D - TC dip	2D
STELO	100%	43%
COPPA	96%	43%
STELO E COPPA	96%	16%

# Planning digitale 3D vs 2D

perché sceglierlo ?



VS



COR + SAG + ASS

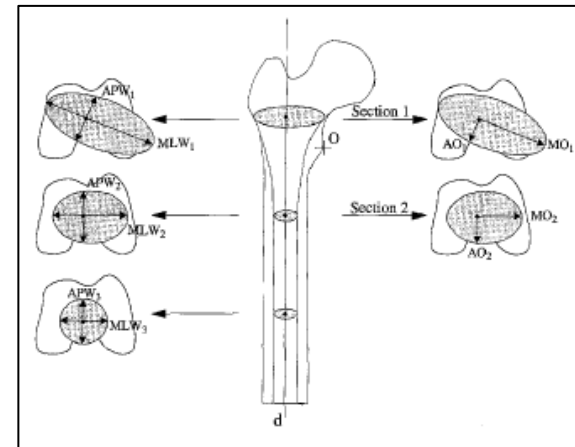
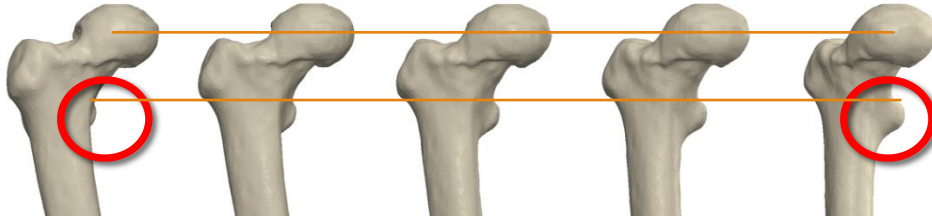
# Planning digitale 3D vs 2D

cosa ci permette di valutare

- **ACETABOLO:**
  - Versione
  - Profondità e distanza dalla lamina
- **FEMORE:**
  - Versione del collo
  - valutazione dell'Elitorsione femorale



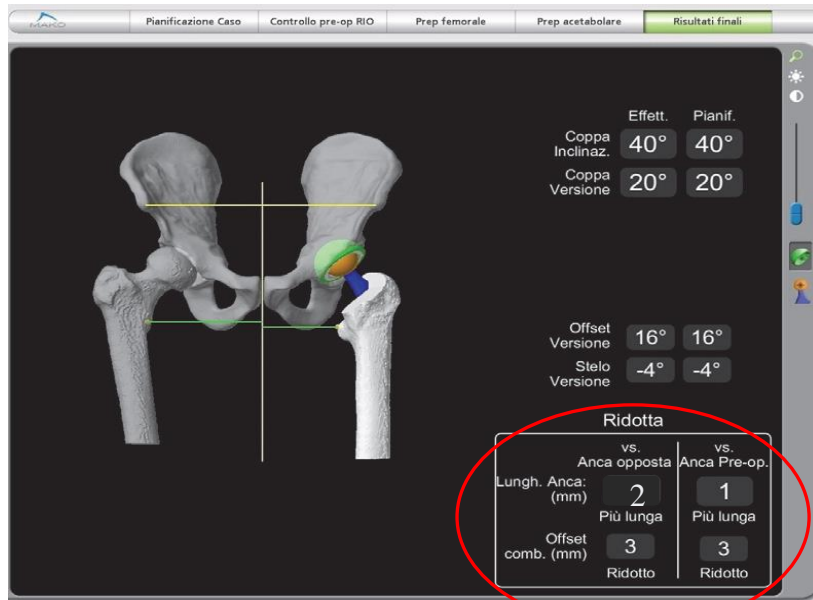
30° Int    15° Int°    Coronal    15° Ext    30° Ext



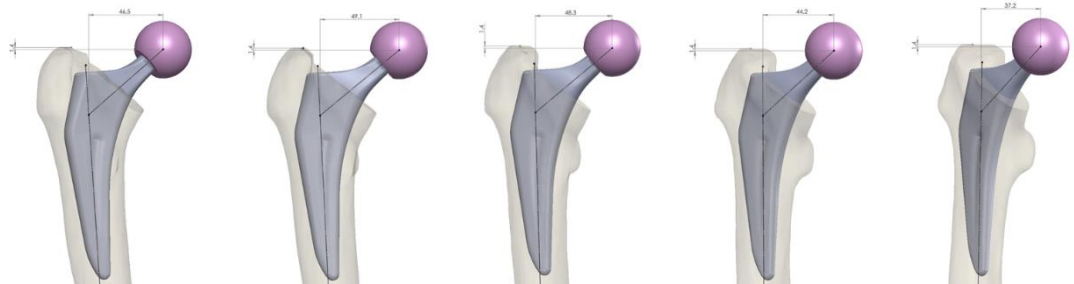


# Planning digitale 3D

cosa permette di valutare



## OFFSET COMBINATO



30°Int

15°Int

Coronal

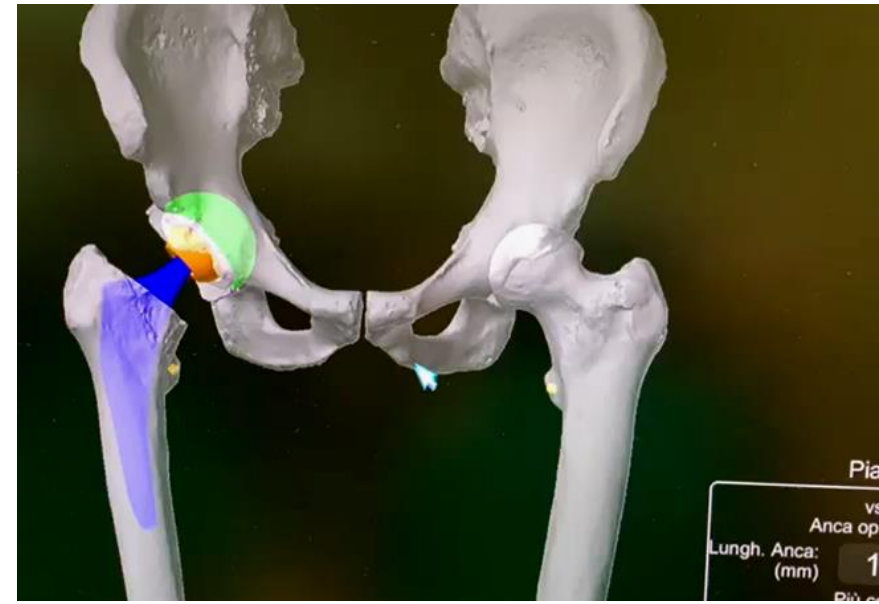
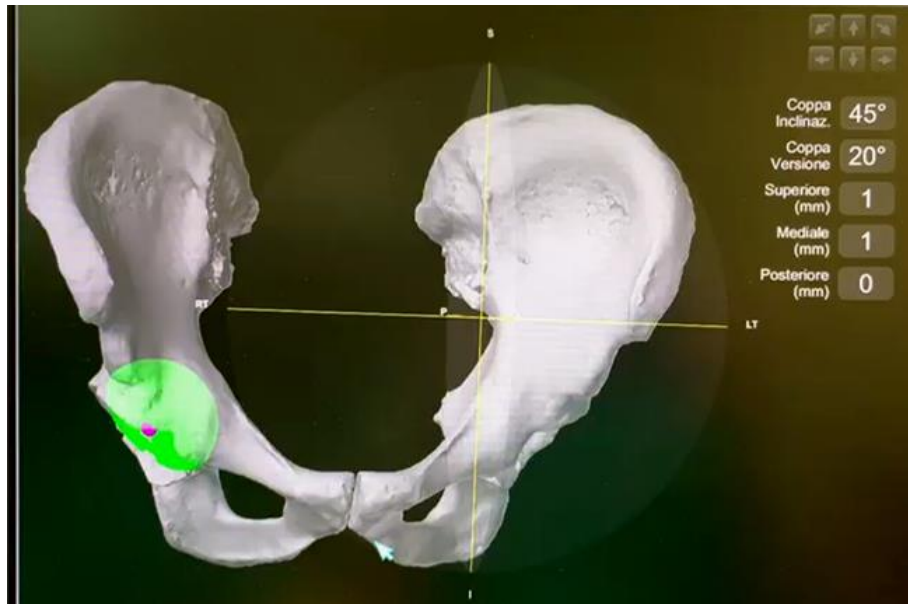
15°Ext

30°Ext

# Planning digitale 3D

cosa permette di valutare

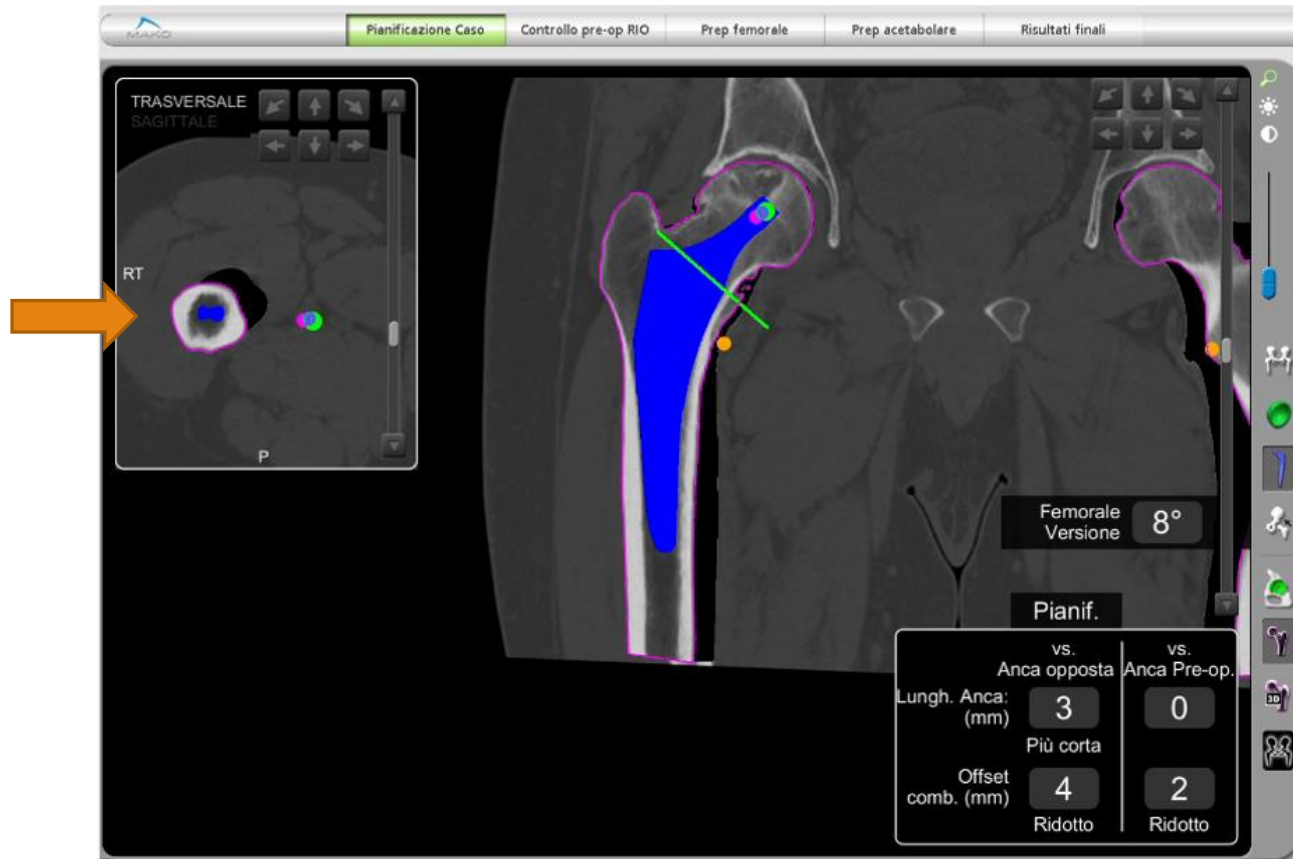
## *VISIONE DINAMICA*



eventuali **OSTEOFITI** acetabolari

# Elitorsione Femorale

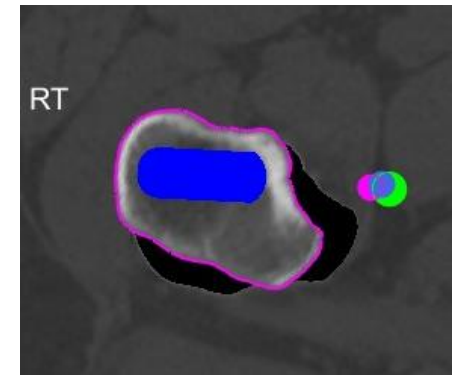
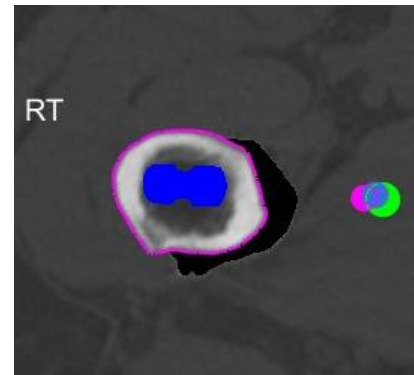
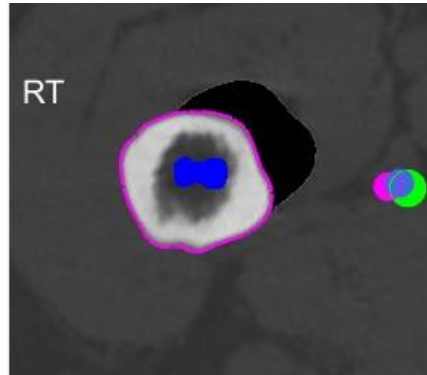
- Parametro di difficile valutazione
- Condiziona notevolmente la VERSIONE DELLO STELO



# Studio sull'ACCURATEZZA della Versione dello Stelo con Planning 3D – TC dipendente e procedura Robotica

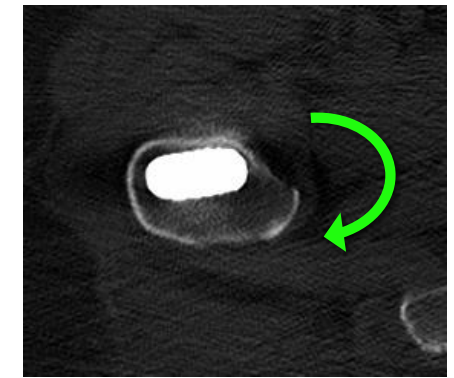
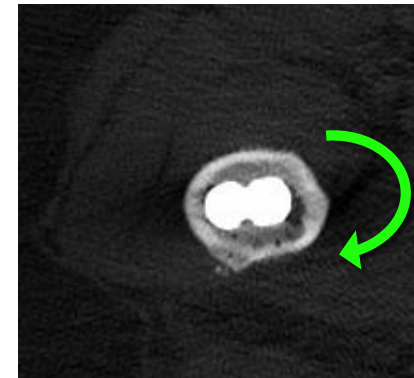
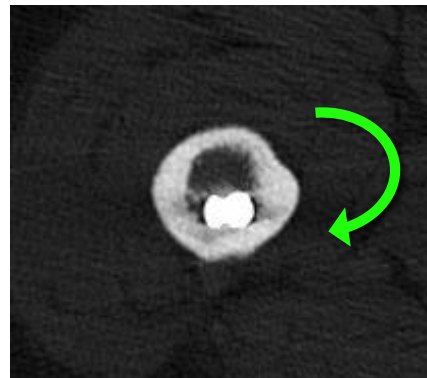
## Risultati preliminari variabili

Pianificata



VS

Post op



# Planning digitale 3D

## TC dipendente + ROBOT

362 pz sottoposti a PTA con stelo single wedge



### Misurazione

- Versione del Collo Femorale (FNV) su TC
- Versione dello Stelo (SV), componente Acetabolare (AV) e Combinata (CV) con strumentazione robotica
- Significativa variabilità nella versione dello stelo (SV) e quindi della versione combinata (CV)

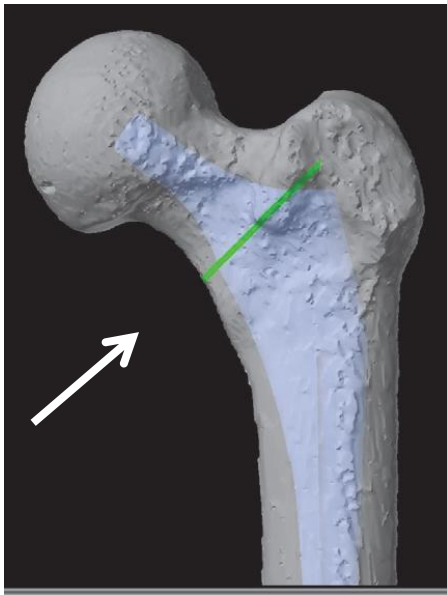
Influenza del design dello stelo  
in funzione dell' elitorsione

Catani, J Arthroplasty 2018

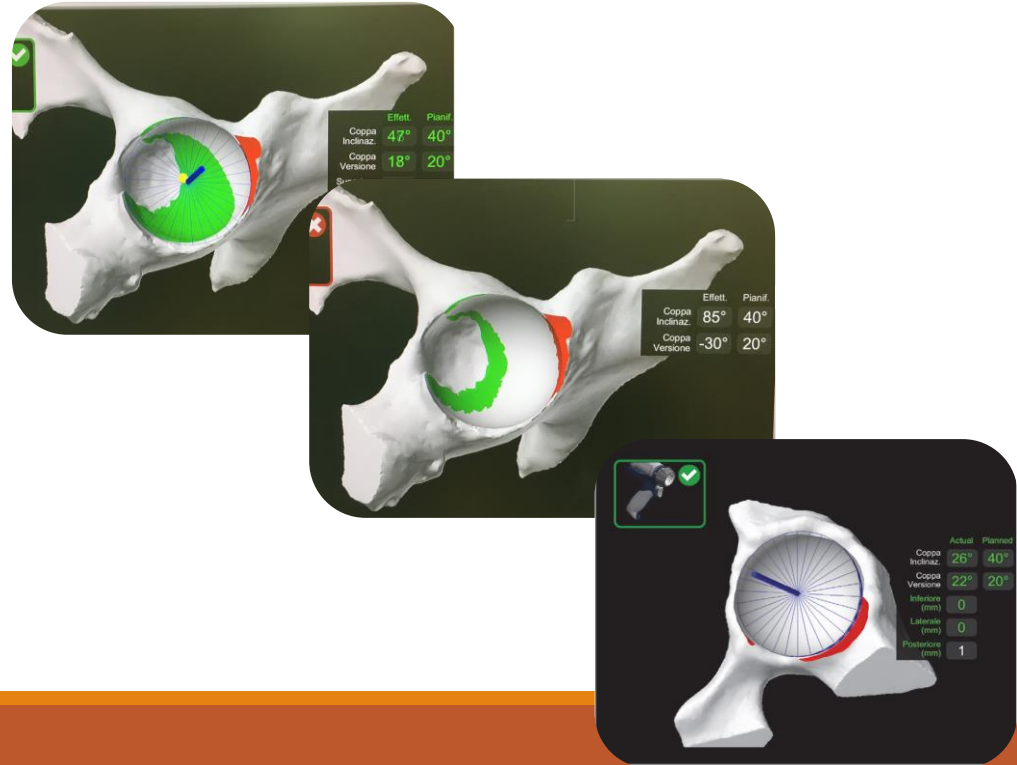
# Planning 3D + Chirurgia Robotica

Accuratezza del Planning / riproduzione chirurgica

Indicazioni sul livello  
di osteotomia del collo



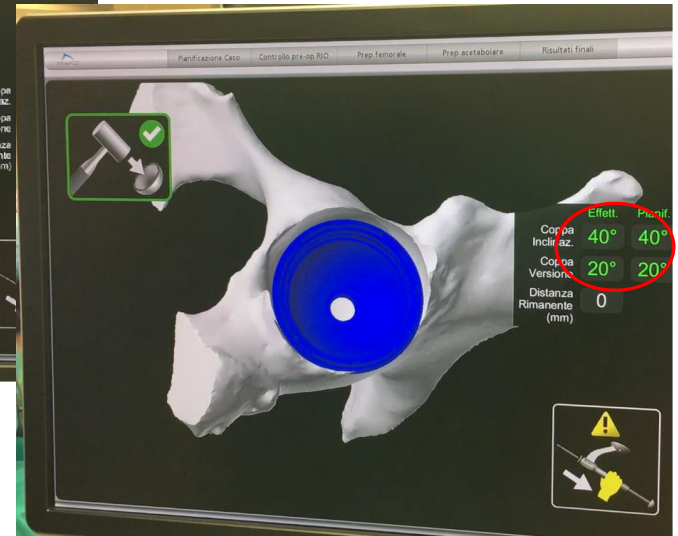
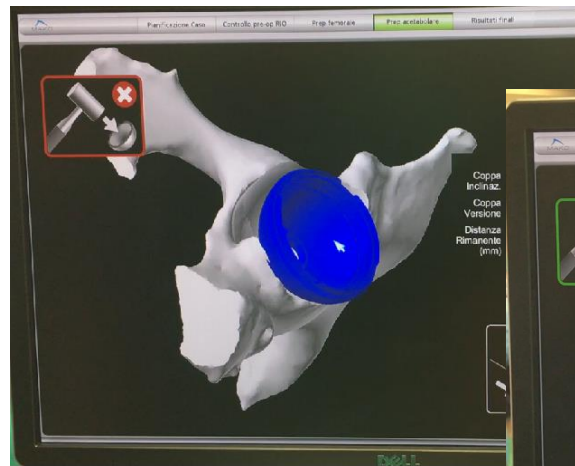
Indicazioni di progressione e  
Stop meccanico della fresatura





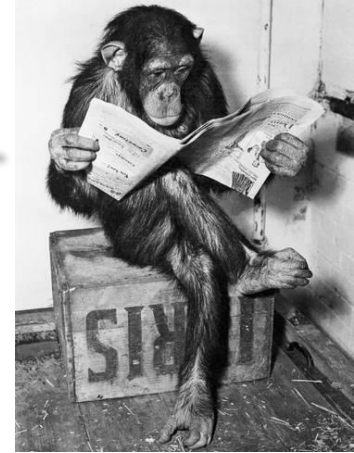
# Planning 3D + Chirurgia Robotica

Accuratezza del Planning / riproduzione chirurgica  
guida “real time” su Orientamento e Posizionamento  
così come pianificato



# CONCLUSIONI

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- Il Planning rimane operatore dipendente
- Esistono variabili, che influenzano le nostre scelte, non prevedibili se non sul campo
- Riprodurre chirurgicamente con costanza e precisione quanto pianificato rimane una sfida aperta

**Planning digitale 2D**

ancora il presente ma...

**Planning digitale 3D**

Grande passo avanti nell'Accuratezza del Planning

Quanto vale senza Robot?

# CONCLUSIONI

*“ I dogmi del tranquillo passato sono inadeguati alle tempestose necessità del presente.*

*Il presente è pieno di difficoltà e dobbiamo alzarci al bisogno.*

*Poiché il nostro presente è nuovo, dobbiamo pensare di nuovo e agire di nuovo ”*



*Abraham Lincoln*





*Grazie*



CONGRESSO NAZIONALE DELLA  
**SOCIETÀ ITALIANA DELL'ANCA**



**19-20**  
settembre 2019

**BERGAMO**

**SALA B**

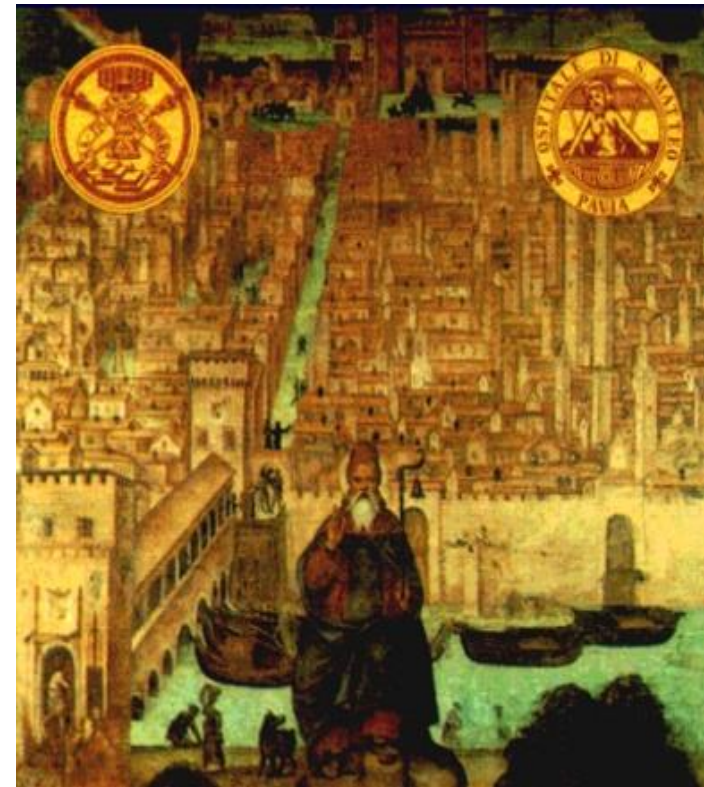
- 08.00** CORSO DI ISTRUZIONE 3  
**08.45** INSTABILITÀ RICORRENTE NELLA PROTESI DI ANCA  
Moderatore: **Giovanni Pignatti** (Bologna)
- 08.00** Inquadramento clinico e radiologico  
**Loris Perticarini** (Pavia)
- 08.10** I rapporti spino pelvici  
**Patrizio Caldora** (Arezzo)
- 08.20** Algoritmo di trattamento  
**Flavio Rinaldo Ravasi** (Vizzolo Predabissi)
- 08.30** Discussione

**GIOVEDÌ**  
**19 SETTEMBRE 2019**



Clinica Ortopedica e Traumatologica  
Università degli Studi di Pavia  
Fondazione IRCCS Policlinico S. Matteo

*Direttore: Prof. F. Benazzo*



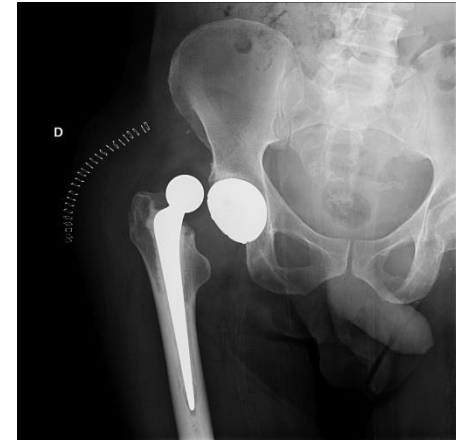
***INSTABILITÀ RICORRENTE NELLA PROTESI D'ANCA:***  
***Inquadramento clinico e radiologico***

*L. Perticarini*



# Instabilità nelle PTA

- la più comune causa di revisione negli USA
- l'incidenza in Italia: 0,3-10% per primarie; fino al 28% nelle revisioni
- Più del 60% dei pazienti che subiscono una lussazione presentano altri episodi di lussazione e richiedono revisione chirurgica
- Costi per l'ospedalizzazione fino al 300% a protesi primarie



- Gwam CU, Mistry JB, Mohamed NS, Thomas M, Bigart KC, Mont MA, et al. Current Epidemiology of Revision Total Hip Arthroplasty in the United States: National Inpatient Sample 2009 to 2013. J Arthroplasty 2017;32:2088–92.
- Falez F, Papalia M, Favetti F, Panegrossi G, Casella F, Mazzotta G. Total hip arthroplasty instability in Italy. Int Orthop 2017;41:635–44.
- Kotwal RS, Ganapathi M, John A, Maheson M, Jones SA. Outcome of treatment for dislocation after primary total hip replacement. J Bone Jt Surg - Ser B 2009;91:321–6.
- Abdel MP, Cross MB, Yassen AT, Haddad FS. The functional and financial impact of isolated and recurrent dislocation after total hip arthroplasty. Bone Jt J 2015;97-B:1046–9.

# Perché?

EXPERIMENTAL AND THERAPEUTIC MEDICINE 18: 1715-1722, 2019

## **Causes of and treatment options for dislocation following total hip arthroplasty (Review)**

YIAN LU, HAIJUN XIAO and FENG XUE

Department of Orthopedics, Fengxian Central Hospital, Shanghai 201400, P.R. China

Received May 21, 2019; Accepted June 28, 2019

- Fattori legati al paziente
- Esperienza del chirurgo
- Fattori legati all'intervento



# Il paziente\_1

## ***Fattori che incidono sul tasso di lussazione***

- Precedenti interventi
- Diagnosi pre-operatoria: fratture, patologie reumatiche, osteonecrosi, post-trauma (non DSA)
- Incremento ASA score
- **Patologie del rachide associate (rapporti Spino-Pelvici)**
- Disabilità neurologiche (M. di Parkinson, lesioni spinali acquisite, paralisi cerebrali)
- Basso livello di attività pre- e post-operatoria
- Obesità
- Età: distribuzione bimodale (<50 e >70)



## Il paziente\_2

### **Fattori che *NON* incidono sul tasso di lussazione**

- Sesso
- Intervento bilaterale nella stessa seduta
- Restrizioni post-operatorie
- Displasia di sviluppo dell'anca



Mu W, Yang D, Xu B, Mamtimin A, Guo W, Cao L. Midterm Outcome of Cementless Total Hip Arthroplasty in Crowe IV-Hartofilakidis Type III Developmental Dysplasia of the Hip. J Arthroplasty 2016.

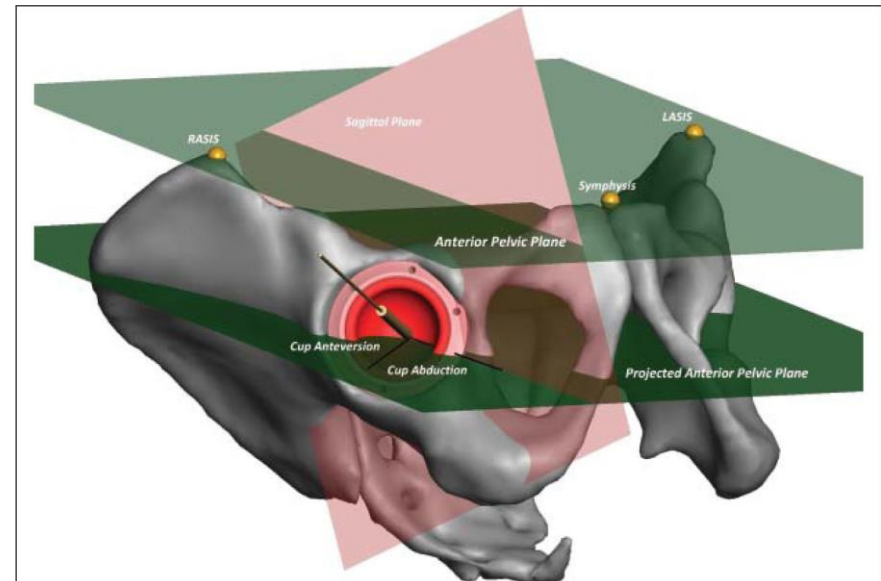
Lübbecke A, Suvà D, Perneger T, Hoffmeyer P. Influence of preoperative patient education on the risk of dislocation after primary total hip arthroplasty. Arthritis Care Res 2009;61:552–8. doi:10.1002/art.24340.

[Fessy MH, Putman S, Viste A, Isida R, Ramdane N, Ferreira A, et al. What are the risk factors for dislocation in primary total hip arthroplasty? A multicenter case-control study of 128 unstable and 438 stable hips. Orthop Traumatol Surg Res 2017;103:663–8. doi:10.1016/j.otsr.2017.05.014.

Esposito CI, Gladnick BP, Lee Y yu, Lyman S, Wright TM, Mayman DJ, et al. Cup position alone does not predict risk of dislocation after hip arthroplasty. J Arthroplasty 2015;30:109–13. doi:10.1016/j.arth.2014.07.009.

# Chirurgia

- Planning
- Ripristino parametri biomeccanici (lunghezza, offset femorale e acetabolare)
- Ripristino leve muscolari
- Impingement intraoperatori
- **Tipo di impianto / tribologia «livello di vincolo»**
- **Posizionamento componenti («Safe Zone»)**



# Impianto

- Dimensioni testa: 22 e 28mm > rischio rispetto 32 e 36mm (dati registri)
- Testa con «gonna»
- Liner con rebord: dati contrastanti. Può proteggere ma creare anche impingement e wear – lussazioni e mobilizzazione asettica
- Offset indipendente o legato alle dimensioni dell'impianto
- Modularità
- Doppia mobilità
- Constrained: in casi selezionati

Zijlstra WP, De Hartog B, Van Steenberghe LN, Scheurs BW, Nelissen RGHH. Effect of femoral head size and surgical approach on risk of revision for dislocation after total hip arthroplasty: An analysis of 166,231 procedures in the Dutch Arthroplasty Register (LROI). *Acta Orthop* 2017;88:395–401. doi:10.1080/17453674.2017.1317515.

Harris WH, Burke DW, Harris WH. Elevated-rim acetabular components: Effect on range of motion and stability in total hip arthroplasty. *J Arthroplasty* 1991;6:S53–8. doi:10.1016/S0883-5403(08)80056-3.

Guyen O, Lewallen DG, Cabanela ME. Modes of failure of osteonics constrained tripolar implants: A retrospective analysis of forty-three failed implants. *J Bone Jt Surg - Ser A* 2008;90:1553–60. doi:10.2106/JBJS.G.00317.





# Posizionamento componenti

«Safe Zone» di Lewinnek

$40\pm 10^\circ$  inclinazione

$15\pm 10^\circ$  anteversione

Copyright 1978 by The Journal of Bone and Joint Surgery, Incorporated

## Dislocations after Total Hip-Replacement Arthroplasties\*

1978

BY GEORGE E. LEWINNEK, M.D.<sup>†</sup>, JACK L. LEWIS, PH.D.<sup>‡</sup>, RICHARD TARR, M.S.<sup>‡</sup>, CLINTON L. COMPERE, M.D.<sup>†</sup>,  
AND JERALD R. ZIMMERMAN, B.S.<sup>‡</sup>, CHICAGO, ILLINOIS  
*From the Northwestern Memorial Hospital, Chicago*

- Studio su 10000 PTA, 206 lussazioni, in cui il 58% nella «safe zone»
- Posizionamento delle componenti paziente-specifico
- Femur first?
- Considerare allineamento spino-pelvico
- Via d'accesso che permette un corretto posizionamento
- Chirurgia robot/navigatore assistita

Abdel MP, von Roth P, Jennings MT, Hanssen AD, Pagnano MW. What Safe Zone? The Vast Majority of Dislocated THAs Are Within the Lewinnek Safe Zone for Acetabular Component Position. Clin Orthop Relat Res 2016;474:386–91. doi:10.1007/s11999-015-4432-5.

# Il chirurgo

- Fondamentale per l'outcome la selezione del paziente, la scelta dell'impianto e della via d'accesso
- Via d'accesso: postero-laterale più alta incidenza; % si riduce se sutura capsula ed extrarotatori
- Numero di impianti per anno / skills
  - Studio canadese su 38000 pz: chirurghi con < 35 PTA/anno 1,9% vs 1,3% di chirurghi con maggior volume

Ravi B, Jenkinson R, Austin PC, Croxford R, Wasserstein D, Escott B, et al. Relation between surgeon volume and risk of complications after total hip arthroplasty: Propensity score matched cohort study. BMJ 2014;348.



# Workup Clinico / Radiografico

## **Tempo intercorso tra lussazione e chirurgia**

### **Precoci (0-6 mesi)**

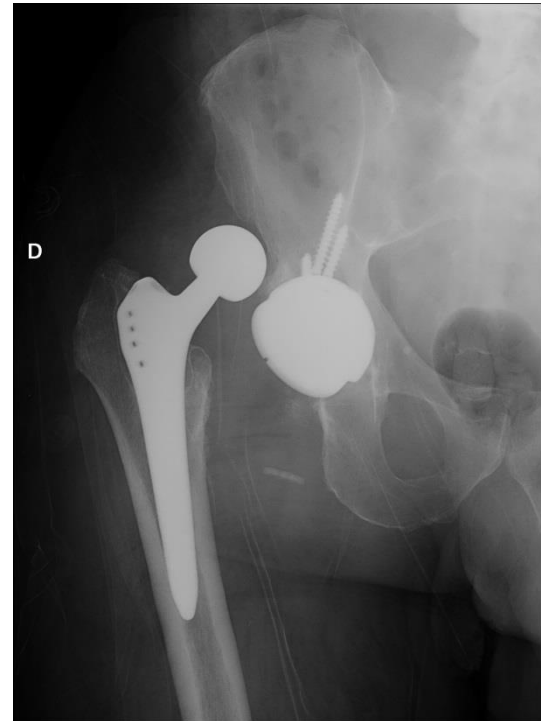
- Fattori di rischio legati al paziente
- Errori chirurgici (malposizionamento componenti, impingement)
- Cicatrice capsulare lassa

### **Tardive (> 5 anni)**

- Perdita funzione adduttori
- Osteolisi da polietilene
- Avulsioni trocanteriche
- Malposizionamento componenti

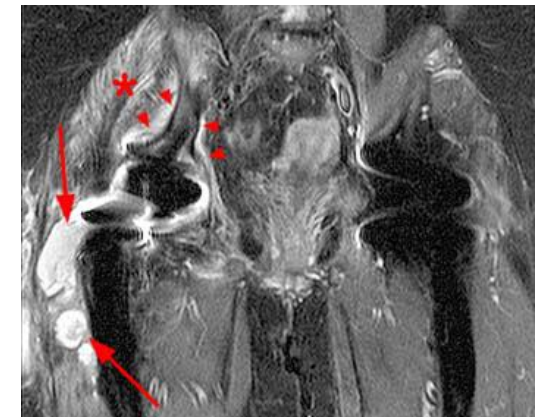
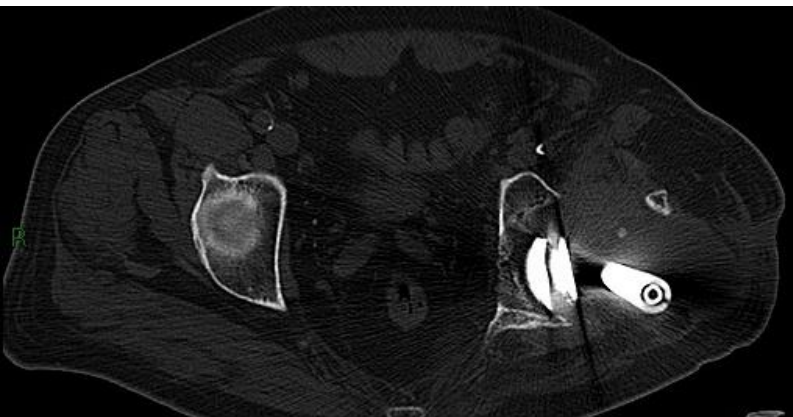
# Workup Clinico / Radiografico

- Numero di lussazioni, direzione, meccanismo
- Lunghezza arti
- Funzione adduttori
- Valutazione fattori di rischio legati al paziente
- Conoscenza dell'impianto utilizzato
- Via d'accesso



# Workup Clinico / Radiografico

- **Rx**: evidenza di osteolisi, avulsione trocanterica, usura del polietilene, accorciamento dell'arto, malposizionamenti
- Controllo dinamico in **scopia**: impingement, direzione lussazione/sublussazione
- **Ecografia**: ematomi, versamento articolare (**effetto acquario**)
- **TC**: migliore valutazione del posizionamento, unico metodo per valutare antiversione delle componenti
- **RM**: pseudotumor, lesioni muscolari, ipotrofia medio gluteo



# Effetto Acquario

Versamento articolare dopo lussazione PTA:

- Riduce la probabilità di riduzione incruenta
- Aumenta la probabilità di nuova lussazione dopo riduzione
- Aumenta la possibilità di infezioni





# Test intraoperatori

- Anca addotta e ginocchio flesso a 45° - dormire sul fianco
- Anca abdotta ed extraruotata – scendere dall'auto
- Anca flessa ed intraruotata – indossare le calzature
- Massima flessione dell'anca – seduta bassa in bagno o su sedia



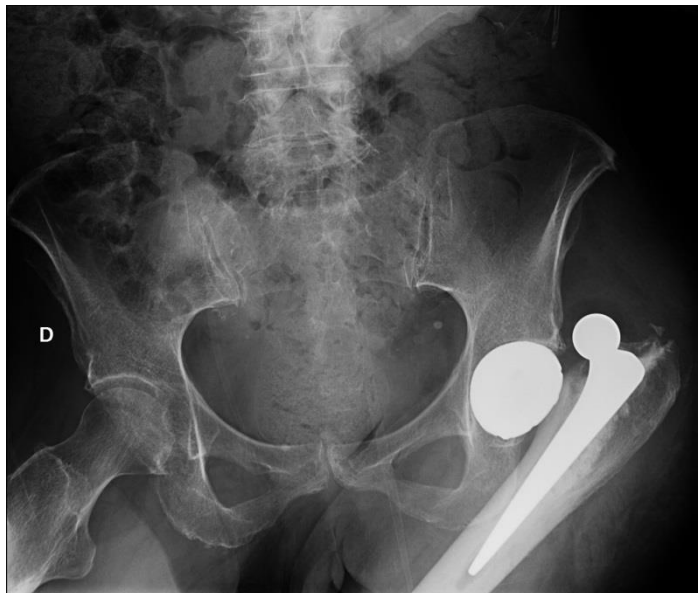
# Opzioni chirurgiche

Reason for Dislocation	Treatment option
Shortening, laxity	Head exchange (consider offset head)
Anteversion low	Dorsal retainment ring
Cup inclination high	Cranial retainment ring or cup exchange
Cup in retroversion	Cup exchange
Anterior impingement	Remove osteophytes and scar tissue, longer head
Anteversion high	Cup exchange or offset head
Cup horizontal, impingement in flexion	Cup exchange
Multidirectional instability	Bipolar hypermobility cup or constrained cup with head exchange
Deficient abductors	Constrained cup or bipolar hypermobility cup

## Frattura sottocapitata (M. Alzheimer)



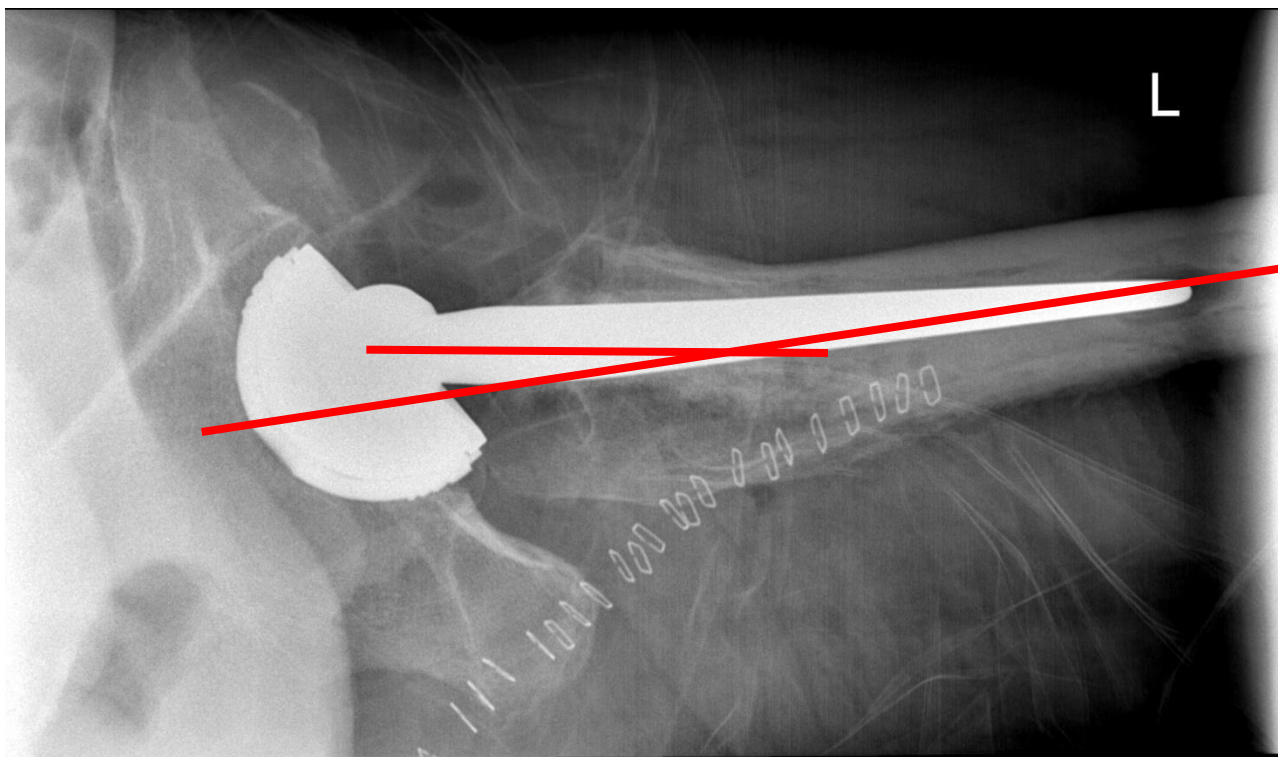
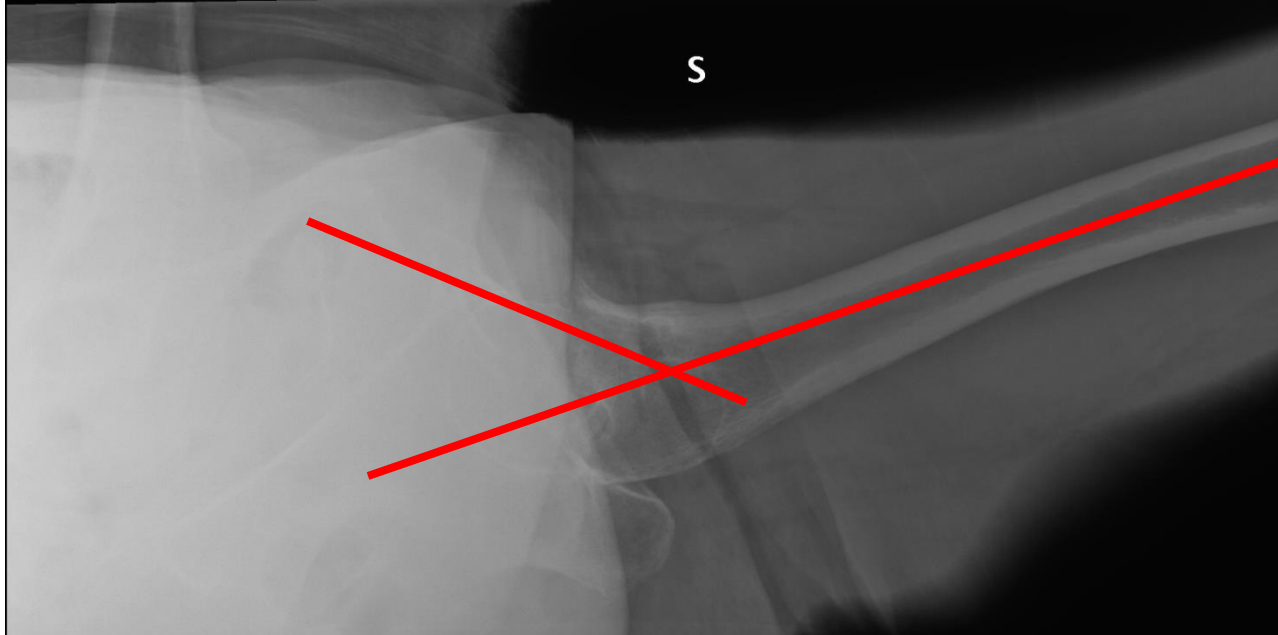
Exeter + Trident – Doppia mobilità

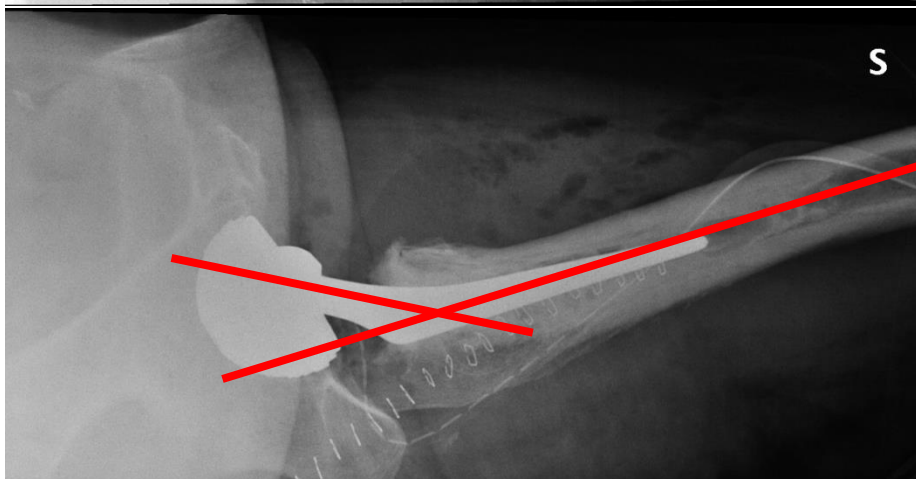
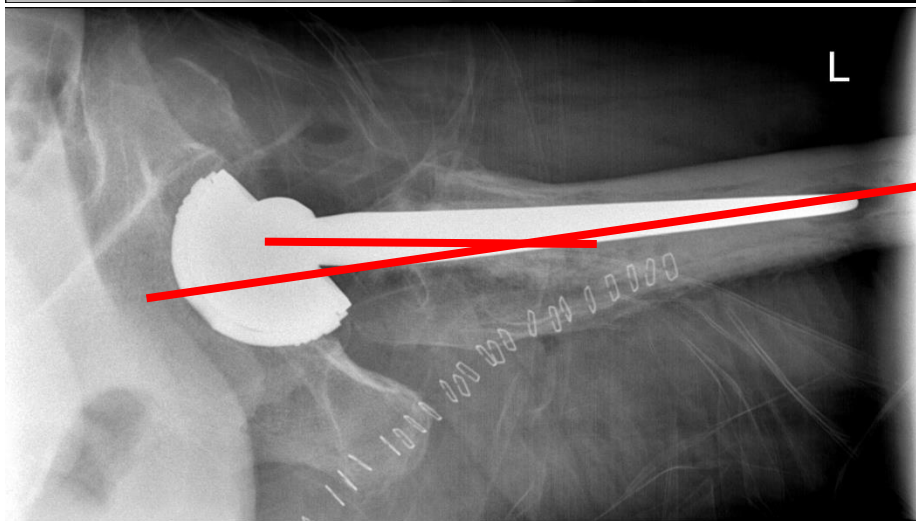
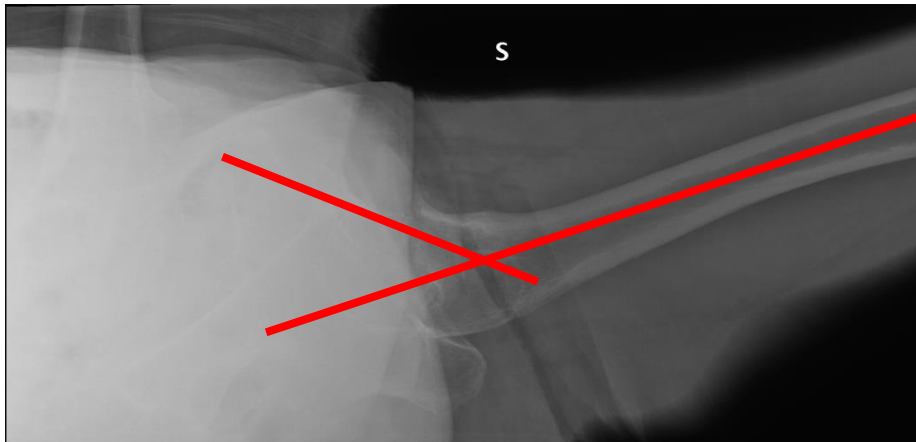


Dopo 1 mese:  
Lussazione

Cambiare il cotile?  
Inserito Constrained?

Il posizionamento dello  
stelo è corretto?

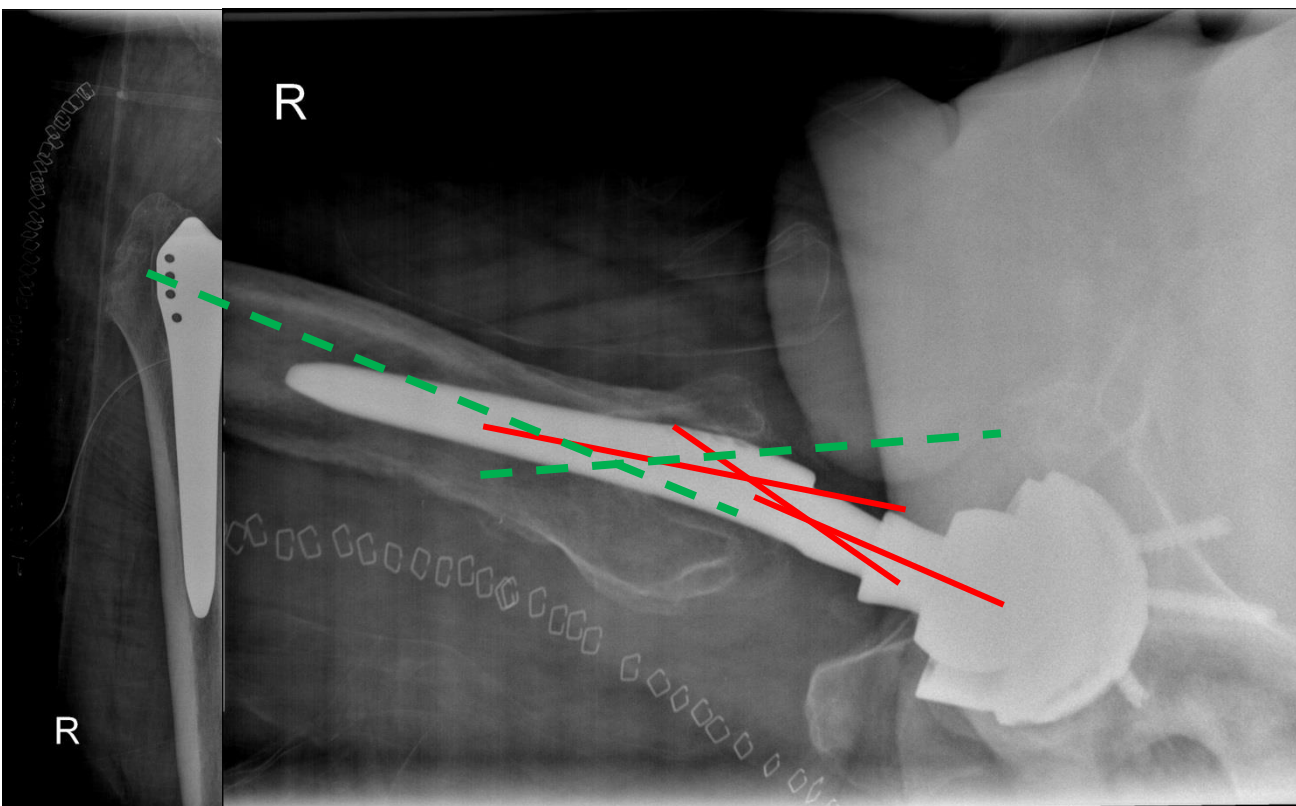




Revisione stelo:  
- Exeter short  
aumentando  
antiversione



- Revisione di cotile (stelo integrato, comorbilità)
- Lussazione posteriore
- Bioball se necessario per migliorare antiversione combinata





# Conclusioni

- Conoscere le cause dell'instabilità
- Workup clinico / radiografico
- Se possibile correggere le cause
- Piano A, B, C
- Prevenzione e trattamento talvolta aggressivo



# INSTABILITA' RICORRENTE NELLA PROTESI D'ANCA: ALGORITMO DI TRATTAMENTO

## MAIN TOPICS

IL PROGRAMMA NAZIONALE ESITI  
(PNE) E LA CHIRURGIA DELL'ANCA

LE VIE DI ACCESSO:  
FATTI, IPOTESI, ILLUSIONI

LE REVISIONI CONSERVATIVE

LE NUOVE TECNOLOGIE:  
FATTI, IPOTESI,  
ILLUSIONI

**19-20**

settembre 2019

**BERGAMO**

Presidente Onorario  
**Paolo Cherubino**

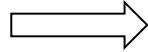
Presidente  
**Claudio Carlo Castelli**

Carlo A.M. Ripamonti

A. Brivio

Direttore: prof. F. Ravasi

# Instabilità



Prima causa di  
revisione nelle PTA

Dai registri:

Sopravvivenza **75%** a **15-20 anni**

Poco **più del 50%** a **25 anni**

nei pazienti con OA.



Lancet 2019; 393: 647–54

# Lussazione Ricorrente :

## Due o più episodi trattati non chirurgicamente

- ✓ Lussazione: complicanza più comune dopo con **incidenza** che varia tra lo **0% e il 5%** [1].
- ✓ Circa il **50%** delle lussazioni avviene **nei primi 3 mesi** dopo l'intervento e più del **75% entro il 1° anno** [2].
- ✓ Nei **primi 2 anni** dopo l'intervento la lussazione è la **causa più comune di revisione** chirurgica [3].

[1] Hailer NP, Weiss RJ, Stark A, Karrholm J. The risk of revision due to dislocation after total hip arthroplasty depends on surgical approach, femoral head size, sex, and primary diagnosis. An analysis of 78,098 operations in the Swedish Hip Arthroplasty Register. Acta Orthop. 2012;83:442–448.

[2] Bolland BJ, Whitehouse SL, Timperley AJ. Indications for early hip revision surgery in the UK—a re-analysis of NJR data. Hip Int.. 2012;22:145–152.

[3] Bozic KJ, Ong K, Lau E, Kurtz SM, Vail TP, Rubash HE, Berry DJ. Risk of complication and revision total hip arthroplasty among Medicare patients with different bearing surfaces. Clin Orthop Relat Res. 2010;468:2357–2362.

# Cause di Lussazione Ricorrente

## Fattori correlati al Paziente

- ✓ Diagnosi
- ✓ Età avanzata (Meek et al, 2006)
- ✓ Malattie neurologiche: paralisi cerebrale, demenza, distrofia muscolare, psicosi (Woolson, 1999)
- ✓ Sesso femminile (Goldman et al, 2019)
- ✓ Artrite Reumatoide (Khatod, 2006)
- ✓ Lunghezza del collo femorale (Nishii, 2004)
- ✓ ASA >3 (Jolles et al, 2002)
- ✓ BMI <20 (Goldman et al, 2019)
- ✓ Disorientamento spazio-temporale durante la degenza (Woolson and Rahintoola, 1999)
- ✓ Alcool (Paterno et al, 1997)
- ✓ Rapporti Spino-Pelvici

Probabilità di lussazione dopo PTA (rispetto ad OA) :

- ✓ Osteonecrosi (x2)
- ✓ Displasia (x3)
- ✓ Fratture (x4)
- ✓ Pseudoartrosi o PTA fallita (x5)
- ✓ Chirurgia per Instabilità Ricorrente (x11)





# Cause di Lussazione Ricorrente

## Fattori correlati all'Impianto

- ✓ Esperienza del chirurgo (Katz et al, 2001)
- ✓ Via d'accesso (Woo and Morrey, 1982; Masonis and Bourne, 2002)
- ✓ Inadeguata tensione dei tessuti molli (Lunghezza/Offset/PSA GT) (Herrlin et al, 1986; Higa et al, 2011)
- ✓ Malposizionamento dell'impianto (Lewinnek, 1978)
- ✓ Usura del polietilene
- ✓ Mobilizzazione asettica

# Fattori correlati al Paziente

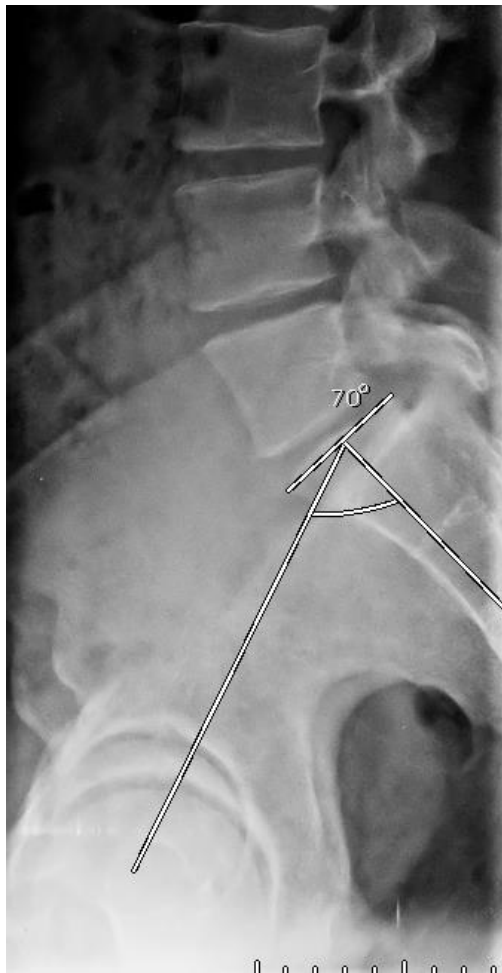
## Rapporti Spino- Pelvici

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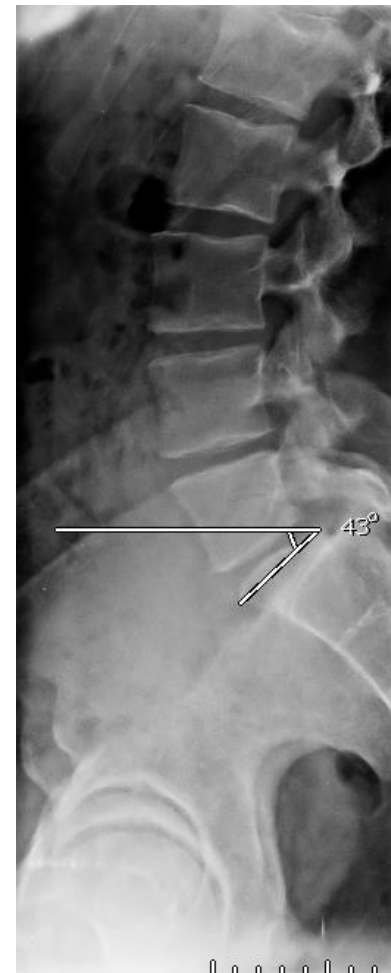
ASST Melegnano e Martesana



Pelvic Inclination (PI)



Pelvic Tilt (PT)



Sacral Slope (SS)

$$PI = PT + SS$$

# Letteratura PTA in S/P alignment



## ■ HIP

### **Lumbar fusion involving the sacrum increases dislocation risk in primary total hip arthroplasty**



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

The Journal of Arthroplasty

journal homepage: [www.arthroplastyjournal.org](http://www.arthroplastyjournal.org)

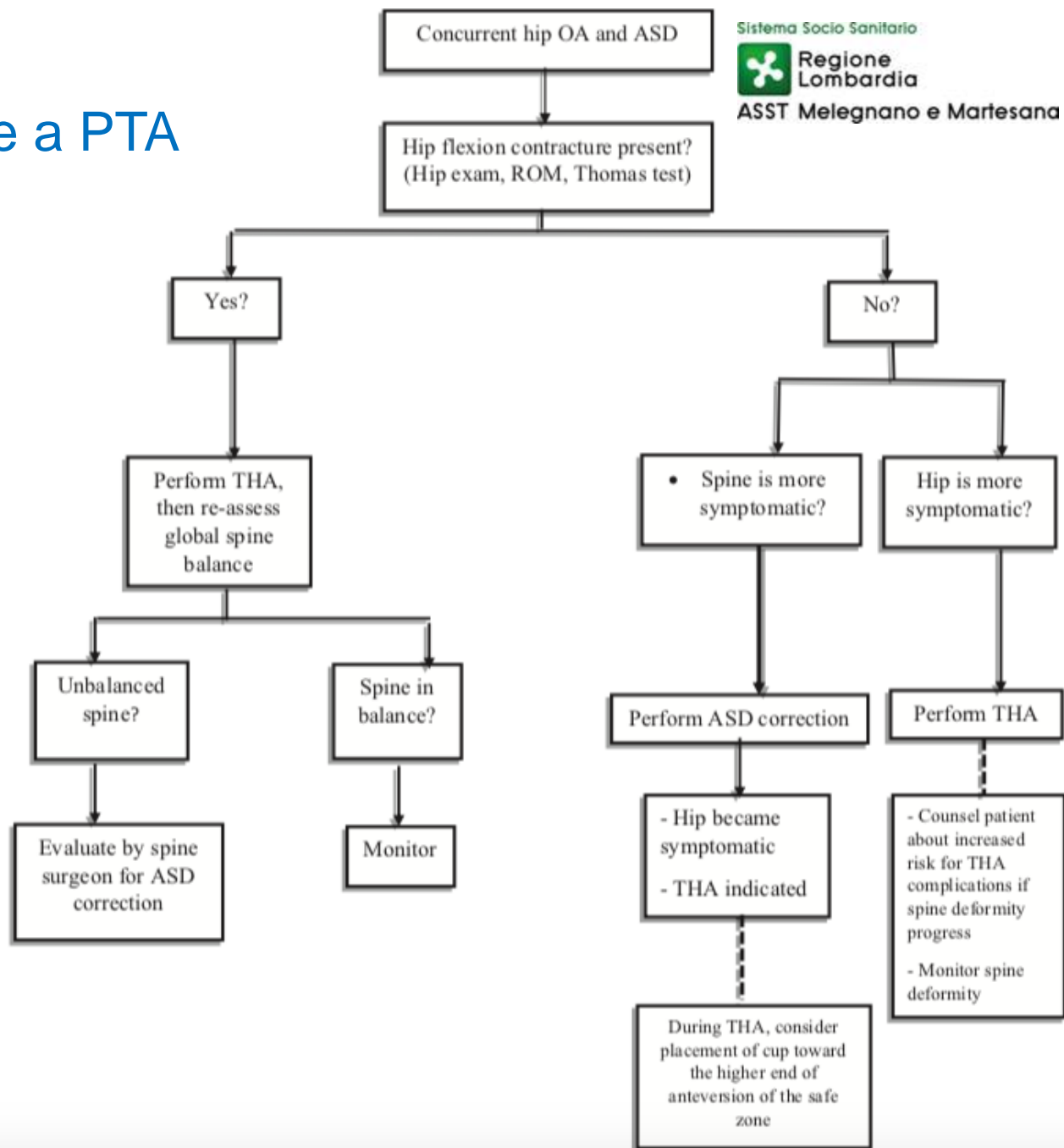
Review Article

### **The Impact of Spino-Pelvic Alignment on Total Hip Arthroplasty Outcomes: A Critical Analysis of Current Evidence**

Assem A. Sultan, MD, Anton Khlopa, MD, Nicolas S. Piuze, MD, Morad Chughtai, MD,  
Nipun Sodhi, BA, Michael A. Mont, MD \*

*Department of Orthopaedic Surgery, Cleveland Clinic, Cleveland, Ohio*

## Prima di procedere a PTA



# Fattori correlati all'Intervento

Percentuali **lussazione** rispetto al numero di  
**protesi/anno per CHIRURGO:**

✓ 1-5/anno	4,2%
✓ 6-10/anno	3,4%
✓ 11-25/anno	2,6%
✓ 26-50/anno	2,4%
✓ >50/anno	1,5%



**Association Between Hospital and Surgeon Procedure Volume and Outcomes  
of Total Hip Replacement in the United States Medicare Population\***

Katz, Jeffrey N.; Losina, Elena; Barrett, Jane; [More](#)

**JBJS.** 83(11):1622-1629, November 2001.

# Fattori correlati all'Intervento

## Via d'Accesso

Percentuale lussazione :

- ✓ Anteriore ????????
- ✓ Antero-laterale 2.18%
- ✓ Posterolaterale 3.23% \*
- ✓ Transtrocanterica 1.27%
- ✓ Laterale diretta 0.55%

**Masonis JI, Bourne rB.**  
Surgical approach, abductor  
function, and total hip  
arthroplasty dislocation. *Clin  
Orthop Relat Res* 2002;405:46-  
53.



# Fattori correlati all'Intervento

## Accesso Anteriore

Barnett, 2016 (5090 casi) 0.23%

Bhandari, 2009 (1277 casi) 0.6%

Sariali, 2008 (1764 casi) 1.5%

Cidambi, 2018 (1035 casi) 0.2%

Mirza, 2014 (1170 casi) 0.4%

Lee e Marconi, 1.2%\*

De Geest, 0.6%\*

# Fattori correlati all'Intervento

## Accesso Anteriore vs Posteriore

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The  
Bone & Joint  
Journal

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The Bone & Joint Journal, VOL. 101-B, NO. 6 | Hip



# Surgical approach significantly affects the complication rates associated with total hip arthroplasty

V. K. Aggarwal , A. Elbuluk, J. Dundon, C. Herrero, C. Hernandez, J. M. Vigdorchik, R. Schwarzkopf, R. Iorio, W. J. Long

**Published Online:** 1 Jun 2019 | <https://doi.org/10.1302/0301-620X.101B6.BJJ-2018-1474.R1>

# Fattori correlati all'Intervento

## Accesso Anteriore vs Posteriore

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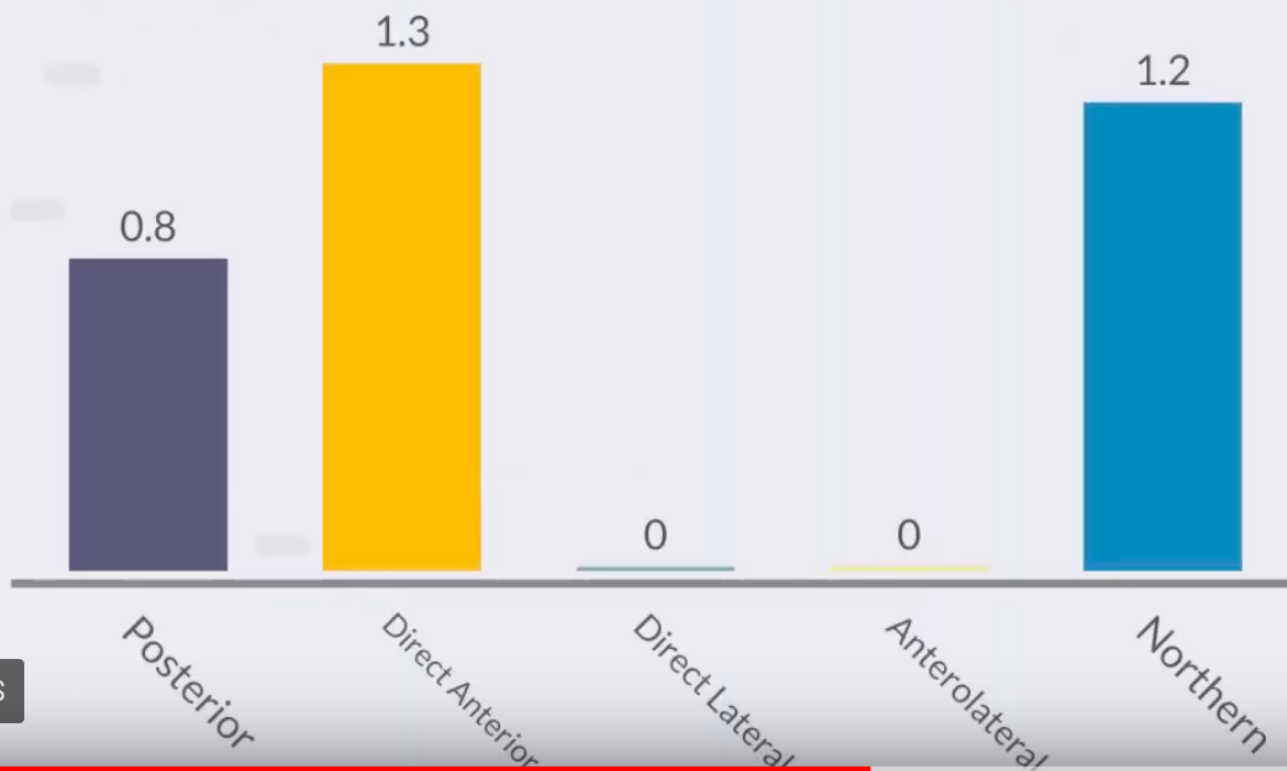
BJJ

Surgical approach significantly affects the complication rates associated with THA



Watch later Share

### Dislocation rate (%)



MORE VIDEOS

Play (k)

# Fattori correlati all'Intervento

## Accesso Anteriore vs Posteriore



# Fattori correlati all'Intervento

## Accesso Anteriore vs Posteriore

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Bjj

Surgical approach significantly affects the complication rates associated with THA



Watch later Share

### Take home messages

- ▶ Overall, THA has a relatively low complication rate
- ▶ DAA was associated with a higher risk of complications, including dislocation and re-operation
- ▶ PA was associated with the lowest rate of complications
- ▶ Shorter LOS associated with the DAA does not appear to justify the higher complication rate

MORE VIDEOS



1:17 / 1:39



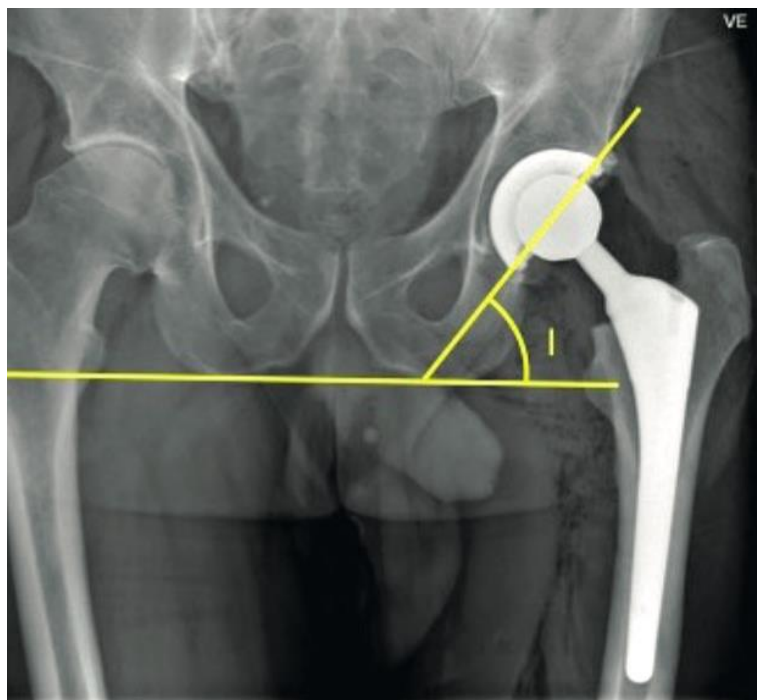
YouTube



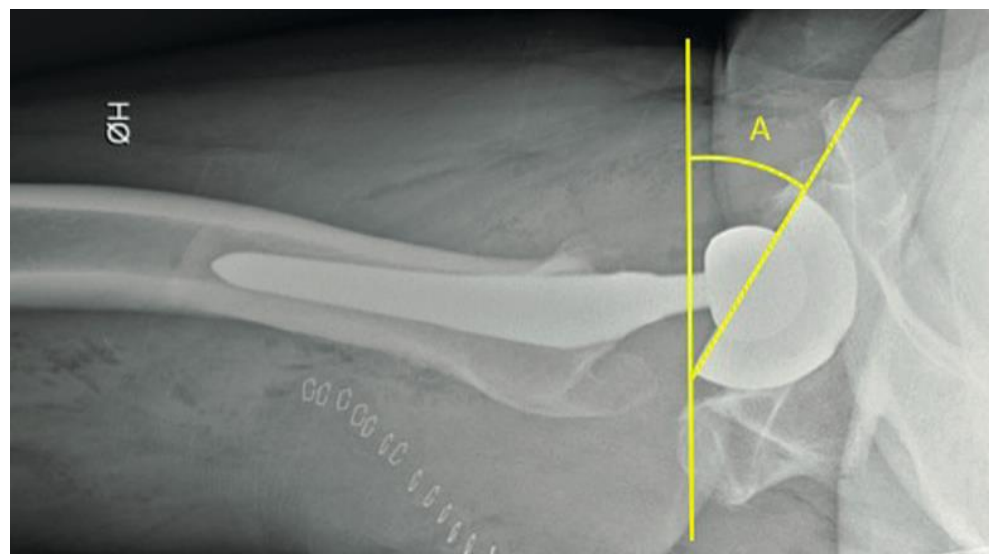
# Fattori correlati all'Intervento

## Safe zone di LEWINNEK (1978)

- ✓ Angolo di Inclinazione:  $30^\circ - 50^\circ$  ( $40^\circ \pm 10^\circ$ )
- ✓ Angolo di Antiversione:  $5^\circ - 25^\circ$  ( $15^\circ \pm 10^\circ$ )



*Angolo di Inclinazione*



*Angolo di Antiversione*



## Posizionamento della coppa acetabolare

Callanan (2011):

- ✓ Angolo di Inclinazione: 30-45°
- ✓ Angolo di Antiversione: 5-25°

Biedermann (2005): *via laterale diretta*

- ✓ Angolo di Inclinazione: 35-55°
- ✓ Angolo di Antiversione: 5-25°

Rittmeister e Callitsis (2006): *via anterolaterale (76%)*

- ✓ Angolo di Inclinazione: 35-55°
- ✓ Angolo di Antiversione: 5-25°

Fujishiro (2016): posterolateral approach

- ✓ Angolo di Inclinazione: 30-50°
- ✓ Angolo di Antiversione: 10-30°

Grammatopoulos (2015):

- ✓ Angolo di Inclinazione: 27-57°
- ✓ Angolo di Antiversione: -3-27°

Danoff (2016):

- ✓ Angolo di Inclinazione: 30-50°
- ✓ Angolo di Antiversione: 10-25°

Garcia-Rey (2016):

- ✓ Angolo di Inclinazione: 35-50°
- ✓ Angolo di Antiversione: 5-25°

Garcia-Cimbrelo (2016):

- ✓ Angolo di Inclinazione: 35-50°
- ✓ Angolo di Antiversione: 15-25°

# Fattori correlati all'Intervento

## Posizionamento della coppa acetabolare

- ✓ 9784 PTA (primi impianti) tra 2003 e 2012
- ✓ 206 (2%) Lussazioni
- ✓ FU medio: 27 mesi
- ✓ Parametri analizzati: angolo di inclinazione, antiversione, centro di rotazione, dismetria
- ✓ **58%** Lussazioni (120 su 206) **entro la “Safe Zone”** di Lewinnek

Clin Orthop Relat Res (2016) 474:386–391  
DOI 10.1007/s11999-015-4432-5

Clinical Orthopaedics  
and Related Research®  
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SYMPOSIUM: 2015 HIP SOCIETY PROCEEDINGS

### **What Safe Zone? The Vast Majority of Dislocated THAs Are Within the Lewinnek Safe Zone for Acetabular Component Position**

Matthew P. Abdel MD, Philipp von Roth MD, Matthew T. Jennings BS,  
Arlen D. Hanssen MD, Mark W. Pagnano MD

## Posizionamento della coppa acetabolare

*Acta Orthopaedica* 2016; 87 (x): x-x

1

### Acetabular cup position and risk of dislocation in primary total hip arthroplasty

#### A systematic review of the literature

Kurt G SEAGRAVE<sup>1,2</sup>, Anders TROELSEN<sup>2</sup>, Henrik MALCHAU<sup>3,4</sup>, Henrik HUSTED<sup>2</sup>, and Kirill GROMOV<sup>2</sup>

<sup>1</sup> Faculty of Medicine, University of New South Wales, Sydney, Australia; <sup>2</sup> Department of Orthopaedic Surgery, Copenhagen University Hospital Hvidovre, Copenhagen, Denmark; <sup>3</sup> Harris Orthopaedic Laboratory, Massachusetts General Hospital; <sup>4</sup> Department of Orthopaedic Surgery, Harvard Medical School, Boston, MA, USA.

Correspondence: kirgromov@gmail.com

Submitted 2016-05-12. Accepted 2016-09-06.

Review di **28** articoli: non c'è correlazione tra la posizione della coppa acetabolare e la lussazione postoperatoria nelle PTA -> **NO IDEAL TARGET ZONE**

# Fattori correlati all'Intervento

## Posizionamento della coppa acetabolare

Clin Orthop Relat Res (2018) 476:325-335  
DOI 10.1007/s11999.0000000000000051

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**2017 Hip Society Proceedings**

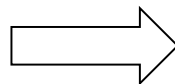
Published online: 17 January 2018

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## The Safe Zone Range for Cup Anteversion Is Narrower Than for Inclination in THA

William S. Murphy AB, Ho Hyun Yun MD, Brett Hayden MD, Jens H. Kowal PhD,  
Stephen B. Murphy MD

SAFE ZONE basato  
sulla TAC



- ✓ Angolo di inclinazione: 31-55°  
(43°  $\pm$  12° )
- ✓ Angolo di antiversione: 23-39°  
(31°  $\pm$  8° )

# Fattori correlati all'Intervento

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## Femoral Offset

- ✓ Maschio:  $4.36 \pm 0.56$  cm
- ✓ Femmina:  $3.95 \pm 0.35$  cm
- ✓ Sesso specifico e simmetrico
- ✓ Correlato all'altezza negli uomini

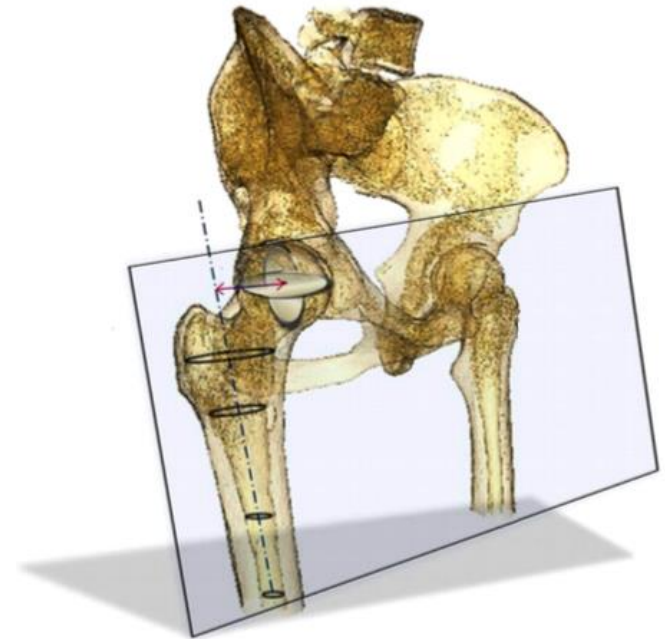


Table 2. Correlation of FO with Height and Body are Shown Together with p-Values

		Female		Male	
		Height	Body Weight	Height	Body Weight
FO	corr. coeff.	-0.22	0.04	0.30	0.29
	p	0.13	0.80	0.03	0.04

FO femoral offset; corr coeff correlation coefficient.

578

*The Open Orthopaedics Journal*, 2012, 6, 578-581

Open Access

## Femoral Offset (3D) in Patients without Osteoarthritis – Index Values from 200 Hip Joints

Bernd Preininger\*, Kathrin Schmorl, Philipp von Roth, Tobias Winkler, Georg Matziolis, Carsten Perka and Stephan Tohtz

Department of Orthopaedics, Center for Musculoskeletal Surgery and Berlin-Brandenburg Center for Regenerative Therapies, Charité - University Medicine Berlin, Charitéplatz 1, D-10117 Berlin, Germany

# Fattori correlati all'Intervento

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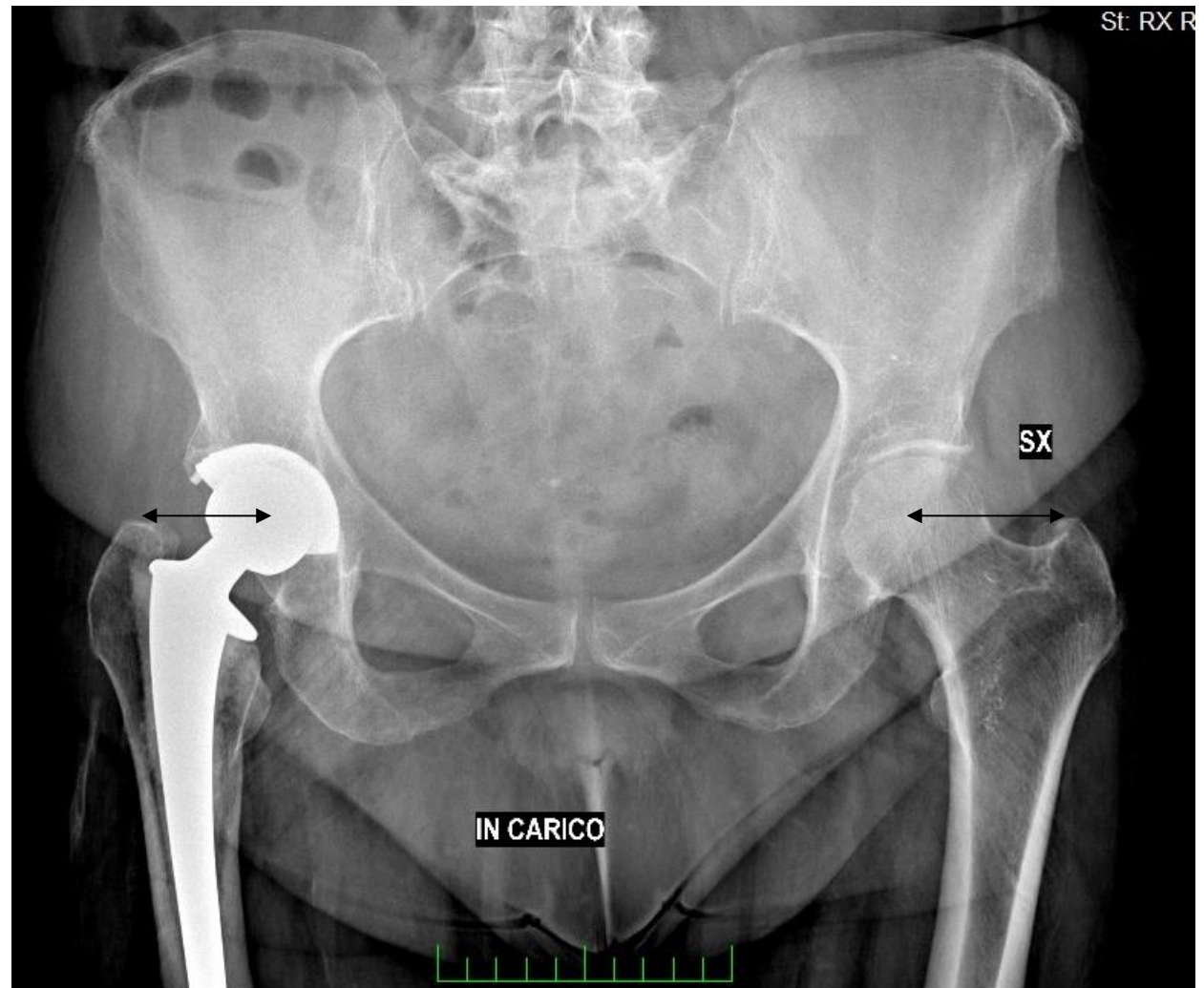


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## Femoral Offset

- ✓ Stabilità
- ✓ Mobilità
- ✓ Efficienza  
ottimale  
degli  
abduuttori





# Fattori correlati all'Intervento

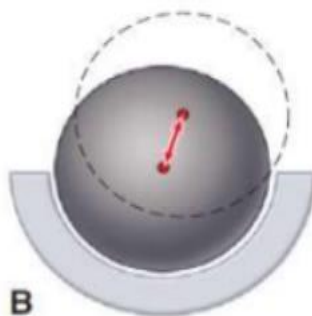
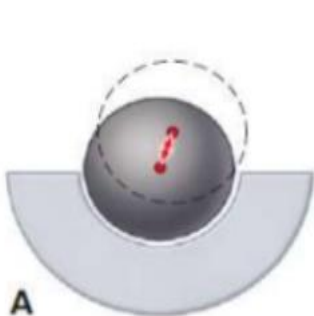
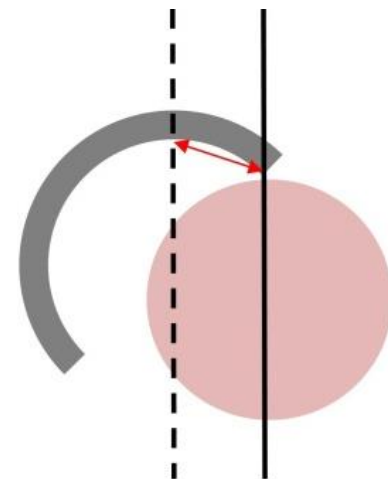
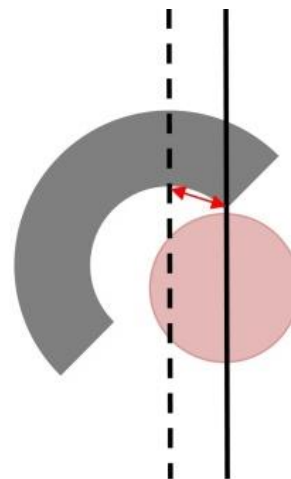
## Tipo di Impianto : Jump Distance

Teste di maggior diametro,  
richiedono traslazione maggiore  
prima della lussazione

MA

il limite

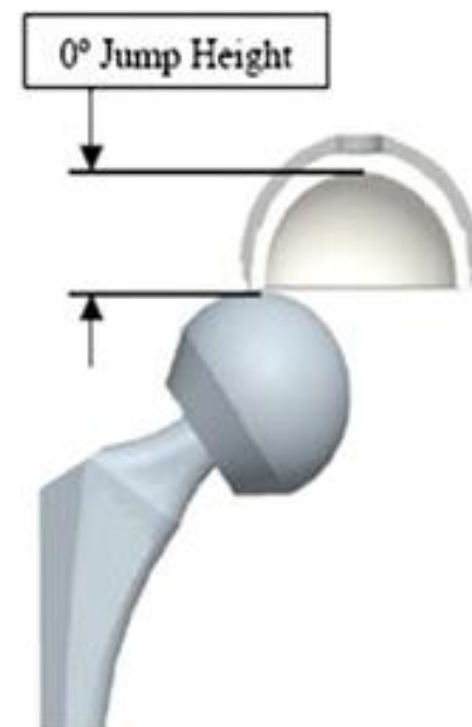
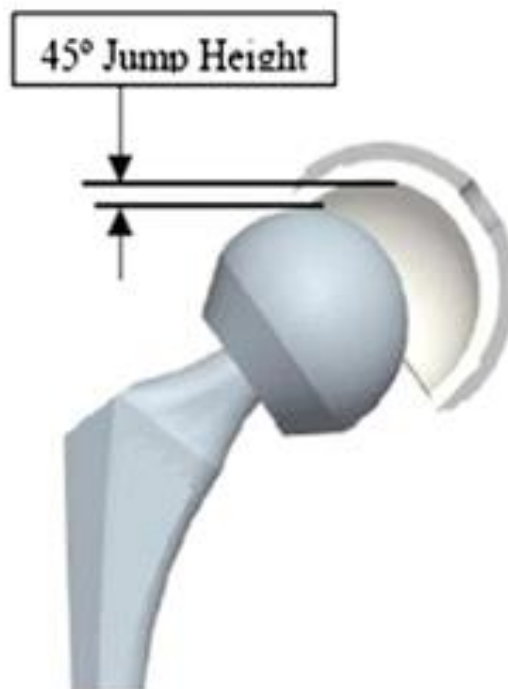
è che NON ci sono vantaggi  
per diametri  $>36$  mm.



# Fattori correlati all'Intervento

## Tipo di Impianto : Jump Distance

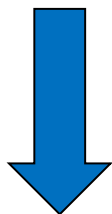
- ✓ Diminuisce a seconda dell'inclinazione della coppa acetabolare: 0.25 mm per  $1^\circ$  con una testa di 32 mm.
- ✓ Aumenta con l'antiversione della coppa: 0.05 mm per  $1^\circ$
- ✓ Aumenta all'aumentare del diametro della testa: 0.4 mm per 1 mm di diametro della testa quando l'inclinazione è  $45^\circ$



# Fattori correlati all'Intervento

Tipo di Impianto : INSERTO

- ✓ Neutro
- ✓ Con spalletta (10° o 20° )



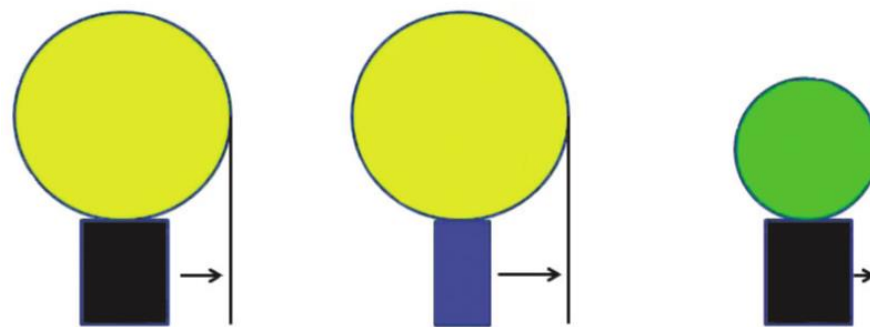
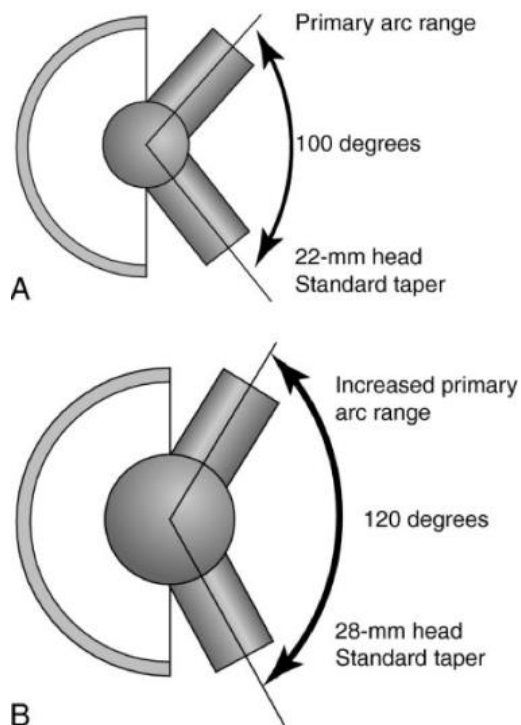
OSTEOFITA  
ARTIFICIALE?!



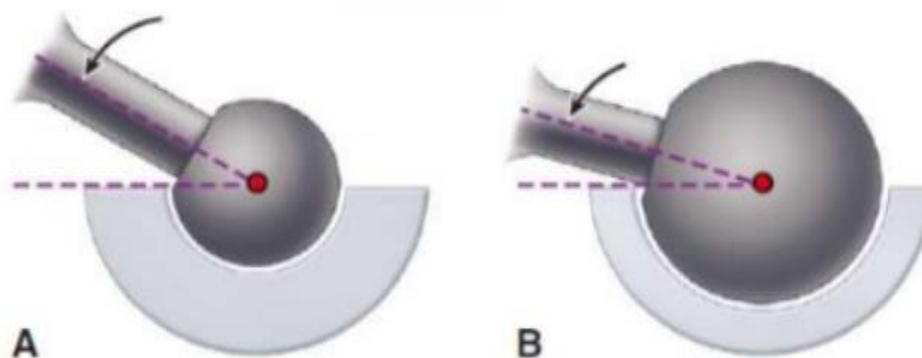
# Fattori correlati all'Intervento

## Tipo di Impianto : Head Neck Ratio

- ✓ ROM
- ✓ Impingement
- ✓ Stabilità dell'articolazione



*McKee – Farrar Principle, 1966*

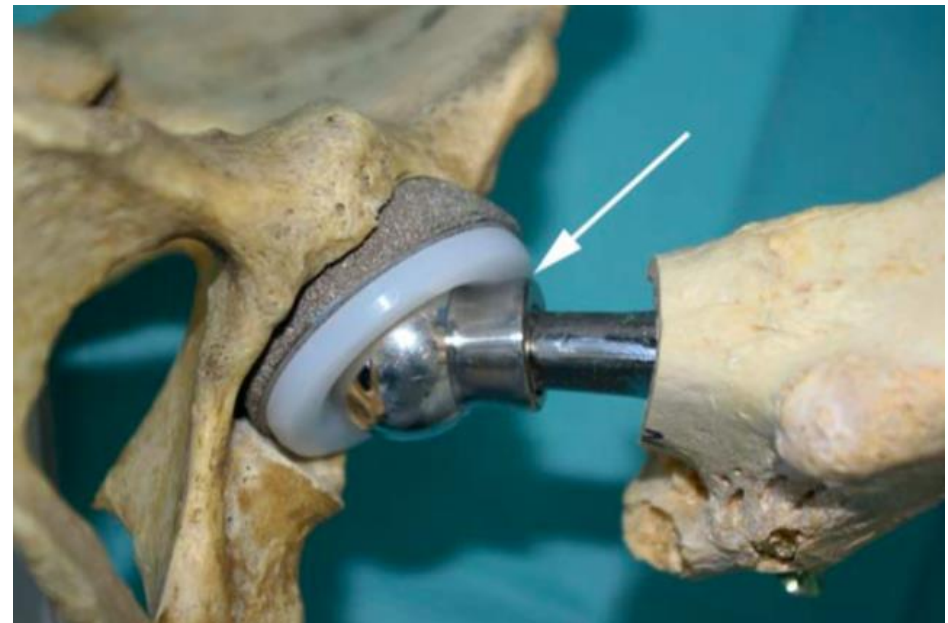
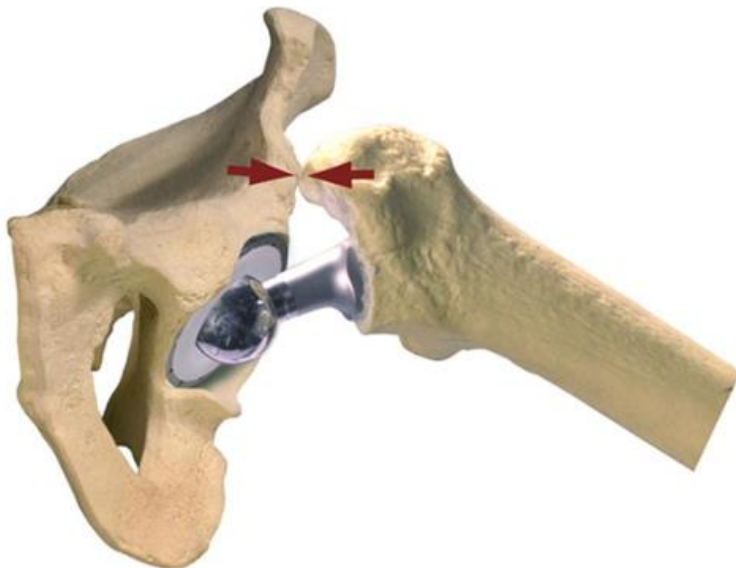
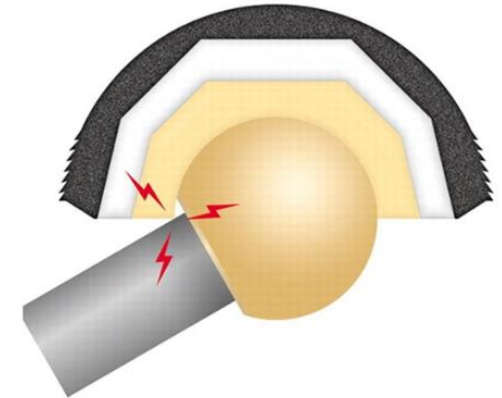


*Fissando il diametro del collo, teste più piccole hanno minor ROM*

# Fattori correlati all'Intervento

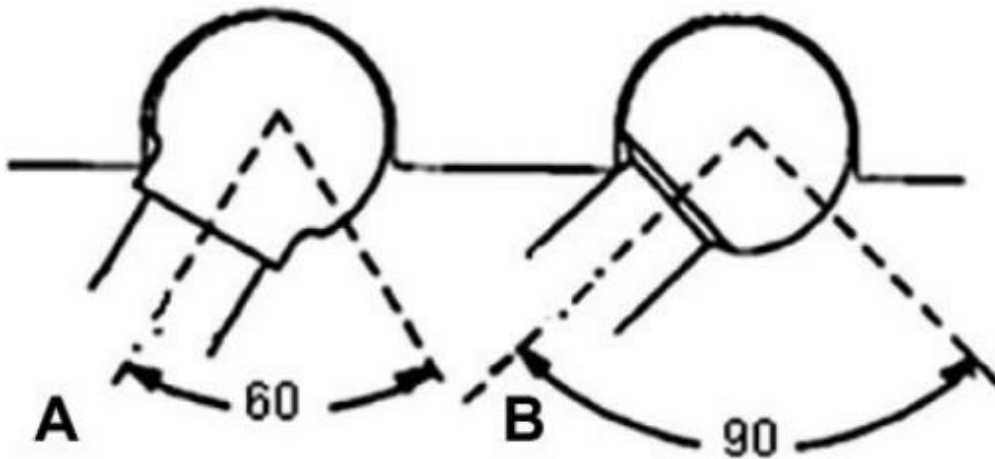
## Tipo di Impianto : Head Neck Ratio VS Impingement

Aumenta rischio di lussazione IMPINGEMENT collo VS osteofita, un tessuto cicatriziale, l'inserto, il cemento o un'ossificazione eterotopica.  
Componenti con **elevata Head-Neck ratio** hanno **minor probabilità di impingement/lussazione**.



# Fattori correlati all'Intervento

## Tipo di Impianto : Head Neck Ratio VS Impingement



Skirted Head:  
diminuiscono il Rom,  
aumentano il rischio di  
Impingement.



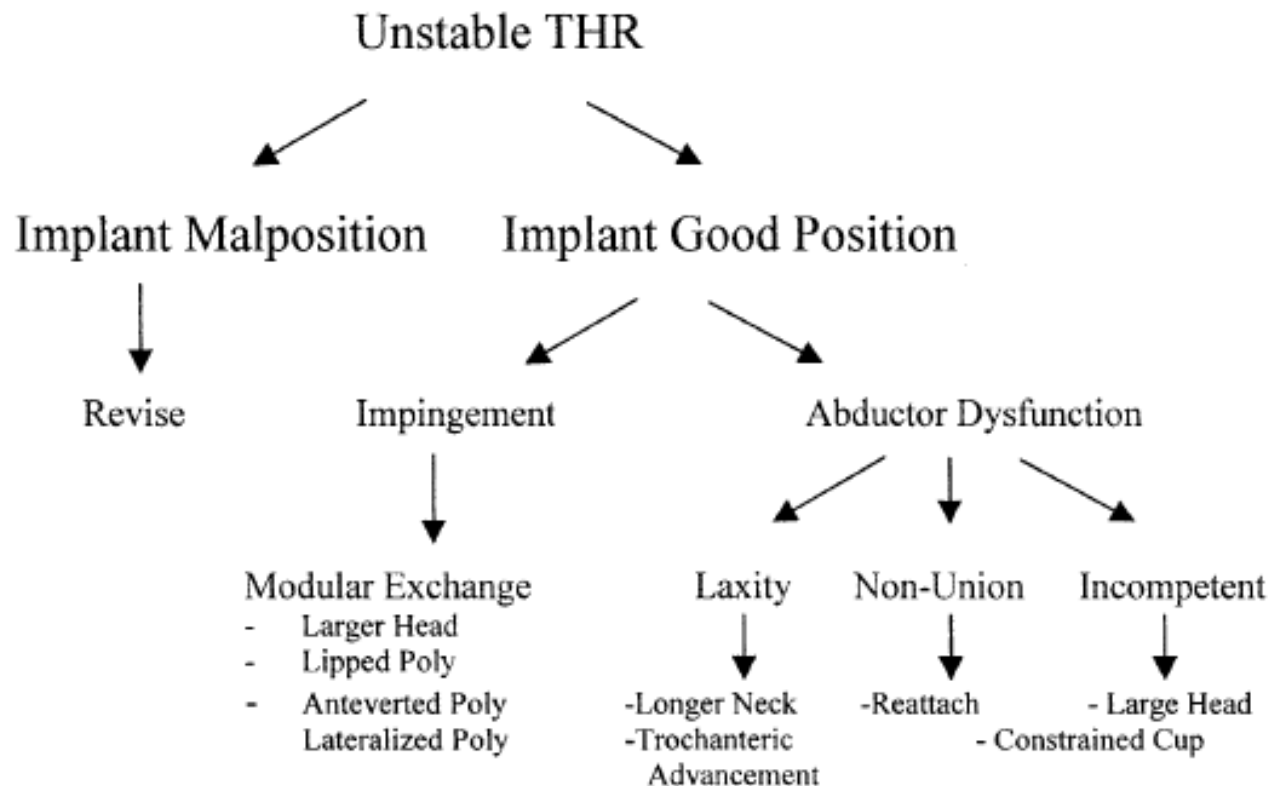


The Journal of Arthroplasty Vol. 19 No. 4 Suppl. 1 2004

### **The Dislocating Hip**

What to Do, What to Do

Robert B. Bourne, MD, FRCSC, and Ramin Mehin, MD, FRCSC



## Letteratura

Wera GD, Ting NT, Moric M, Paprosky WG, Sporer SM, Della Valle CJ. **Classification and management of the unstable total hip arthroplasty.**

J Arthroplasty. 2012 May;27 (5):710-5. doi:10.1016/j.arth.2011.09.010. Epub 2011 Oct 29.

### Classificazione Instabilità :

1. Malposizionamento della componente acetabolare
2. Malposizionamento della componente femorale
3. Deficit degli abduttori
4. Impingement tessuti molli/osso
5. Usura tardiva eccentrica del polietilene
6. Causa non definita

Dopo revisione

Fallimento: 14.6% a 12 mesi

Complicazioni: 21% a 60 mesi

# Algoritmo di Trattamento

## Letteratura

The Journal of Arthroplasty Vol. 26 No. 6 Suppl. 1 2011

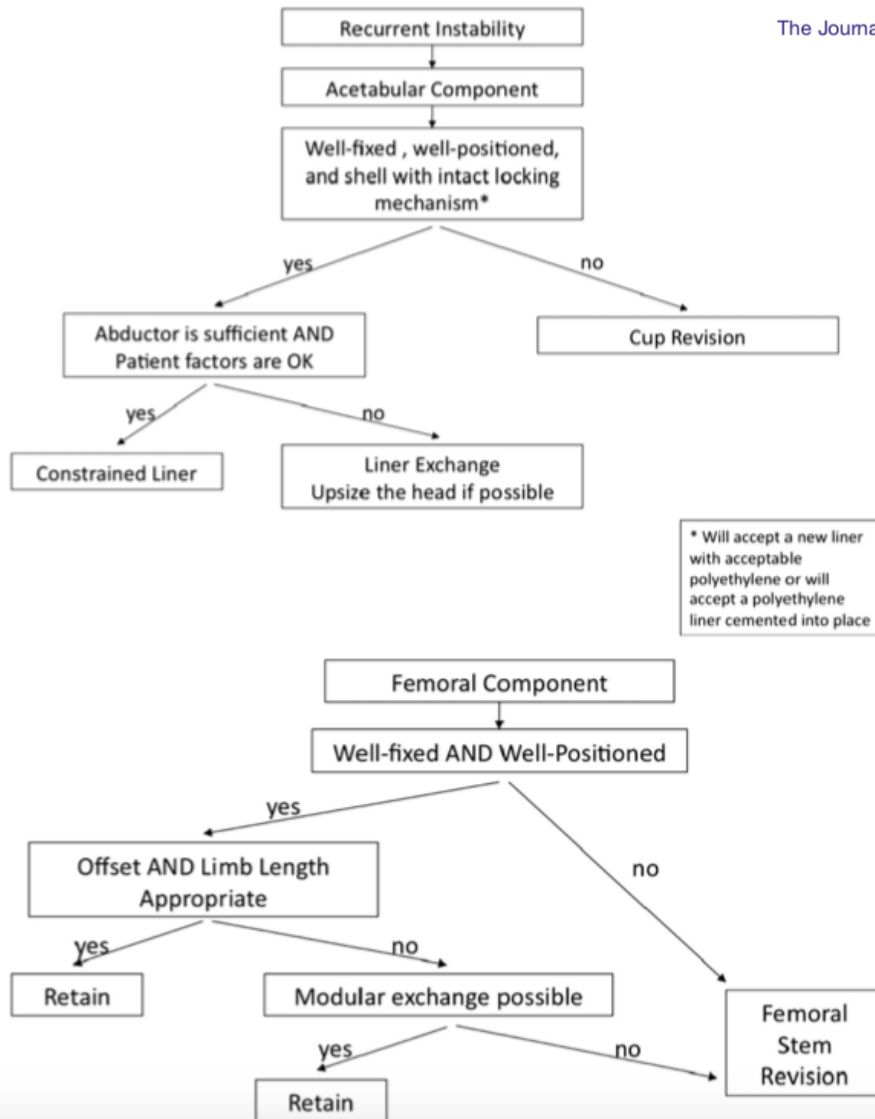
### Revision for Recurrent Instability

#### What are the Predictors of Failure?

Aaron H. Carter, MS, Eoin C. Sheehan, MD, S.M. Javad Mortazavi, MD, James J. Purtill, MD, Peter F. Sharkey, MD, and Javad Parvizi, MD, FRCS

**Abstract:** Dislocation is a common complication following total hip arthroplasty (THA). In this study, we evaluated treatment strategies in patients undergoing revision THA for instability. A total of 156 hips in 154 patients underwent revision THA for instability between 2000 and 2007 at our institution. Demographic data and surgical treatment used were analyzed to determine risk factors for failure. Revision treatments included acetabular components in 100 hips, liner exchange in 56 hips, and femoral and acetabular components in 13 hips. Thirty-three (21.2%) had further dislocation. Isolated liner revision ( $P = .004$ ), previous revision arthroplasty ( $P < .05$ ), and the use of a 28-mm femoral head were associated with higher failure rates. A total of 20.3% (12/59) of constrained liners failed. Isolated liner exchange, history of revision, and use of a 28-mm head were associated with failure in revision THA for instability. **Keywords:** total hip arthroplasty, instability, predictors of failure.

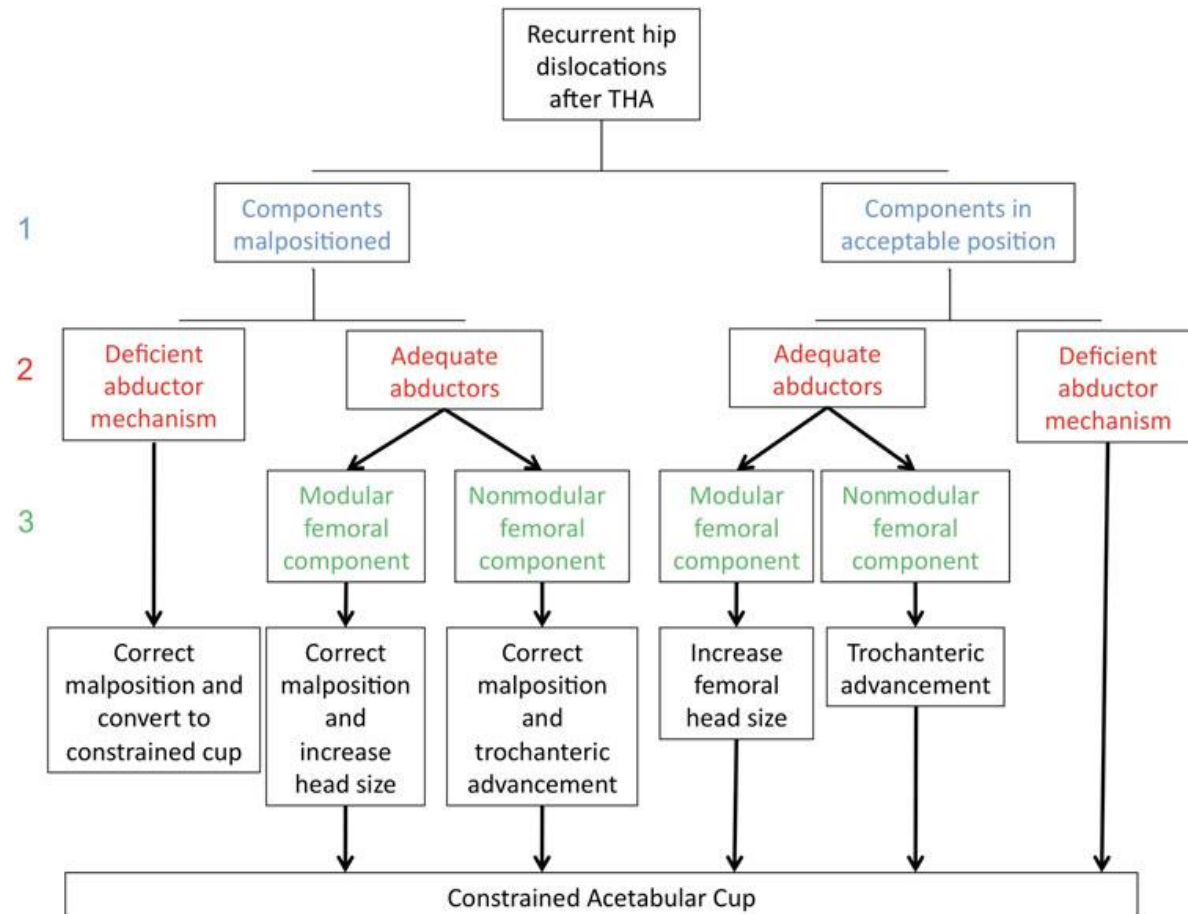
© 2011 Elsevier Inc. All rights reserved.



SYMPOSIUM: PAPERS PRESENTED AT THE ANNUAL MEETINGS OF THE HIP SOCIETY

## Is an Algorithmic Approach to the Treatment of Recurrent Dislocation After THA Effective?

Ehsan Saadat MD, Glenn Diekmann MD,  
Steven Takemoto PhD, Michael D. Ries MD



# Dislocation Following Total Hip Replacement

Jens Dargel, Johannes Oppermann, Gert-Peter Brüggemann, Peer Eysel

Deutsches Ärzteblatt International 2014; 111: 884–90

Sistema Socio Sanitario

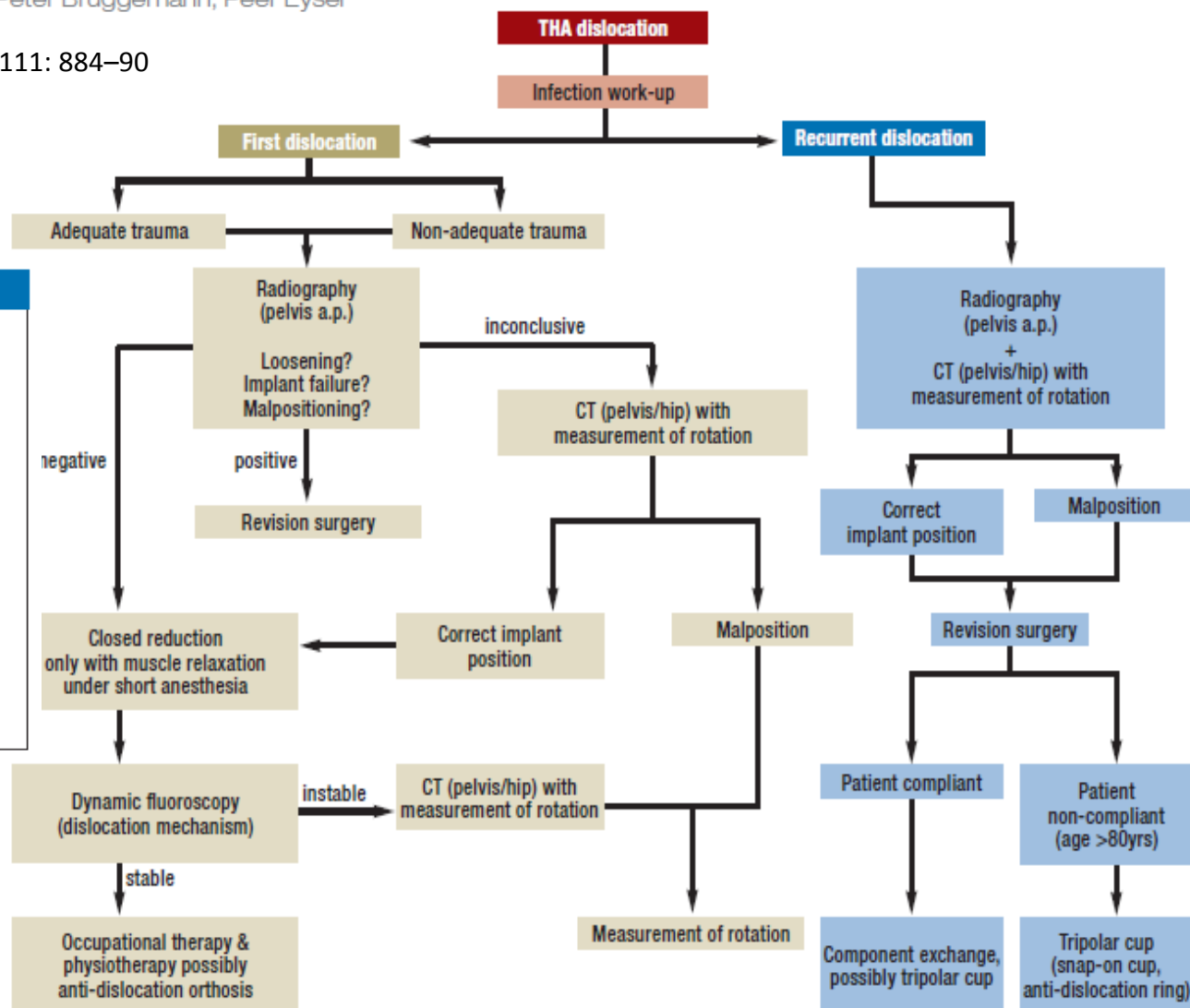


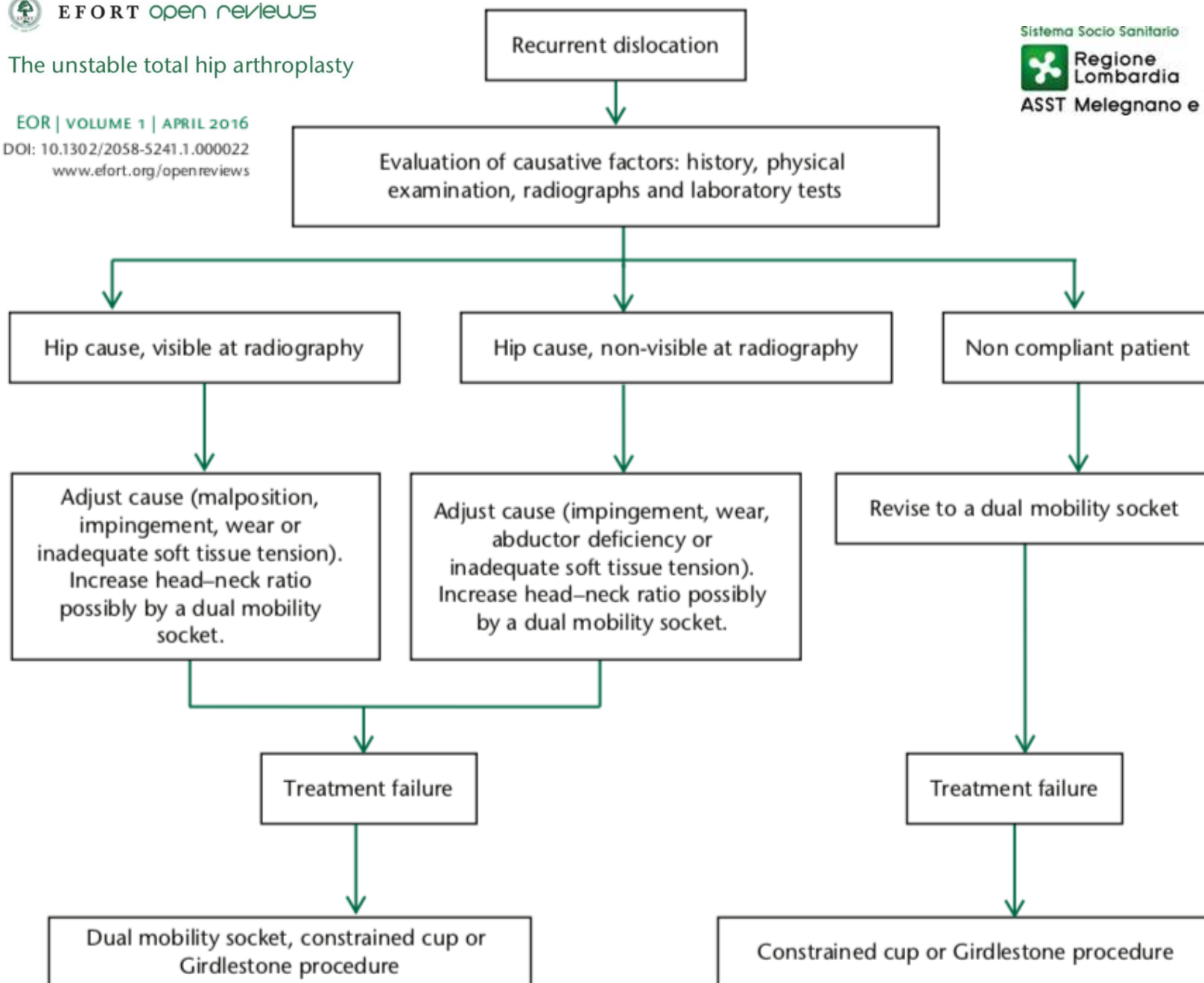
Regione  
Lombardia

ASST Melegnano e Martesana

## KEY MESSAGES

- The risk of dislocation after primary total hip arthroplasty is approximately 2%.
- Dislocation rates of up to 28% are found after revision and implant exchange surgeries.
- Patient-specific risk factors include advanced age, concomitant neurological disease and limited compliance.
- Relevant operation-specific risk factors include implant malpositioning, inadequate soft-tissue tension, and little surgical experience.
- Treatment of instability after total hip replacement should follow a standardized algorithm.







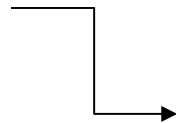
# Algoritmo di Trattamento

## Cause di instabilità :

1. Identificabili radiograficamente

1. Non identificabili radiograficamente

1. Non dipendenti dall'intervento



- ✓ Paziente non collaborante
- ✓ Disordini neuromuscolari
- ✓ Demenza
- ✓ Combinazione di 2 o più dei 3 fattori sopracitati

## Imaging

- ✓ Rx del Bacino AP + assiale anca
- ✓ RX bacino con la colonna LS (AP e LL)
- ✓ Studio TC per:
  - ✓ Versione dello stelo (software riduzione artefatti metallici)
  - ✓ Posizione dell'acetabolo in relazione al bacino

Imaging INCONCLUSIVO  Fluoroscopia dinamica

T. Ala Eddine, H. Migaud, C. Chantelot, A. Cotton, C. Fontaine, A. Duquennoy  
**Variations of pelvic anteversion in the lying and standing positions: analysis of 24 control subjects and implications for CT measurement of position of a prosthetic cup**  
Surg Radiol Anat, 23 (2001), pp. 105-112

J.Y. Lazennec  
**L'équilibre lombo-pelvi-fémoral en vue de profil, debout et assis. Conférence d'enseignement. Cahiers d'enseignement de la Sofcot**  
Elsevier Masson, Paris (2012), pp. 101-119

# Algoritmo di Trattamento

## Revisione chirurgica

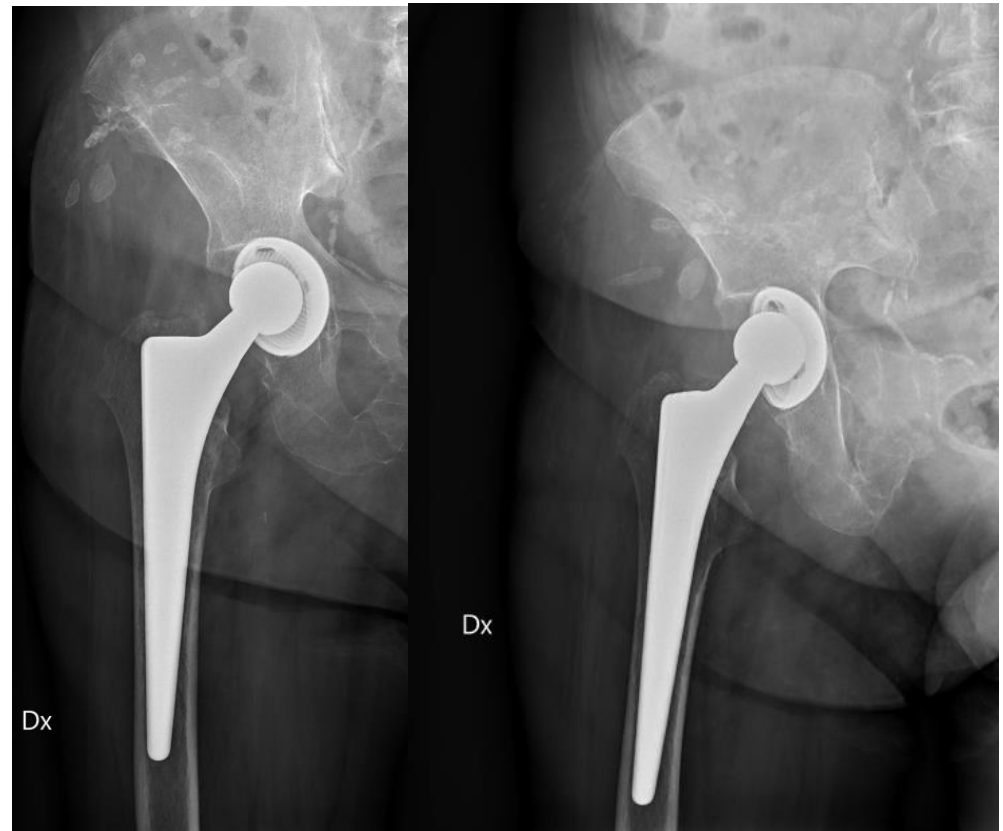
Le **Strategie di Revisione** per l'instabilità ricorrente sono tipicamente rivolte alla **correzione della/e causa/e**.

- ✓ Revisione componente acetabolare/femorale/componenti modulari
- ✓ Plastica del ventaglio gluteo/Osteotomia trocanterica
- ✓ Rimozione Impingement tessuti molli/osso
- ✓ Sostituzione del polietilene
- ✓ Doppia mobilità
- ✓ Coppa ritentiva

# Algoritmo di Trattamento

## Malposizionamento dei Componenti

- ✓ Più frequentemente il problema è la componente acetabolare (33%) [Morrey, CORR 1997]
- ✓ *Cambiare lo stelo è una procedura che si attua meno frequentemente (11,5%) [Morrey, CORR 1997]*
- ✓ Tasso di successo variabile:  
69% [Morrey, CORR 1997]  
86% [Carter, J Arthroplasty 2011]



L.D. Dorr, A. Malik, M. Dastane, Z. Wan

**Combined anteversion technique for total hip arthroplasty**

Clin Orthop Relat Res, 467 (2009), pp. 119-127

# Algoritmo di Trattamento

## Malposizionamento dei Componenti

Cambio del SOLO inserto -> fallimento **34%-55%**  
Risultato di un malposizionamento acetabolare  
non diagnosticato [Carter, J Arthroplasty 2011]

- ✓ Testa più lunga
- ✓ Collo modulare più lungo
- ✓ Inserto con spalletta
- ✓ Inserto lateralizzante

possono essere una strategia di stabilizzazione a  
volte però con scarsi risultati...

# Algoritmo di Trattamento

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## Caso clinico:

- ✓ Bio ball retrovertente  
(lussazione post op  
recidivante)
- ✓ RIDUZIONE





# Algoritmo di Trattamento

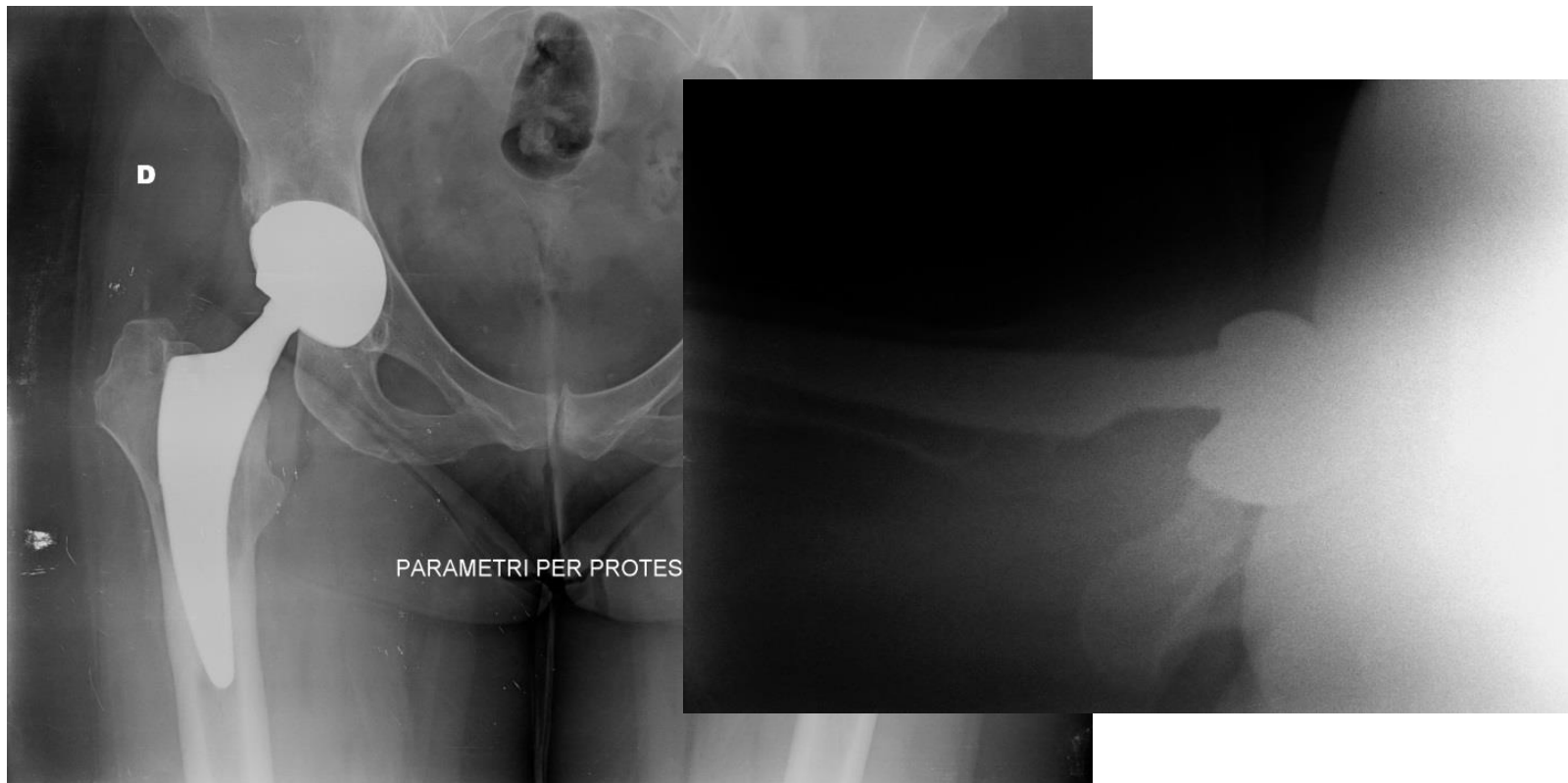
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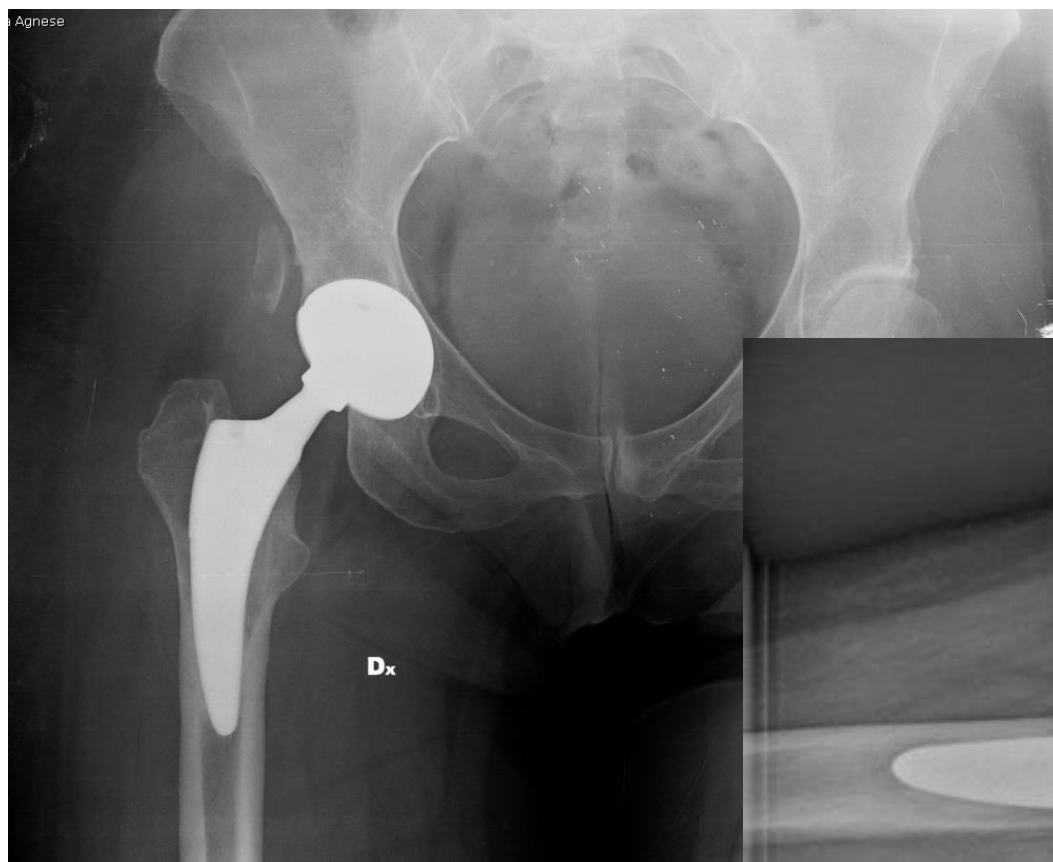
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## Caso clinico:

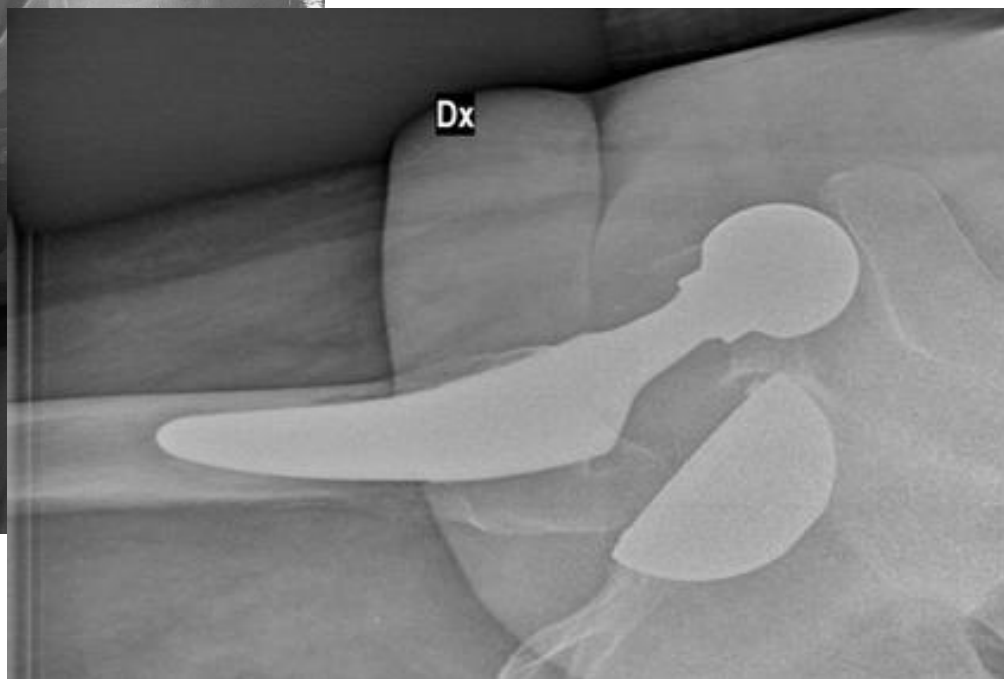


# Algoritmo di Trattamento

## Caso clinico:



- ✓ Inserto antilussante + testa skirted lunga



# Algoritmo di Trattamento

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## Caso clinico:



Revisione globale:  
- Correzione VERSIONE  
COTILE e STELO

Ctrl a 2 anni



# Algoritmo di Trattamento

## Deficit degli abduttori

- ✓ Pseudoartrosi trocanterica  
↓  
Osteosintesi GT
- ✓ Distacco della muscolatura glutea  
↓  
Plastica del ventaglio gluteo



# Algoritmo di Trattamento

## Usura inserto in PE



2015 -> testa 28mm



# Algoritmo di Trattamento

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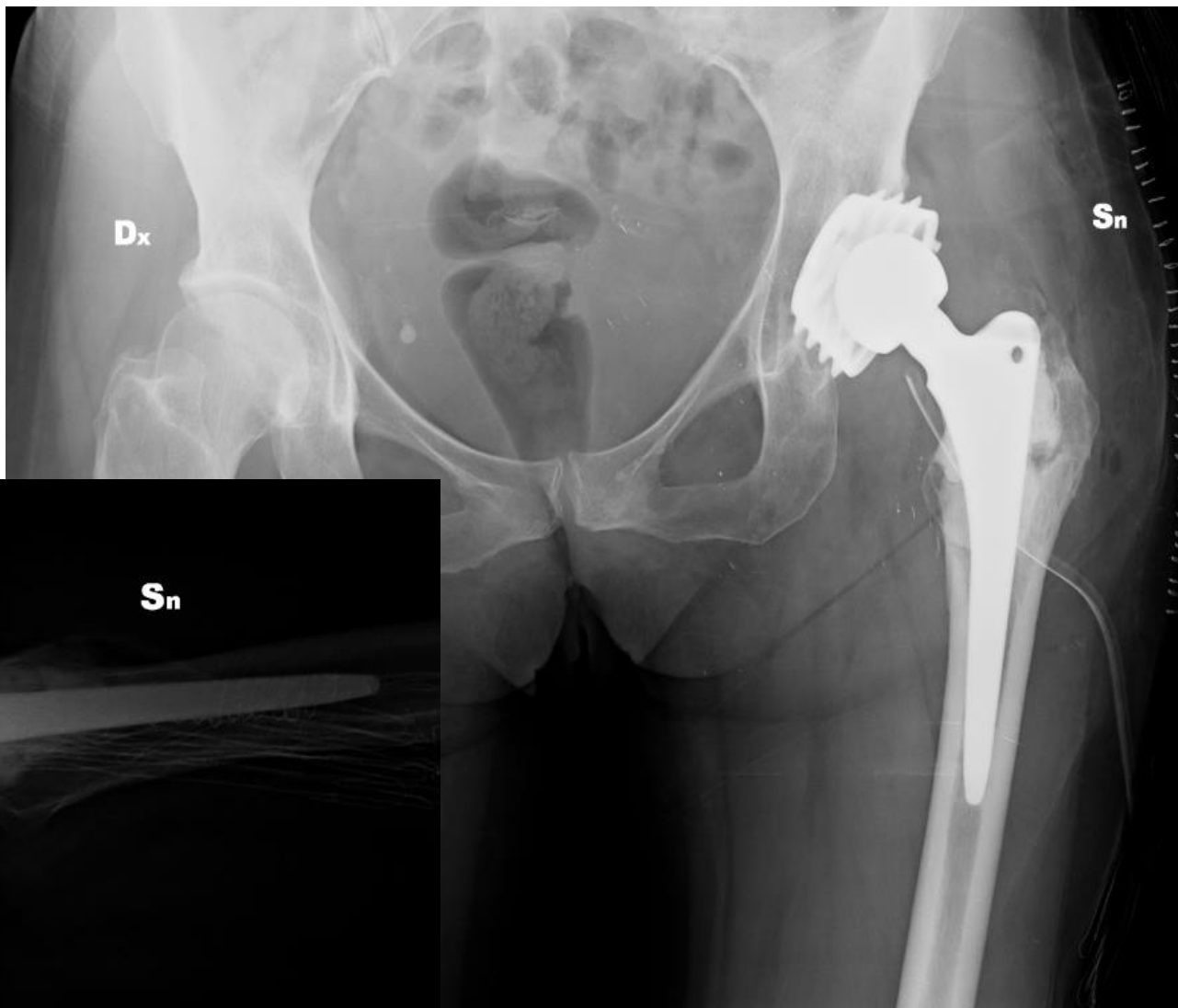
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## Usura inserto in PE

2015:

- Cambio inserto PE;
- Testa 32mm;
- Cementazione prossimale.





# Algoritmo di Trattamento

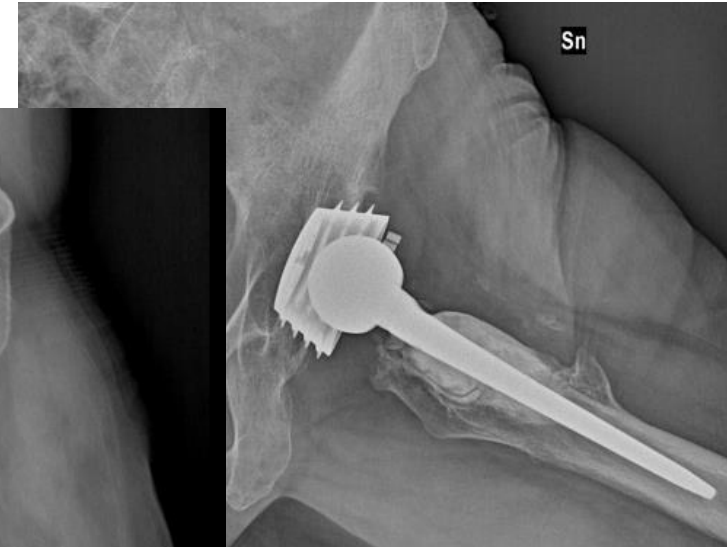
## Usura inserto in PE

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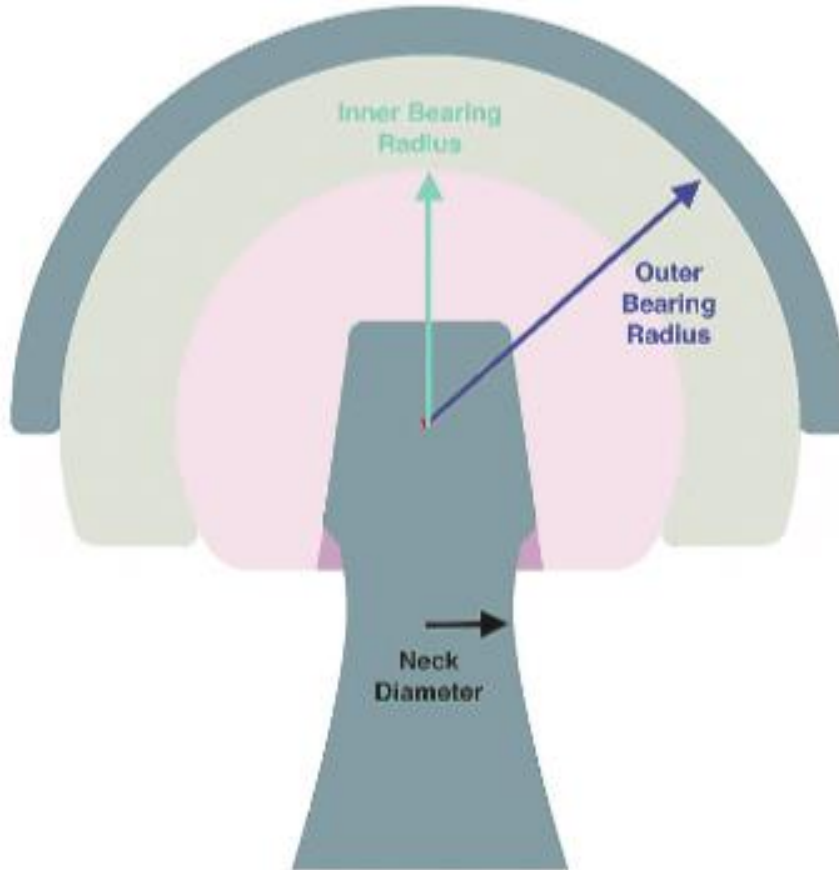
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2018

# Algoritmo di Trattamento

## Doppia mobilità

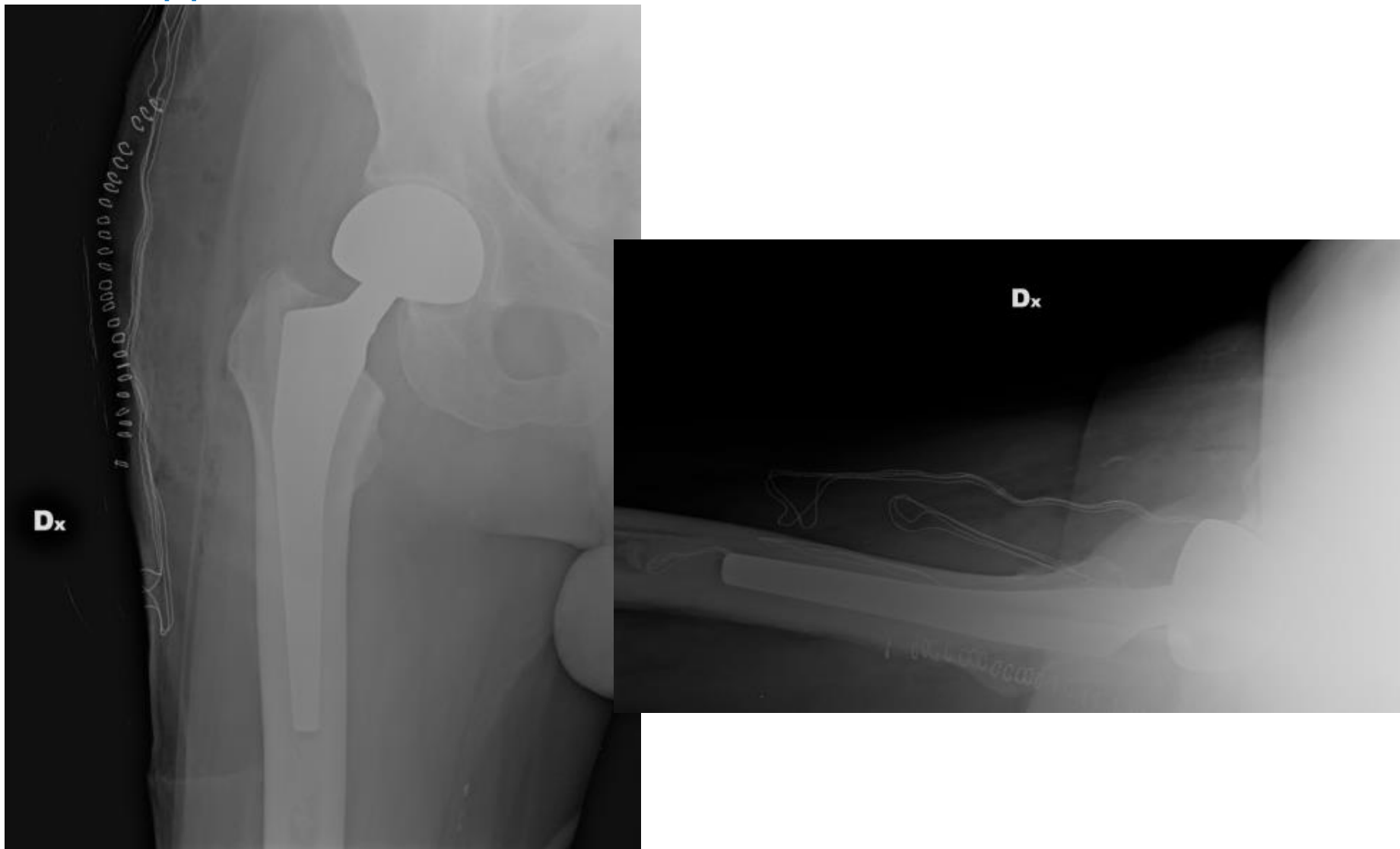


Indicazione più comune è il trattamento dell'instabilità

*Bousquet e  
Bornand, 1984*

# Algoritmo di Trattamento

## Doppia mobilità : caso clinico



# Algoritmo di Trattamento

## Doppia mobilità : caso clinico



# Algoritmo di Trattamento

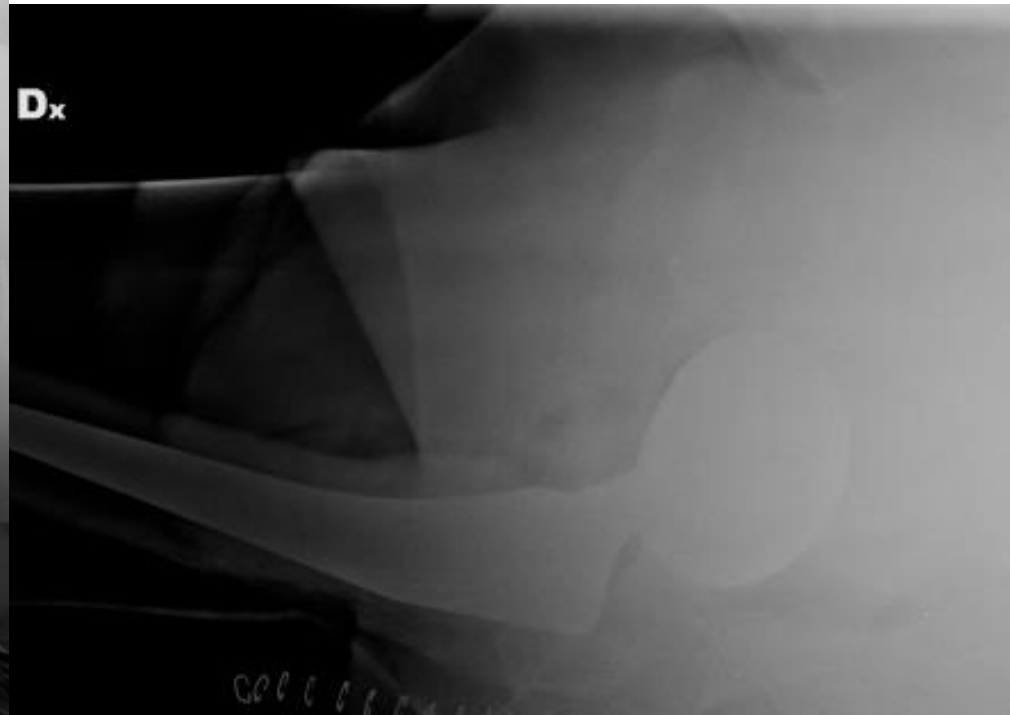
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## Doppia mobilità : caso clinico



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## Doppia mobilità : caso clinico





# Algoritmo di Trattamento

## Doppia mobilità



■ INSTRUCTIONAL REVIEW VOL. 100-B, No. 1, JANUARY 2018  
**Outcomes of dual mobility components in total hip arthroplasty**  
A SYSTEMATIC REVIEW OF THE LITERATURE

- ✓Valida alternativa agli impianti tradizionali: basso tasso di instabilità e una sopravvivenza complessiva buona.
- ✓La dissociazione delle componenti era un problema coi primi designs con PE non crosslinked e testine da 22 mm.
- ✓Indicati nei pazienti ad alto rischio di lussazione per impianti primari, nelle revisioni e fratture del collo del femore.

Medline e Embase 10 anni (2007-2016) : 54 articoli trovati -> 25 articoli considerati sopravvivenza a 5.4 aa del 96.5%!

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**B. Darrith,  
P. M. Courtney,  
C. J. Della Valle**

*From Rush  
University Medical  
Center, Chicago,  
Illinois, United States*

# Algoritmo di Trattamento

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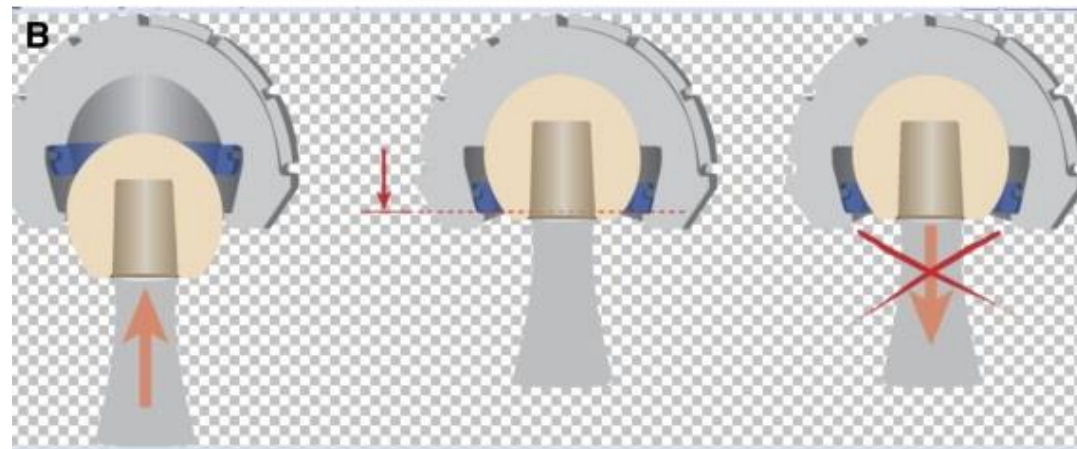
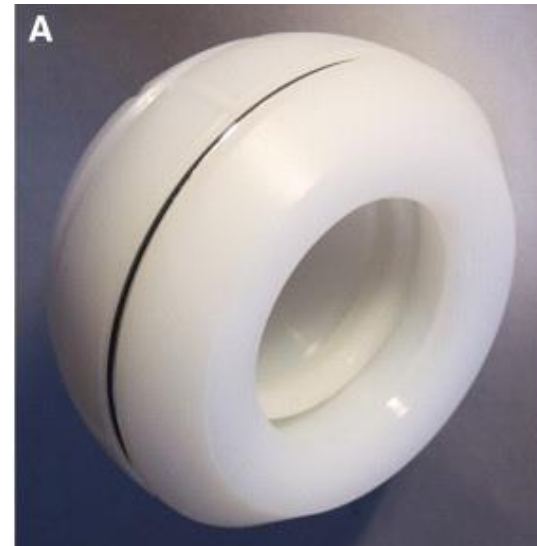
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## Constrained Cup

### Indicazioni :

- ✓ Insufficiente tensione dei tessuti molli
- ✓ Deficit degli abduttori
- ✓ Malattie neurologiche
- ✓ Impianti ben posizionati con lussazione ricorrente



# Algoritmo di Trattamento

## Constrained Cup

Sistema Socio Sanitario

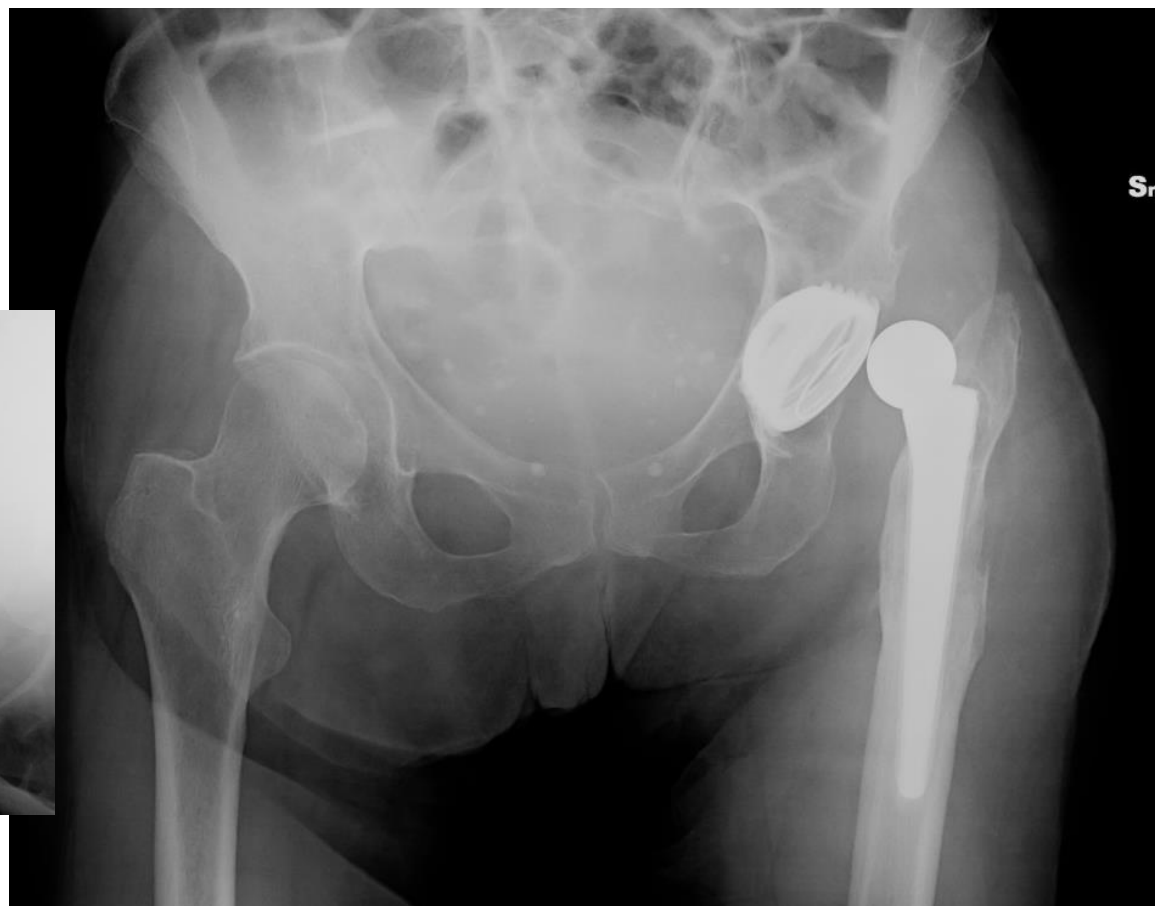
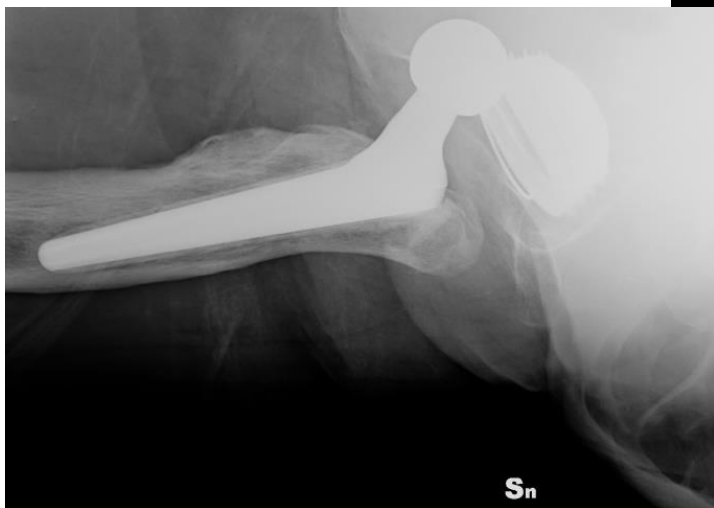


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Pz di 63 anni, con disturbo bipolare

Agosto  
2012



# Algoritmo di Trattamento

## Constrained Cup

Agosto  
2012

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# Algoritmo di Trattamento

## Constrained Cup

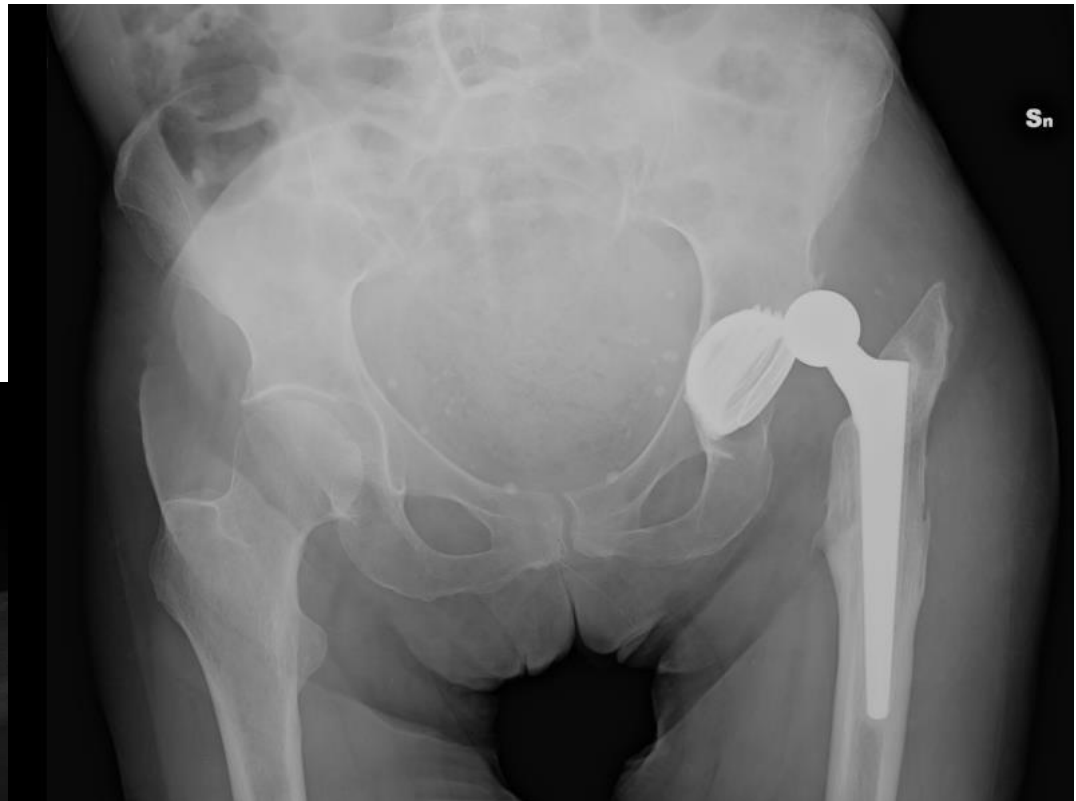
Ottobre  
2012

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# Algoritmo di Trattamento

## Constrained Cup

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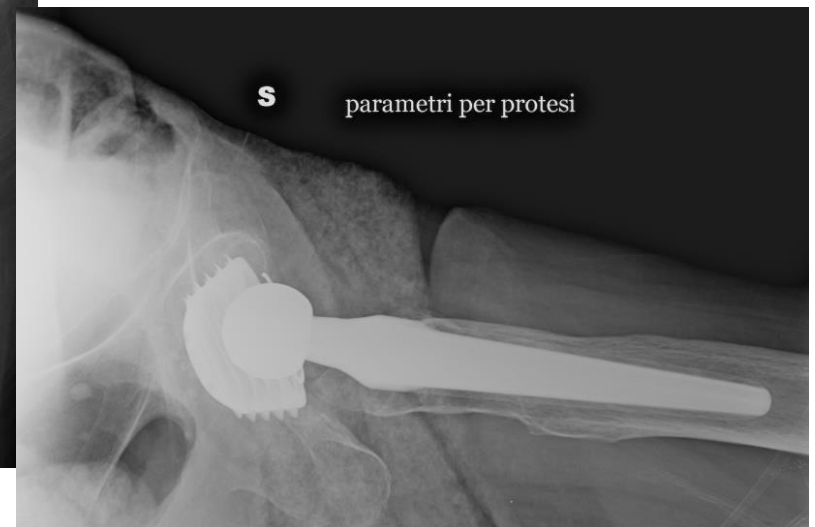


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Marzo  
2013





# Algoritmo di Trattamento

## Constrained Cup

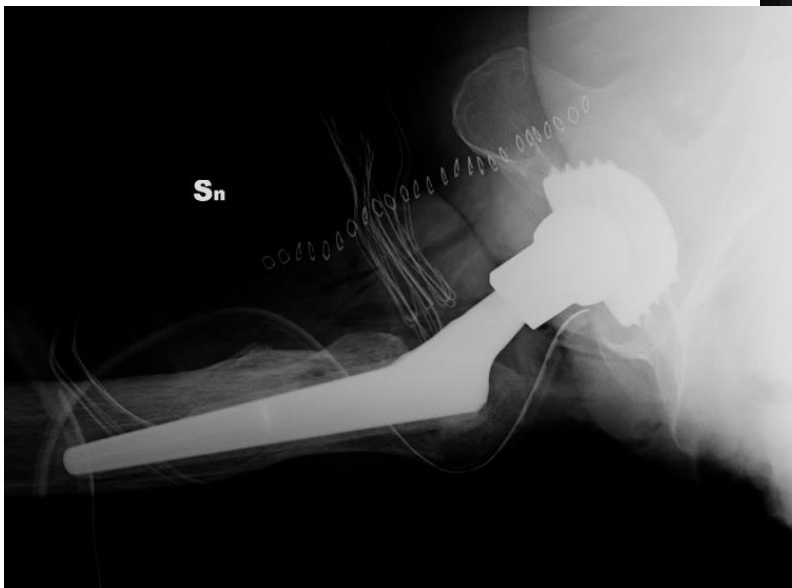
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Regione  
Lombardia

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Settembre  
2013 - Postop



# Algoritmo di Trattamento

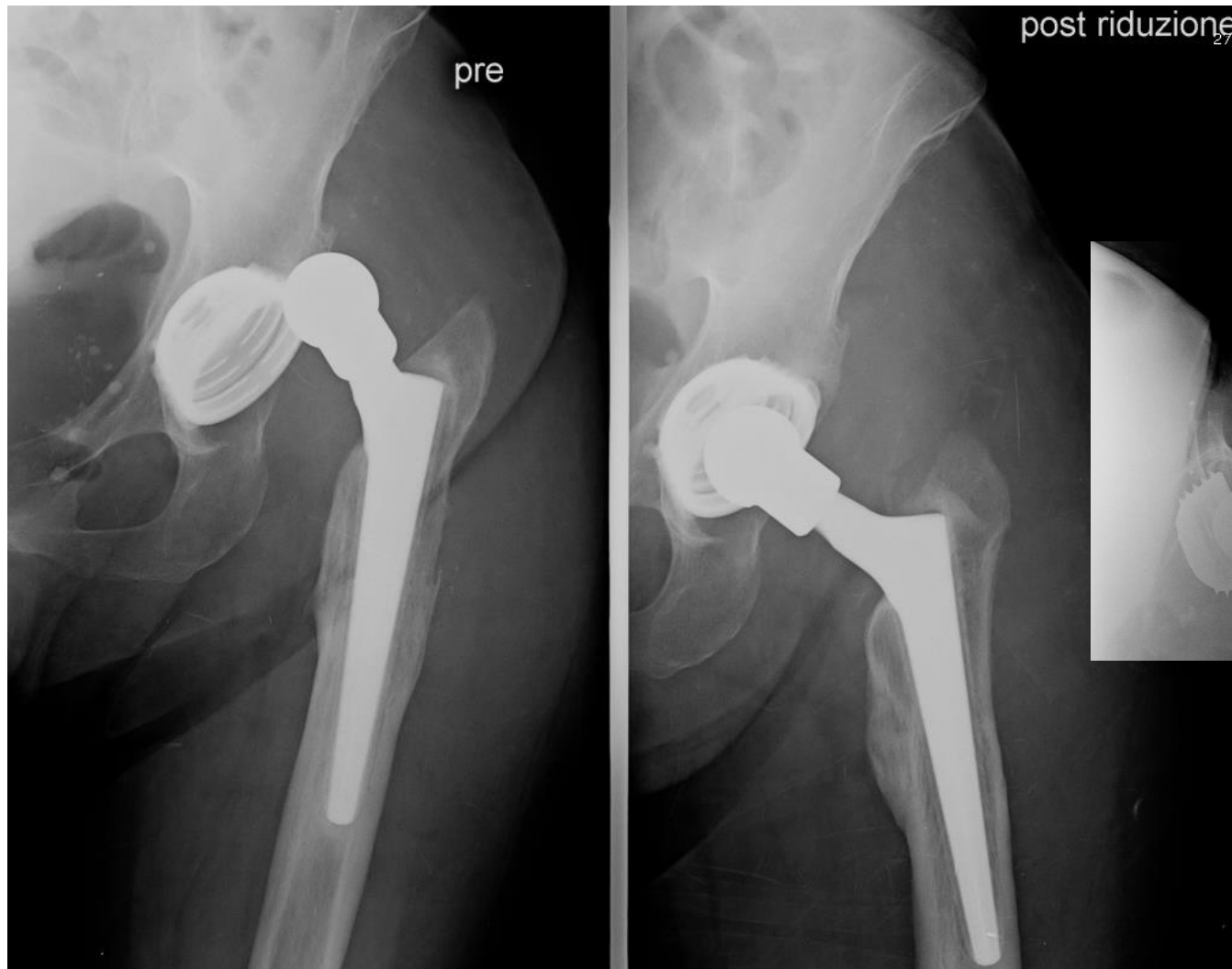
## Constrained Cup

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Regione  
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Gennaio  
2014

# Algoritmo di Trattamento

## Constrained Cup

Agosto  
2014

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Regione  
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# Algoritmo di Trattamento

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## Constrained Cup

NON assicurano una stabilità a lungo termine.

Noble



**Depuy S-Rom**



**Zimmer Trilogy Longevity  
Constrained Liner**



**Depuy Duraloc**



**Biomet Freedom Constrained  
Liner**

# Algoritmo di Trattamento

## Constrained Cup

### Svantaggi :

- ✓ Limitazione del ROM
- ✓ Trasmissione delle forze all'interfaccia cotile-osso con aumentato rischio di mobilizzazione asettica
- ✓ Difficile revisione nel caso di lussazione

**Williams JT Jr, Ragland PS, Clarke S.**  
Constrained components for the unstable hip following total hip arthroplasty: a literature review. *Int Orthop* 2007;31:273-7.

**Noble PC, Durrani SK, Usrey MM, Mathis KB, Bardakos NV.**  
Constrained cups appear incapable of meeting the demands of revision THA. *Clin Orthop Relat Res* 2012;470:1907-16.

# Algoritmo di Trattamento

## Constrained Cup

- ✓ 164 PTA in pazienti con deficit cognitivi e malattie neurologiche
- ✓ Lussazioni 2% a 7 anni



Hernigou P, Filippini P, Flouzat-Lachaniette CH, Batista SU, Poignard A. Constrained liner in neurologic or cognitively impaired patients undergoing primary THA. Clin Orthop Relat Res 2010;468:3255–62.

- ✓ 755 cotili ritentivi in revisioni PTA
- ✓ Sopravvivenza a 5 anni 68.5%
- ✓ Sopravvivenza a 10 anni 51.7%
- ✓ Tasso di lussazione 17.5% in generale e 28.9% dopo revisione



Berend KR, Sporer SM, Sierra RJ, Glassman AH, Morris MJ. Achieving stability and lower-limb length in total hip arthroplasty. J Bone Joint Surg Am 2010;92:2737–52.

- ✓ 57 cotili ritentivi di 4 designs in revisioni di PTA (media 36 mesi dopo il primo impianto)
- ✓ Rottura dell'anello di blocco 51%
- ✓ Mobilizzazione asettica 28%



Noble PC, Durrani SK, Usrey MM, Mathis KB, Bardakos NV. Constrained cups appear incapable of meeting the demands of revision THA. Clin Orthop Relat Res 2012;470:1907–16.



# Algoritmo di Trattamento

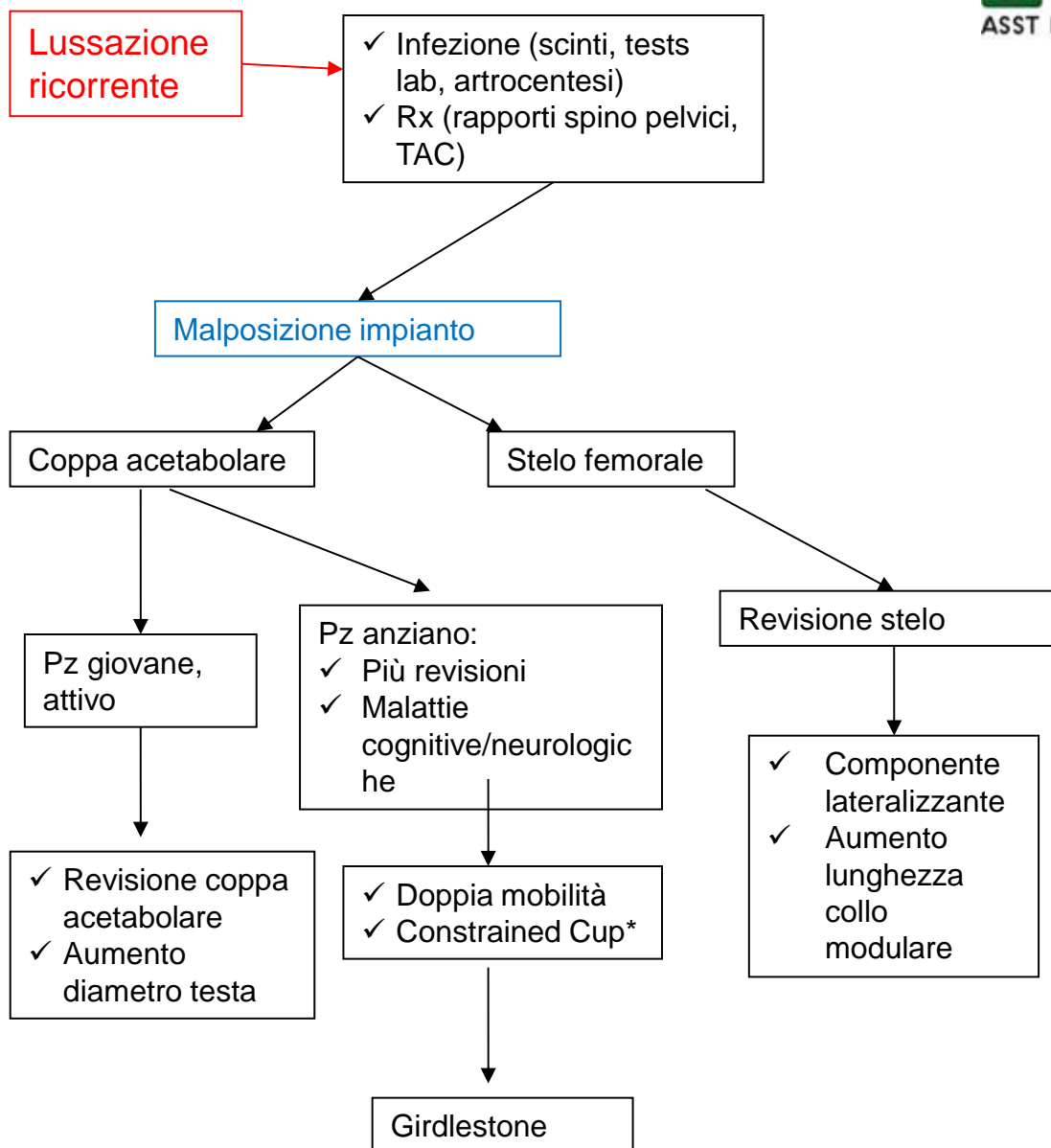
## Intervento di Girdlestone

Anca pendente: i tessuti molli rimanenti formano una cicatrice, lasciando al paziente un arto accorciato e una zoppia significativi.

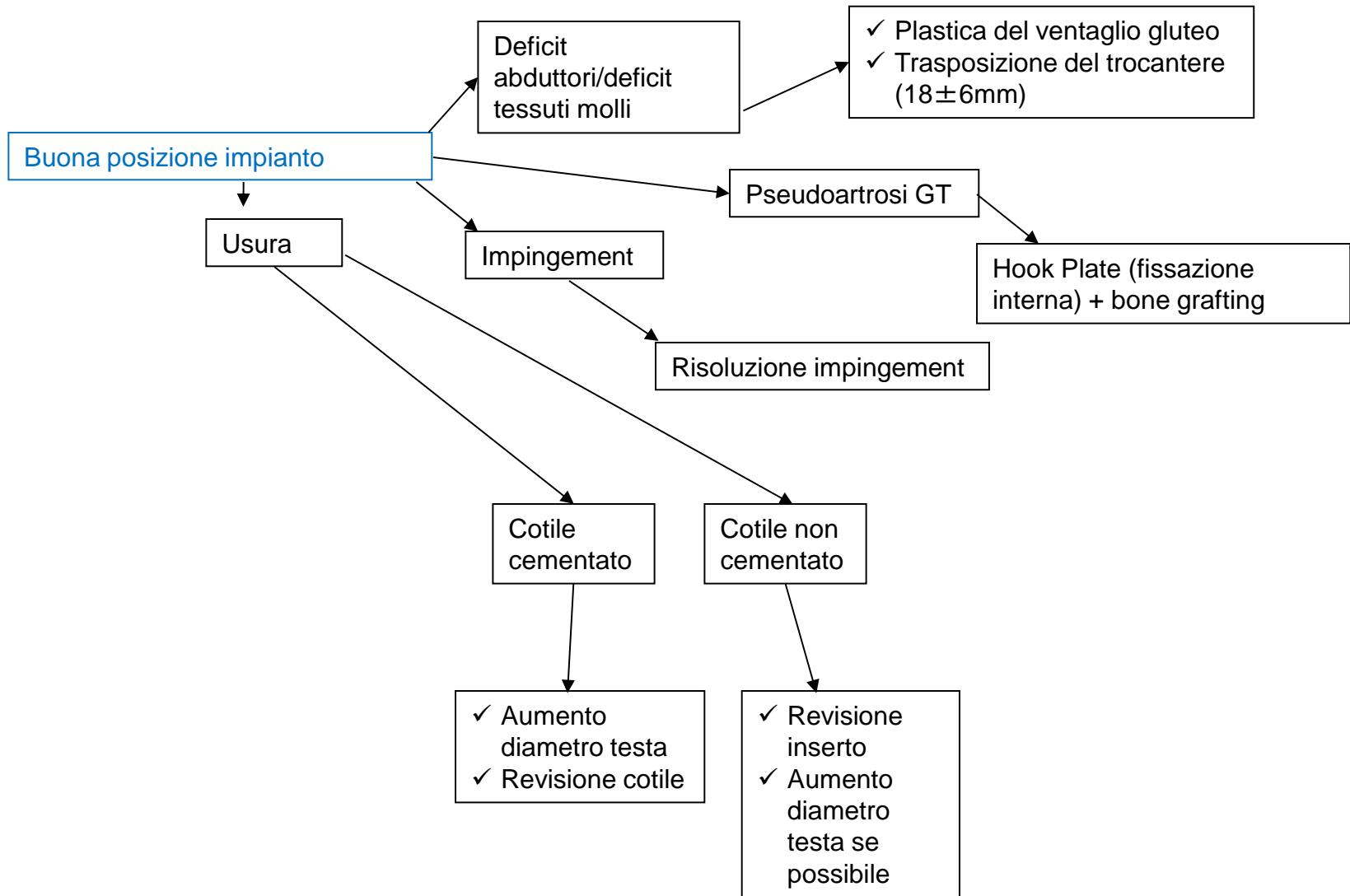
- ✓ *Anca instabile*
- ✓ *Libera dal dolore*



# Nostro Algoritmo di Trattamento



# Nostro Algoritmo di Trattamento



# Conclusioni

## Instabilità nella PTA

- ✓ problema complesso
- ✓ con un'alta spesa sanitaria.
- ✓ causa comune di reintervento

## Chirurgia di revisione: alta incidenza di

- ✓ fallimenti
- ✓ infezioni profonde

*Un'altra revisione potrebbe essere necessaria (28%), per cui ...*

*Facendo una revisione pensiamo sempre a cosa potrebbe succedere se un nuovo intervento dovesse esser necessario*

## *Soluzione ideale* → Prevenzione

- ✓ Aumento Head-to-Neck Ratio
- ✓ Via d'accesso sicura e rispettosa
- ✓ Fattori di rischio del paziente
- ✓ Rapporti Spino-Pelvici
- ✓ Esperienza e numerosità impianti

**Vetch sA, Jones sA.** Prevention of dislocation in hip arthroplasty.  
*Orthop Trauma* 2009;23:35-9.

Le **Strategie di Revisione** per l'instabilità ricorrente sono tipicamente rivolte alla **correzione della/e causa/e**.

## GOALS OF TOTAL HIP ARTHROPLASTY

**...Precision is mandatory because we are implanting a mechanical device in a biological environment and it must replicate biological function! Stability , and avoidance of impingement, [successful total hip arthroplasty] is a consequence of correct mechanical positioning and biological healing and without both there is more dependence on the other. In [an] ideal reconstruction they are balanced. If bad biology (no capsule in revision or bad spinopelvic-hip balance for instance) then mechanical must be increased (constrained liner or dual mobility). That's how I explain it."**

***Larry D. Dorr, MD, by email 4-7-19***





CONGRESSO NAZIONALE DELLA  
**SOCIETÀ ITALIANA DELL'ANCA**

**19-20**

settembre 2019

**BERGAMO**

**SALA A**

- 08.00** CORSO DI ISTRUZIONE 2  
**08.45** EPIFISIOLISI: INDICAZIONI, TECNICA E RISULTATI  
Moderatore: **Pasquale Farsetti** (Roma)
- 08.00** Pinning in situ  
**Nicola Guindani** (Bergamo)
- 08.10** Riduzione aperta  
**Alessandro Massè** (Torino)
- 08.20** Osteotomie di correzione della deformità  
**Maurizio De Pellegrin** (Milano)
- 08.30** Discussione

**GIOVEDÌ**  
**19 SETTEMBRE 2019**

# SCFE

## REVIEW OF THE LITERATURE COMPARING PINNING IN SITU, EXTRACAPSULAR CORRECTIVE OSTEOTOMIES AND MDO

**Guindani N<sup>1</sup>, Rizzi L<sup>1</sup>, De Pellegrin M<sup>2</sup>, Barbieri F<sup>1</sup>, Locatelli G<sup>1</sup>, Eberhardt O<sup>3</sup>, Fernandez FF<sup>3</sup>, Wirth T<sup>3</sup>, Castelli CC<sup>1</sup>**

<sup>1</sup> Bergamo - ASST Papa Giovanni 23°,

<sup>2</sup> Milano - IRCCS San Raffaele,

<sup>3</sup> Stuttgart - Olgahospital, Klinikum Stuttgart

# THE PROBLEM


## SCFE: WHICH TREATMENT IS BETTER?

J Orthop Traumatol  
DOI 10.1007/s10195-017-0469-4



ORIGINAL ARTICLE

**Treatment of stable slipped capital femoral epiphysis: systematic review and exploratory patient level analysis**

H. Naseem<sup>1</sup> · S. Chatterji<sup>1</sup> · K. Tsang<sup>2</sup> · M. Hakimi<sup>1</sup> · A. Chytas<sup>1</sup> ·  
S. Alshryda<sup>1</sup> 

Received: 1 May 2017 / Accepted: 13 July 2017  
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EBM SUPPLEMENT

## What Is the Best Evidence for the Treatment of Slipped Capital Femoral Epiphysis?

*Randall T. Loder, MD\*† and Frederick R. Dietz, MD‡*

*(J Pediatr Orthop 2012;32:S158–S165)*

IS TREATMENT BETTER THAN NON-  
TREATMENT?



## IS TREATMENT BETTER THAN NON-TREATMENT?

**PROGRESSION OF DISEASE :**  $\approx 75\%$       involved hip  
 $\approx 10-30\%$       contralateral hip

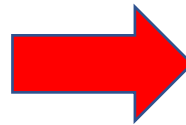
**UBIQUITARY EVIDENCE OF WORSE RESULTS WITH BIGGER  
DEFORMITIES**



# THE PROBLEM

## SCFE: WHICH TREATMENT IS BETTER?

↓ Nr of  
patients  
↓ FU years  
↑ Techniques  
↑ Outcomes




↑ Nr of  
patients  
= FU years  
↓ Techniques  
↓ Outcomes

J Orthop Traumatol  
DOI 10.1007/s10195-017-0469-4



ORIGINAL ARTICLE

Treatment of stable slipped capital femoral epiphysis: systematic review and exploratory patient level analysis

H. Naseem<sup>1</sup> · S. Chatterji<sup>1</sup> · K. Tsang<sup>2</sup> · M. Hakimi<sup>1</sup> · A. Chytas<sup>1</sup> ·  
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## What Is the Best Evidence for the Treatment of Slipped Capital Femoral Epiphysis?

Randall T. Loder, MD\*<sup>†</sup> and Frederick R. Dietz, MD<sup>‡</sup>

(*J Pediatr Orthop* 2012;32:S158–S165)



# THE PROBLEM

↓ Techniques & ↑ Patients Nr

1. ISP\*
2. EXTRACAPSULAR REALIGNEMENT (Imhäuser/Southwick)\*\*
3. DEFORMITY CORRECTION (MDO)\*\*

\* With one ore more pins

\*\* In this study we focused on these techniques, because of their diffusion and used in some Author's Institutions.

All types of SCFE are included.



## What Is the Best Evidence for the Treatment of Slipped Capital Femoral Epiphysis?

Randall T. Loder, MD\*† and Frederick R. Dietz, MD‡

# THE PROBLEM

↓ Variables & ↓ Outcomes

1. AVN

2. OA

3. Other COMPLICAT

4. CLINICAL RESULTS

- \* With one ore more pins
  - \*\* In this study we focused c  
some Author's Institutions.
- All types of SCFE are included.



n and used in

ment of Slipped  
s?

tz, MD<sup>†</sup>

# M&M

## Review of the literature (PubMed, Medscape)

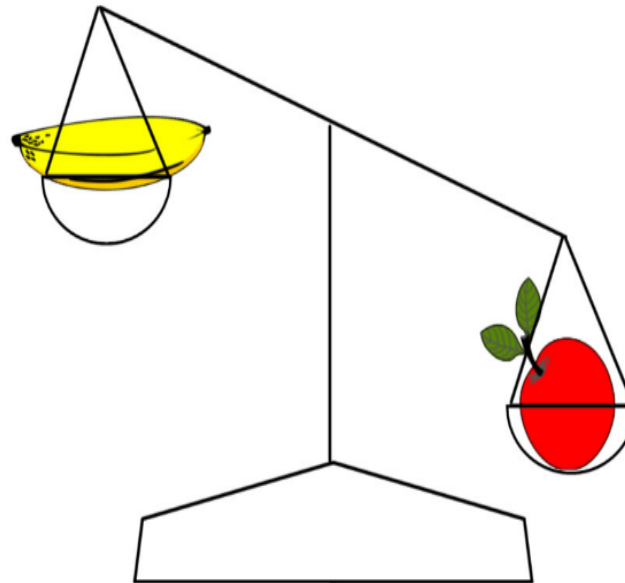
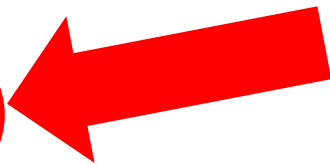
1. SCFE / SUFE
2. PINNING IN SITU / PINNING
3. IMHÄUSER / SOUTHWICK OSTEOTOMY
4. MODIFIED DUNN OSTEOTOMY / GANZ HIP / SUBCAPITAL HIP OSTEOTOMY

a) AVN

b) OA

c) Other COMPLICATIONS

d) CLINICAL RESULTS



# M&M

## Review of the literature (PubMed, Medscape)



Dr [Editor-in-Chief's first and last name]

Editor-in-Chief

*Journal Name*

|  
Date [Month, Day, Year]

Dear Dr [Editor-in-Chief's last name]:

≈1300 -> 39

# M&M

## Review of the literature (PubMed, Medscape)

ISP		Southwick - Imhäuser		MDO	
1° Author (...)	Pub J	1° Author (...)	Pub J	1° Author (...)	Pub J
Zahrawi	1983	Southwick	1967	Ballmer	1990
Engelhardt	1984	Imhäuser	1977	Ziebarth (Ganz-Kim)	2009
Betz	1990	Irelan-Newman	1978	Slongo (Ziebarth)	2010
Carney	1991	Rao	1984	Huber (Dierauer)	2011
Herman	1996	Salvati	1980	Masse (Ganz)	2012
Hannson	1998	Boyer (Ponseti)	1981	Madan(Fernandes)	2013
Larson	2012	Ballmer (Ganz)	1990	Sankar (...)	2013
Castaneda	2013	Schai	1996	Upasani (spencer, Kim)	2014
Nectoux	2015	Parsch	1999	Novais (Sink)	2014
Novais	2015	Kartenbender	2000	Elmarghany (Masse)	2016
de Poorter	2016	Diab	2004	Persinger (Klinge)	2016
		El-Mowafi	2005	Ziebarth (Siebenrock)	2017
		Coppola (maffulli)	2008	Guindani (Fernandez)	2017
		Witbreuk	2009		
		Trisolino (Stilli)	2017		

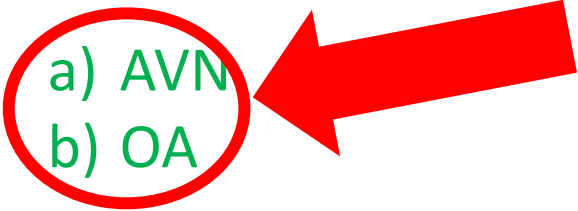
# M&M

## Review of the literature (PubMed, Medscape)

1. ISP: 11 st / 844 hips / 18 y FU
2. IMHÄUSER / SOUTHWICK: 15 st / 409 hips / 13 y FU
3. MDO: 13 st / 384 hips / 4 y FU

Tot: 39 st / 1637 hips

### OUTCOMES:




- 
- a) AVN
  - b) OA



# RESULTS

## AVN

1. ISP:
2. IMHÄU
3. MDO:

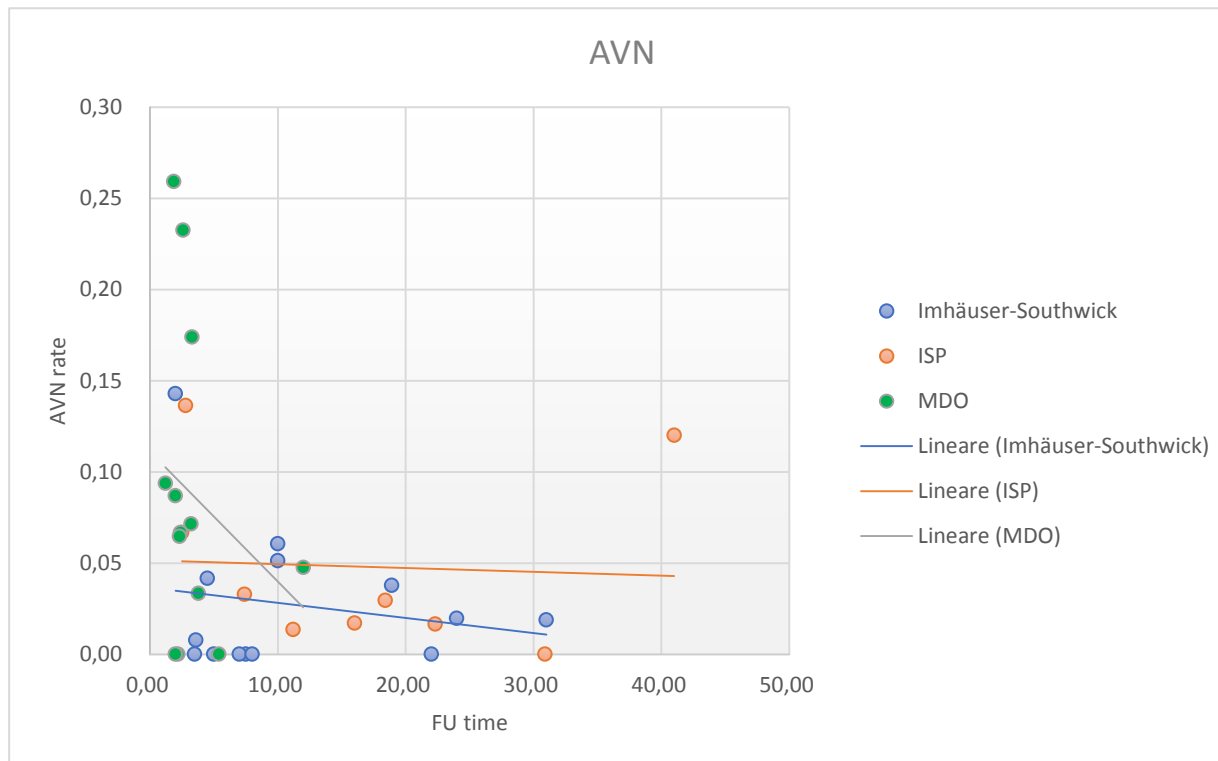
Mehrfachvergleiche							
Abhängige Variable: AVN							
	(I) GRUPPE	(J) GRUPPE	Mittlere Differenz (I-J)	Standardfehler	Signifikanz	95%-Konfidenzintervall	
				r		Untergrenze	Obergrenze
	1,00	2,00	,01077	,02532	,905	-,0512	,0727
		3,00	-,05143	,02490	,112	-,1124	,0095
	2,00	1,00	-,01077	,02532	,905	-,0727	,0512
		3,00	-,06220*	,02380	,034	-,1204	-,0039
	3,00	1,00	,05143	,02490	,112	-,0095	,1124
		2,00	,06220*	,02380	,034	,0039	,1204
	1,00	2,00	,01077	,02532	,673	-,0406	,0622
		3,00	-,05143*	,02490	,046	-,1020	-,0009
	2,00	1,00	-,01077	,02532	,673	-,0622	,0406
		3,00	-,06220*	,02380	,013	-,1105	-,0139
	3,00	1,00	,05143*	,02490	,046	,0009	,1020
		2,00	,06220*	,02380	,013	,0139	,1105
	1,00	2,00	,01077	,02532	1,000	-,0529	,0744
		3,00	-,05143	,02490	,139	-,1140	,0112
	2,00	1,00	-,01077	,02532	1,000	-,0744	,0529
		3,00	-,06220*	,02380	,039	-,1220	-,0023
	3,00	1,00	,05143	,02490	,139	-,0112	,1140
		2,00	,06220*	,02380	,039	,0023	,1220

\*. Die Differenz der Mittelwerte ist auf dem Niveau 0.05 signifikant.

# RESULTS

## AVN

1. ISP: 4 % / 844 hips / 18 y
2. IMHÄUSER / SOUTHWICK: 3 % / 409 hips / 13 y
3. MDO: 9 % / 384 hips / 4 y



- MDO: high variability in the first years: learning curve? Pz selection?
- Imhäuser/Southwic k Vs ISP: no slope, no stat difference in slopes and intercept -> maybe no AVN progression




# RESULTS

## OA

Mehrfachvergleiche

1. ISP:
2. IMHÄUS
3. MDO:

Abhängige Variable: OA

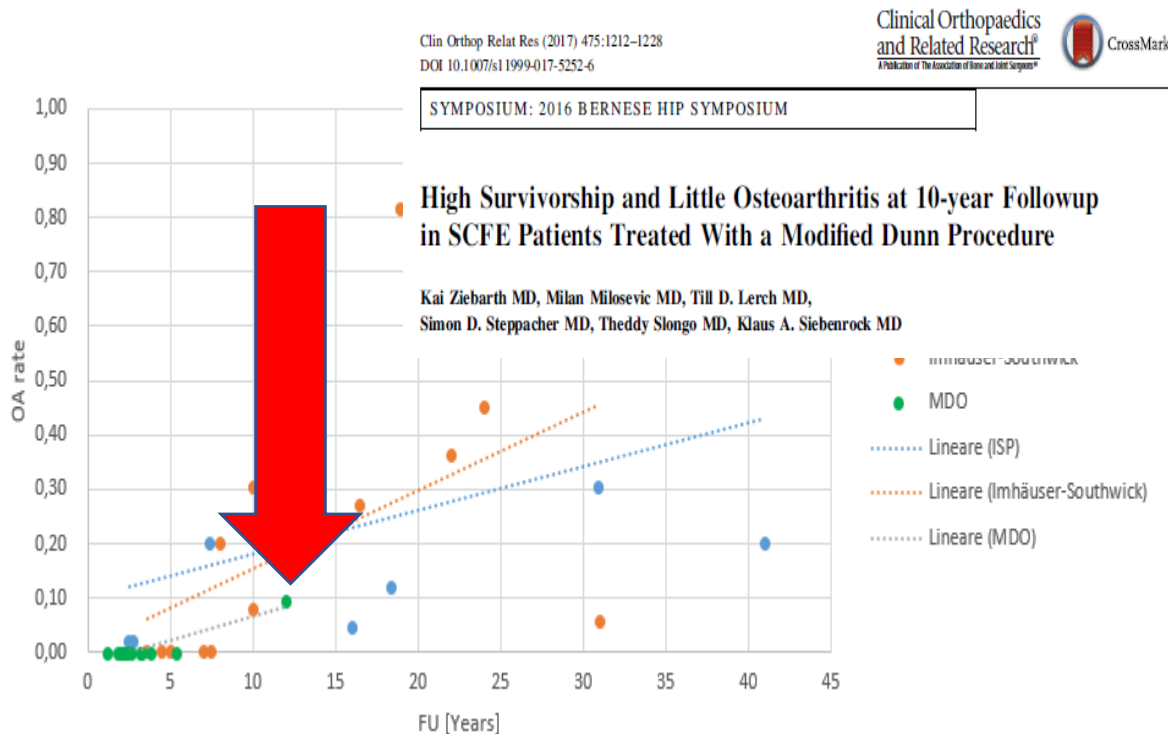
	(I) GRUPPE	(J) GRUPPE	Mittlere Differenz (I-J)	Standardfehler	Signifikanz	95%-Konfidenzintervall	
						Untergrenze	Obergrenze
	1,00	2,00	,03217	,09296	,936	-,1960	,2603
		3,00	,20729	,08990	,069	-,0133	,4279
	2,00	1,00	-,03217	,09296	,936	-,2603	,1960
		3,00	,17512	,08541	,116	-,0345	,3847
	3,00	1,00	-,20729	,08990	,069	-,4279	,0133
	1,00	2,00	,03217	,09296	,732	-,1570	,2213
		3,00	,20729*	,08990	,028	,0244	,3902
	2,00	1,00	-,03217	,09296	,732	-,2213	,1570
		3,00	,17512*	,08541	,048	,0013	,3489
	3,00	1,00	-,20729*	,08990	,028	-,3902	-,0244
	1,00	2,00	,03217	,09296	1,000	-,2023	,2666
		3,00	,20729	,08990	,083	-,0195	,4340
	2,00	1,00	-,03217	,09296	1,000	-,2666	,2023
		3,00	,17512	,08541	,145	-,0403	,3906
	3,00	1,00	-,20729	,08990	,083	-,4340	,0195
		2,00	-,17512	,08541	,145	-,3906	,0403

\*. Die Differenz der Mittelwerte ist auf dem Niveau 0.05 signifikant.

# RESULTS

## OA

1. ISP: 33 % / 844 hips / 18 y FU
2. IMHÄUSER / SOUTHWICK: 19 % / 409 hips / 13 y FU
3. MDO: 0 % / 384 hips / 4 y FU



- MDO:  $r = 0,7$   
 $\beta = 0,72$
- Im/So  $r = 0,5$   
 $\beta = 0,51$
- ISP:  $r = 0,06$   
 $\beta = 0,07$

$p_{\beta}$  +/–  
0,05  
 $p_{\text{int MDO Vs others}} < 0,05$

# RESULTS

1. ISP:

2. IMHÄUSER / SOUTHWICK:

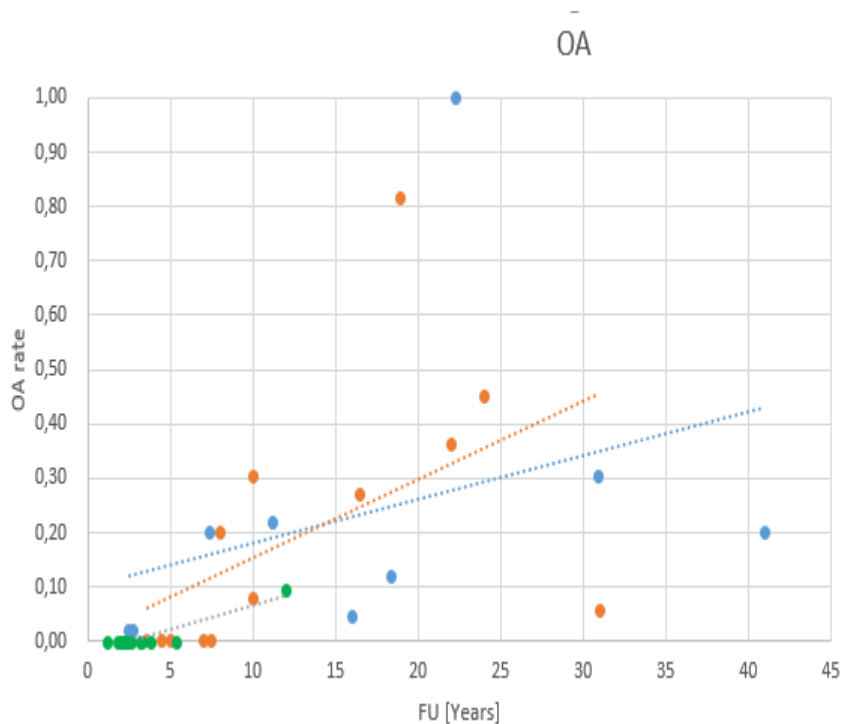
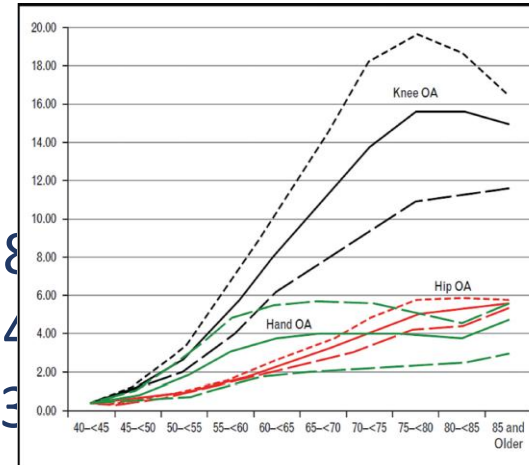
3. MDO:

**OA**

33 % / 8

19 % / 4

0 % / 3






# RESULTS

## „LOST“ HIPS (AVN+OA)

1. ISP:
2. IMHÄU
3. MDO:

Abhängige Variable: AVNChLOA

	(I) GRUPPE	(J) GRUPPE	Mittlere Differenz (I-J)	Standardfehler r	Signifikanz	95%-Konfidenzintervall	
						Untergrenze	Obergrenze
	1,00	2,00	-,00566	,08633	,998	-,2172	,2059
		3,00	,16908	,08878	,153	-,0485	,3866
	2,00	1,00	,00566	,08633	,998	-,2059	,2172
		3,00	,17474	,07758	,077	-,0154	,3649
	3,00	1,00	-,16908	,08878	,153	-,3866	,0485
		2,00	-,17474	,07758	,077	-,3649	,0154
	1,00	2,00	-,00566	,08633	,948	-,1811	,1698
		3,00	,16908	,08878	,065	-,0113	,3495
	2,00	1,00	,00566	,08633	,948	-,1698	,1811
		3,00	,17474*	,07758	,031	,0171	,3324
	3,00	1,00	-,16908	,08878	,065	-,3495	,0113
		2,00	-,17474*	,07758	,031	-,3324	-,0171
	1,00	2,00	-,00566	,08633	1,000	-,2231	,2117
		3,00	,16908	,08878	,196	-,0545	,3927
	2,00	1,00	,00566	,08633	1,000	-,2117	,2231
		3,00	,17474	,07758	,093	-,0206	,3701
	3,00	1,00	-,16908	,08878	,196	-,3927	,0545
		2,00	-,17474	,07758	,093	-,3701	,0206

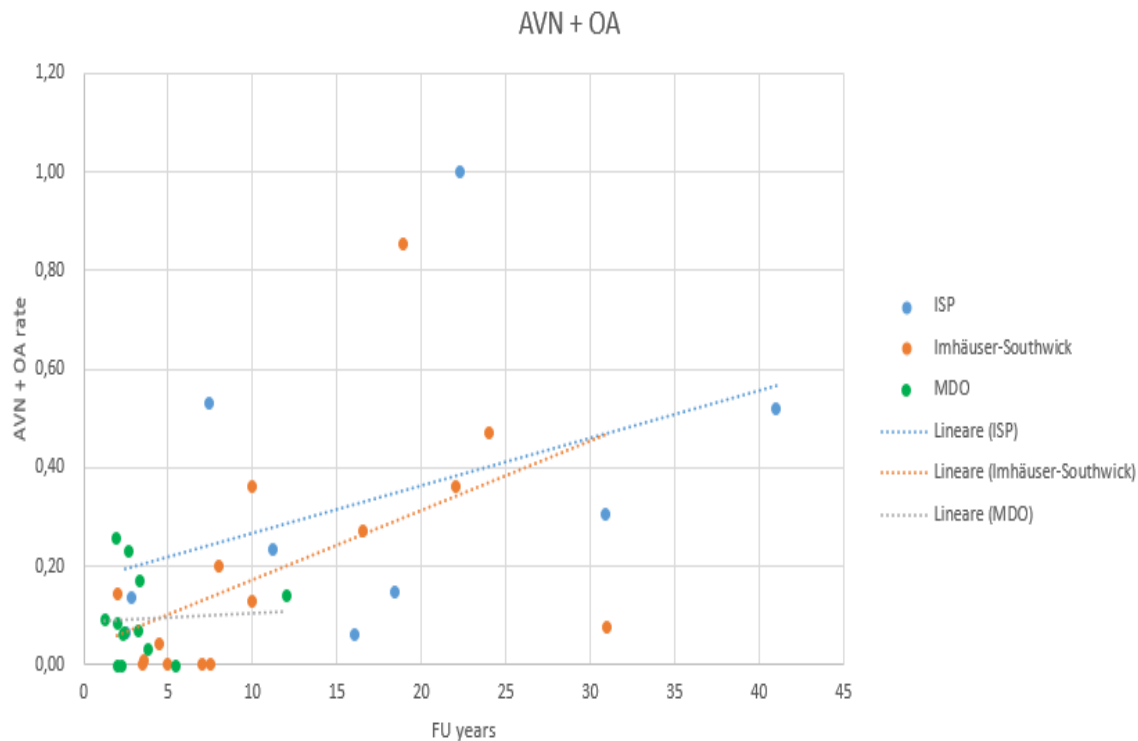
\*. Die Differenz der Mittelwerte ist auf dem Niveau 0.05 signifikant.



# RESULTS

## „LOST“ HIPS (AVN+OA)

1. ISP: 37 % / 844 hips / 18 y FU
2. IMHÄUSER / SOUTHWICK: 22 % / 409 hips / 13 y FU
3. MDO: 9 % / 384 hips / 4 y FU



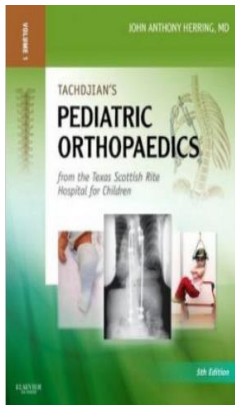
$p_{\beta}$  I/S > (ISP ^  
MDO)  
 $p_{int}$  MDO ISP &  
I/S

# RESULTS

## Chondrolisis

1. ISP: 8 % / 844 hips / 18 y FU
2. IMHÄUSER / SOUTHWICK: 11 % / 409 hips / 13 y FU
3. MDO: 0 % / 384 hips / 4 y FU

- ✓ “ACUTE CARTILAGE NECROSIS”
- ✓  $\approx 0,23$  TO 1,0 REGAIN A NORMAL JO
- ✓ CHL OCCURS EVEN BEFORE TRE



### Mehrfachvergleiche

Abhängige Variable: OA

	(I) GRUPPE	(J) GRUPPE	Mittlere Differenz (I-J)	Standardfehler r	Signifikanz	95%-Konfidenzintervall	
						Untergrenze	Obergrenze
	1,00	2,00	-,03433	,03236	,546	-,1146	,0459
		3,00	,07667*	,03058	,047	,0009	,1525
	2,00	1,00	,03433	,03236	,546	-,0459	,1146
		3,00	,11100*	,02595	,001	,0467	,1753
	3,00	1,00	-,07667*	,03058	,047	-,1525	-,0009
		2,00	-,11100*	,02595	,001	-,1753	-,0467
	1,00	2,00	-,03433	,03236	,298	-,1007	,0321
		3,00	,07667*	,03058	,018	,0139	,1394
	2,00	1,00	,03433	,03236	,298	-,0321	,1007
		3,00	,11100*	,02595	,000	,0578	,1642
	3,00	1,00	-,07667*	,03058	,018	-,1394	-,0139
		2,00	-,11100*	,02595	,000	-,1642	-,0578
	1,00	2,00	-,03433	,03236	,894	-,1169	,0483
		3,00	,07667	,03058	,055	-,0014	,1547
	2,00	1,00	,03433	,03236	,894	-,0483	,1169
		3,00	,11100*	,02595	,001	,0448	,1772
	3,00	1,00	-,07667	,03058	,055	-,1547	,0014
		2,00	-,11100*	,02595	,001	-,1772	-,0448

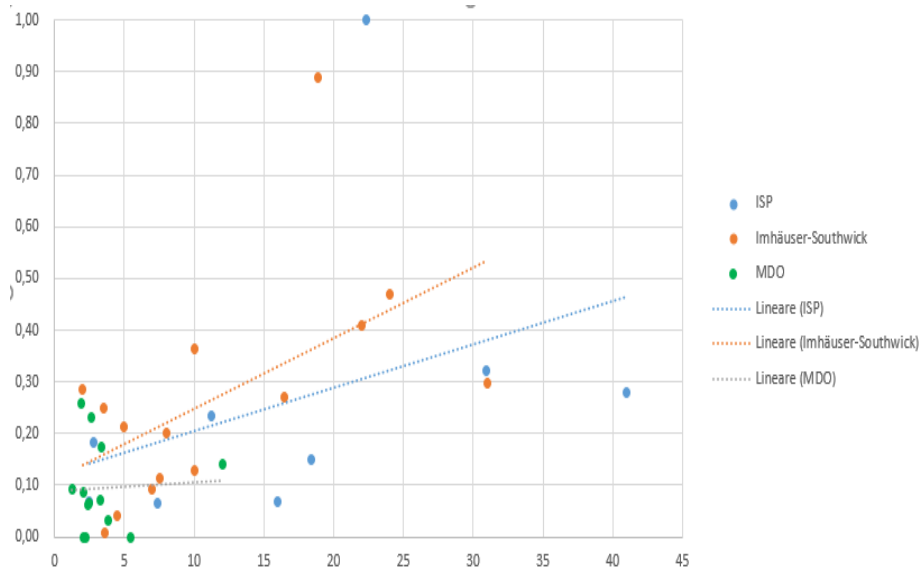
\*. Die Differenz der Mittelwerte ist auf dem Niveau 0.05 signifikant.

# RESULTS

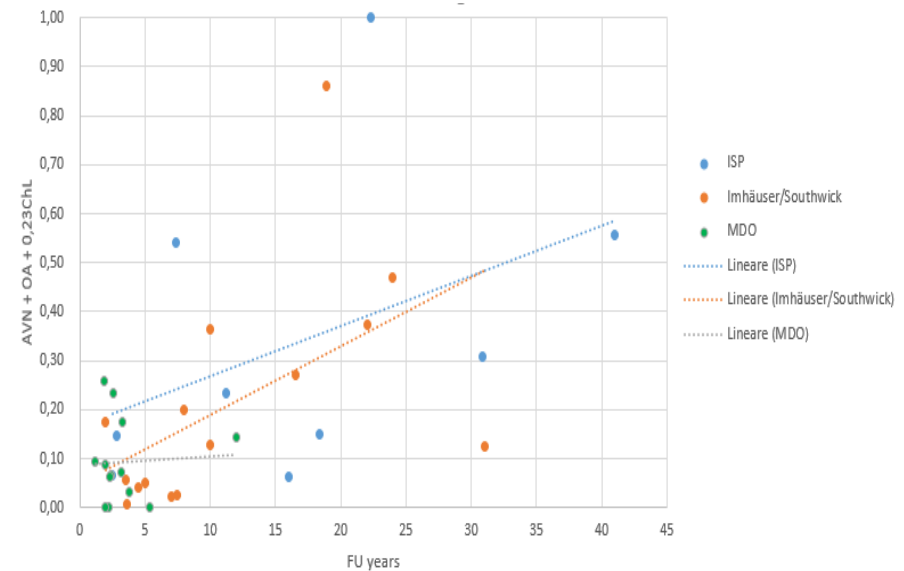
## „LOST“ HIPS (AVN+OA+ChL)

1. PIS: 26 % / 844 hips / 18 y FU
2. IMHÄUSER / SOUTHWICK: 27 % / 409 hips / 13 y FU
3. MDO: 9 % / 384 hips / 4 y FU

If all ChL as lost hips

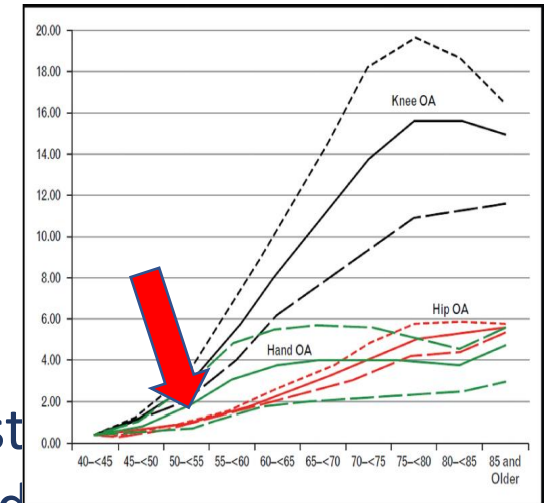


If 0,23 ChL as lost hips



# DISCUSSION LIMITS

1. Different studies
2. Different FU
3. Different techniques/surgeons
4. Also the „long term“ FUs are not in the worst
5. Not all available techniques have been included
6. Not all complications have been included (the not restorable ones)
7. Acute + Acute on chronic + chronic & un/stable SCFE gathered together

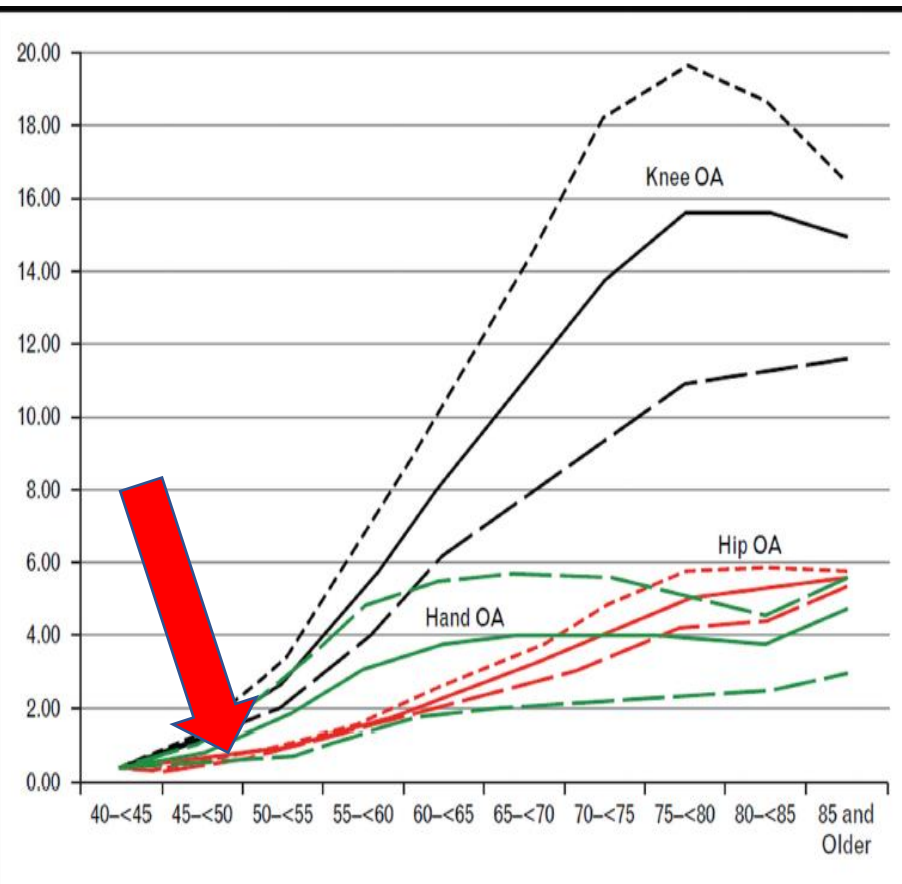


## STRENG HTs

1. ↑ Pts
2. ↓ and objectivable variables
3. Dichotomous (Y or N) variables

# DISCUSSION

## OA - general population

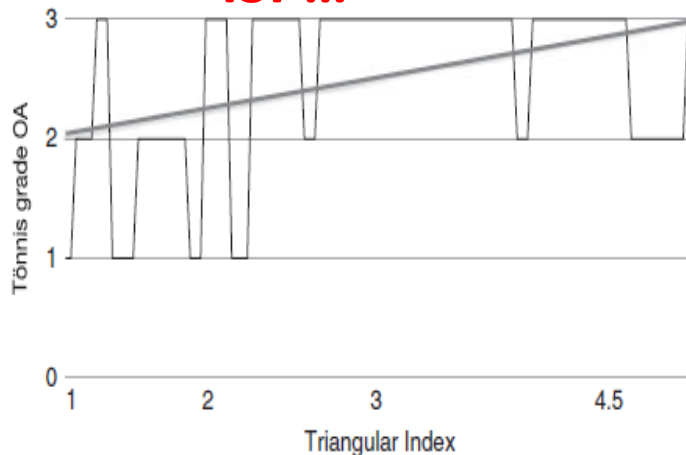


- SCFE has  $\uparrow$  OA
  - Even more OA is attended
  - Which curve will describe I/S, ISP and MDO is unknown. Maybe more predictable in the future?
- $$\text{LOST SCFE} = \lim_{t \rightarrow \Omega} \int f(\text{deformity}) + \lim_{t \rightarrow \Omega} \int f(\text{Surgery}) + \lim_{t \rightarrow \Omega} \int f(\text{pathology})$$

# DISCUSSION

## OA INCREASES WITH DEFORMITY:

**BOTH  
ISP...**



**FIGURE 7.** Tönnis grade of osteoarthritis versus triangular index.

HIP DISORDERS SUPPLEMENT

The Natural History of Osteoarthritis After a Slipped Capital Femoral Epiphysis/The Pistol Grip Deformity

Pablo Castañeda, MD, César Ponce, MD, Gabriela Villareal, MD, and Carlos Vidal, MD

**...AND ANATOMICAL  
REDUCTION**

Results: The mean age in our series was 12.2 years and average follow-up was 31 months. 60-percent of SCFEs were unstable and 40-percent were stable. 30% were acute, 42% acute-on-chronic, and 28% were chronic. At most recent follow-up, 80-percent of hips were considered to have an aspherical femoral epiphysis. The mean AP alpha angle was 72-degrees (range 30–115) and the mean lateral alpha angle was 52-degrees (range 26–97). There was no association between sphericity and stability, temporal class, sex, or age. There was a significant correlation between length of follow-up and AP alpha angle.

**Conclusion** Growth of the proximal femoral epiphysis is abnormal in 80-percent of hips successfully treated using the modified-Dunn. Abnormal growth is independent of preoperative variables but proportional to the length of follow-up.

**Significance** Abnormal proximal femoral growth following modified-Dunn is concerning, and serves as a reminder that near anatomic postoperative alignment does not guarantee normal morphology long-term. Although the clinical significance is not yet known, these findings may influence surgical

Abnormal Growth of the Upper Femur Following the Modified-Dunn Procedure

Ira Zaltz, Eduardo Novais, Michael Millis, Young Jo Kim, Wudbhav Sankar

*J Child Orthop* 2017;11 (Suppl 1):S67–S188

PubMed Abnormal Growth of the Upper Femur Following the Modified-Dunn Procedure  
Create alert Advanced

Search results

Items: 0

No documents match your search terms

2017 Combined EPOS/POSNA (EPOSNA)  
Annual Meeting

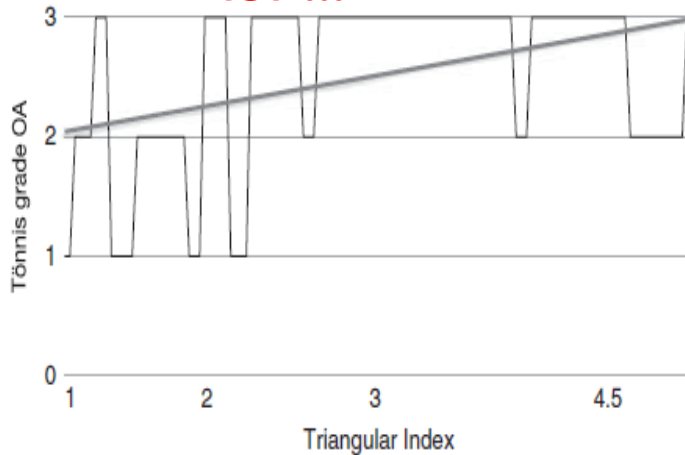
May 3-6, 2017 - Barcelona, Spain



# DISCUSSION

OA+AVN is function of DEFORMITY, SURGERY and PATHOLOGY (SCFE)

**BOTH  
ISP...**



**FIGURE 7.** Tönnis grade of osteoarthritis versus triangular index.

**...AND ANATOMICAL  
REDUCTION**

Results: The mean age in our series was 12.2 years and average follow-up was 31 months. 60-percent of SCFEs were unstable and 40-percent were stable. 30% were acute, 42% acute-on-chronic, and 28% were chronic. At most recent follow-up, 80-percent of hips were considered to have an aspherical femoral epiphysis. The mean AP alpha angle was 72-degrees (range 30–115) and the mean lateral alpha angle was 52-degrees (range 26–97). There was no association between sphericity and stability, temporal class, sex, or age. There was a significant correlation between length of follow-up and AP alpha angle.

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PubMed Abnormal Growth of the Upper Femur Following the Modified-Dunn Procedure  
Create alert Advanced

Search results

Items: 0

No documents match your search terms



# CONCLUSION

## ...Questions...

Which treatment for which SCFE?

How we choose the „complication“ / treatment (AVN/OA)?

To which extent can we maintain the restored anatomy on the long term?

Need more (long term) data! ...MDO?  
MDO learning process/know how?

Other techniques/methods?

# CONCLUSION

BETTER DEFORMITY CORRECTION PRESERVES  
FROM OA

In our opinion/experience

- No ISP for „severe“ SCFE
- No MDO for „mild“ SCFE
- No I/S for both „mild“ or „severe“ SCFE

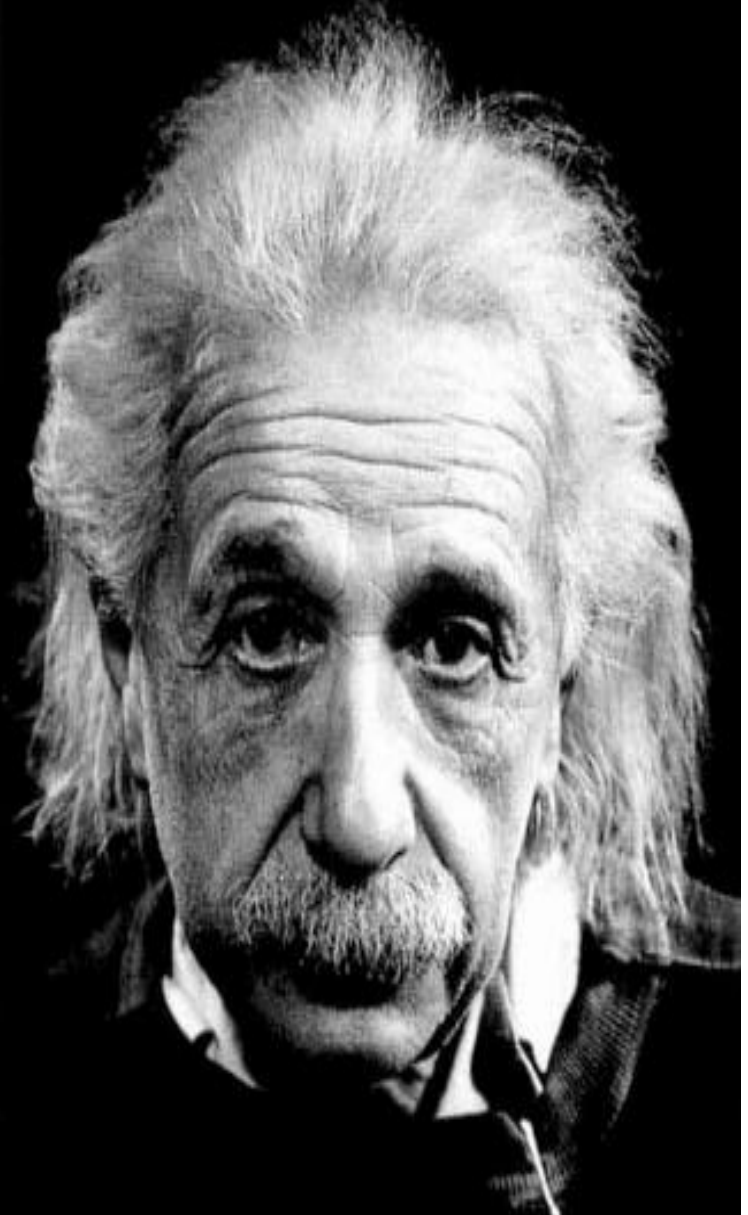
FOR EVERY TECHNIQUE:

- FOLLOW UP ALL PATIENTs
- CONSIDER EARLY CORRECTION OF THE  
REST DEFORMITY

(PLEASE, REPORT ALSO RAW DATA IN ARTICLES – NOT JUST THE  
DESCR. STAT. RESULTS!)

“Everything should be made  
as simple as possible,  
but not simpler.”

Albert Einstein







...





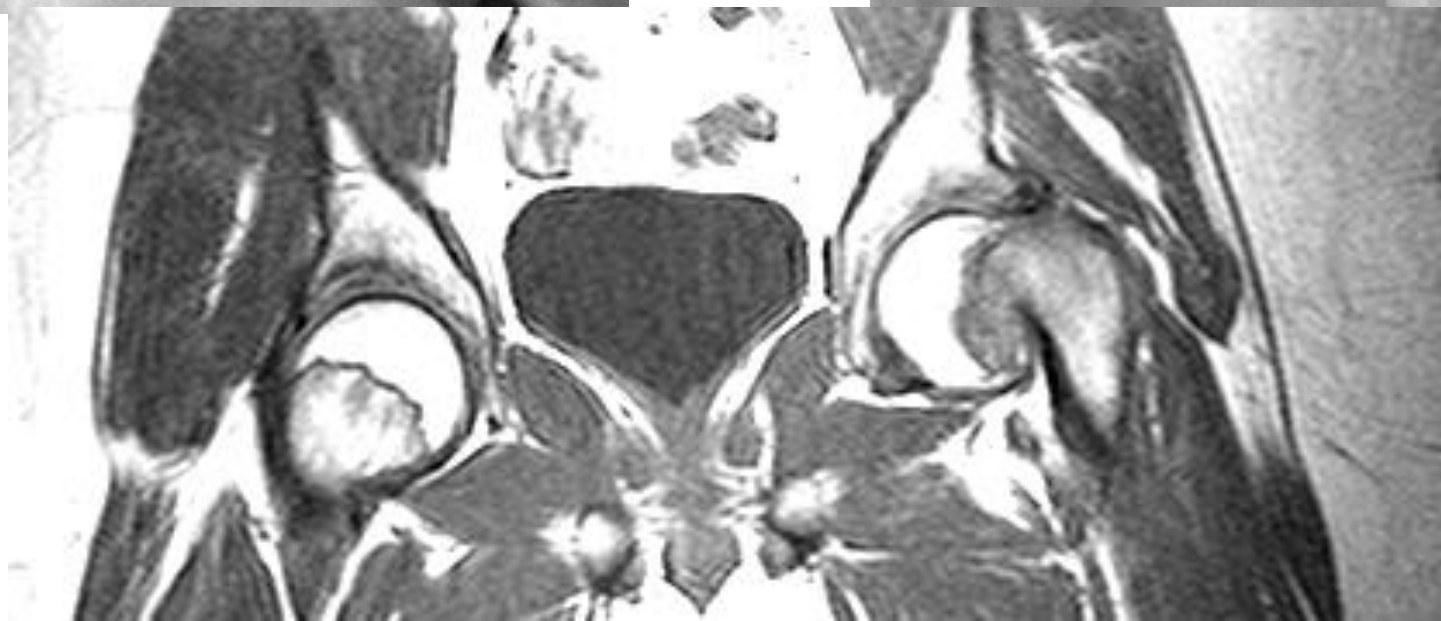
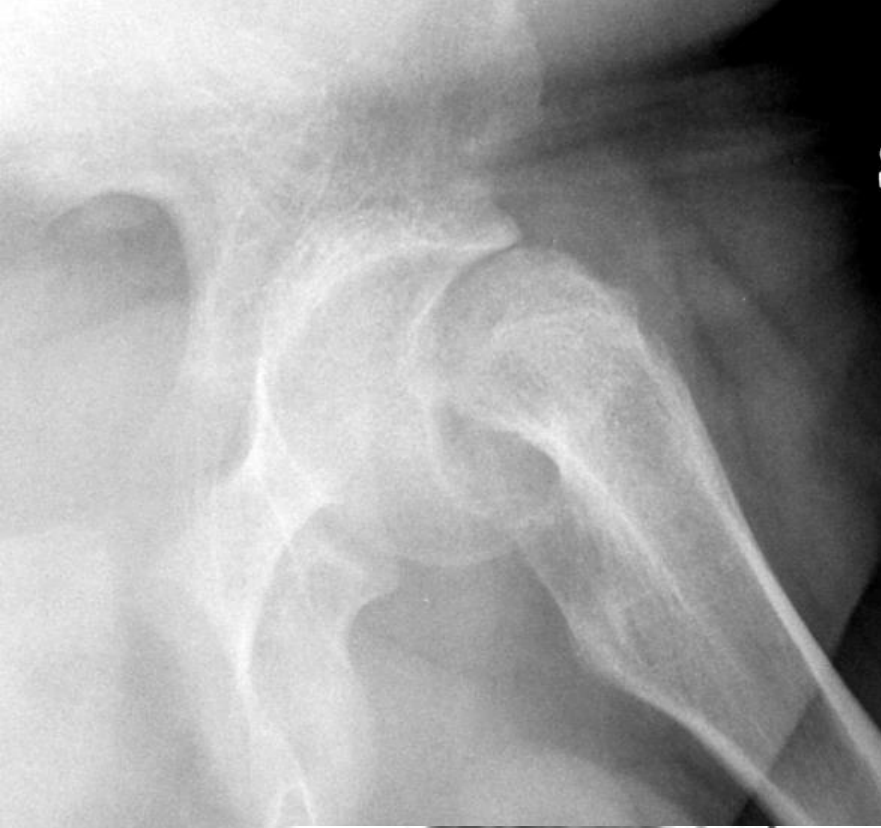
# Modified Dunn

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Alessandro Massè  
Alessandro Aprato  
Marco Favuto  
Claudia Galletta

S.C.D.U. Ortopedia e Traumatologia I  
AOU Città della Salute e della Scienza di Torino  
Università di Torino



# GOALS

1. Treat the articular damage

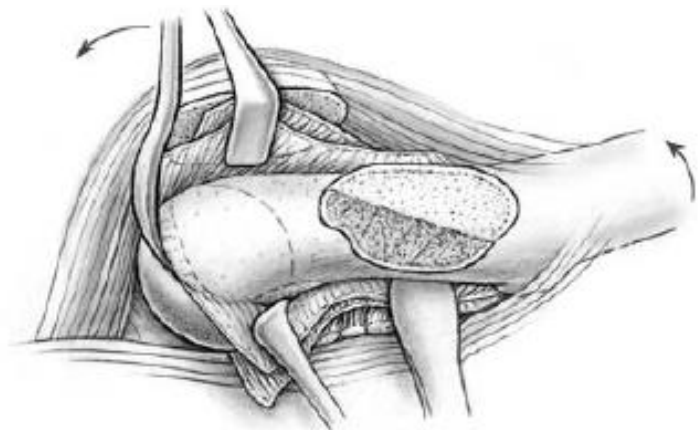
2. Restore the anatomy

- ✓ Reorientation of the epiphysis
- ✓ Treatment of pelvitrochanteric impingement
- ✓ Restoration of abductors lever arm

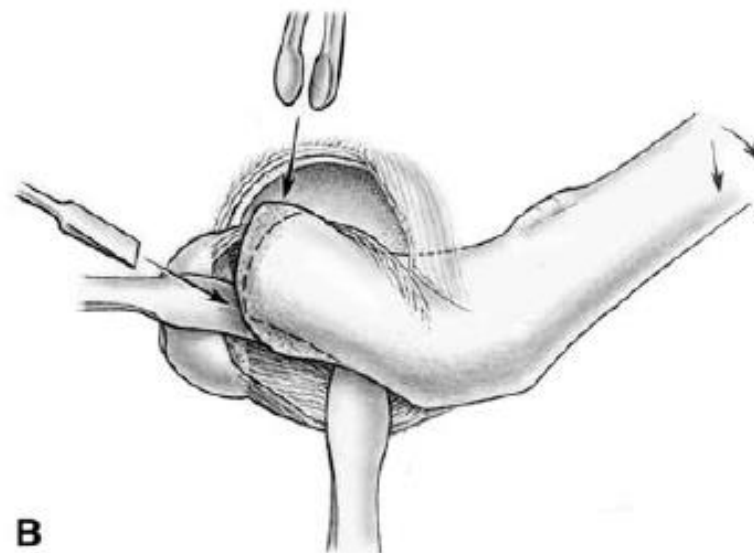


## Capital Realignment for Moderate and Severe SCFE Using a Modified Dunn Procedure

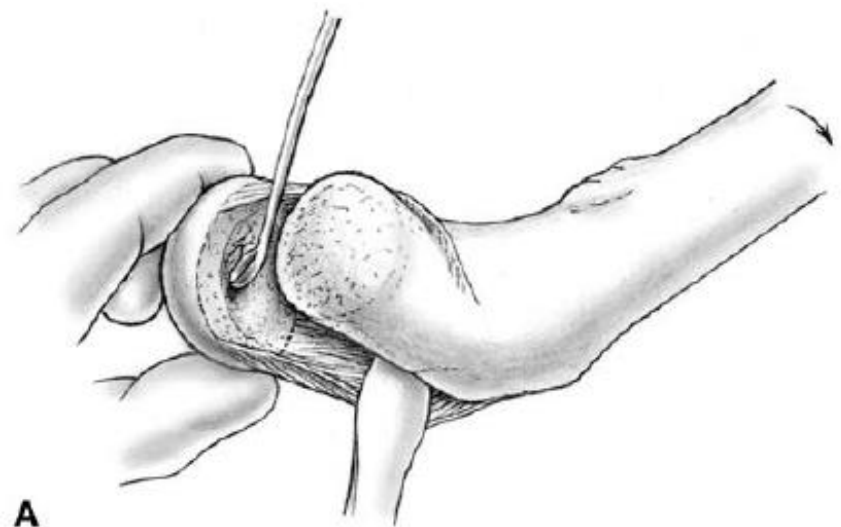
Kai Ziebarth MD, Christoph Zilkens MD,  
Samantha Spencer MD, Michael Leunig MD,  
Reinhold Ganz MD, Young-Jo Kim MD, PhD



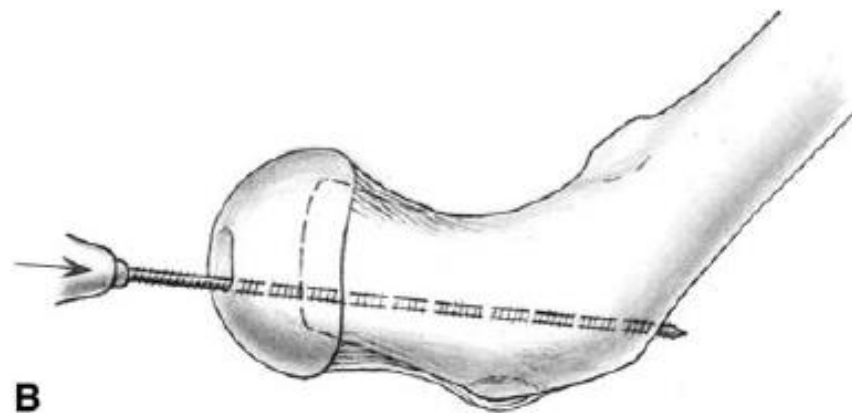
A



B

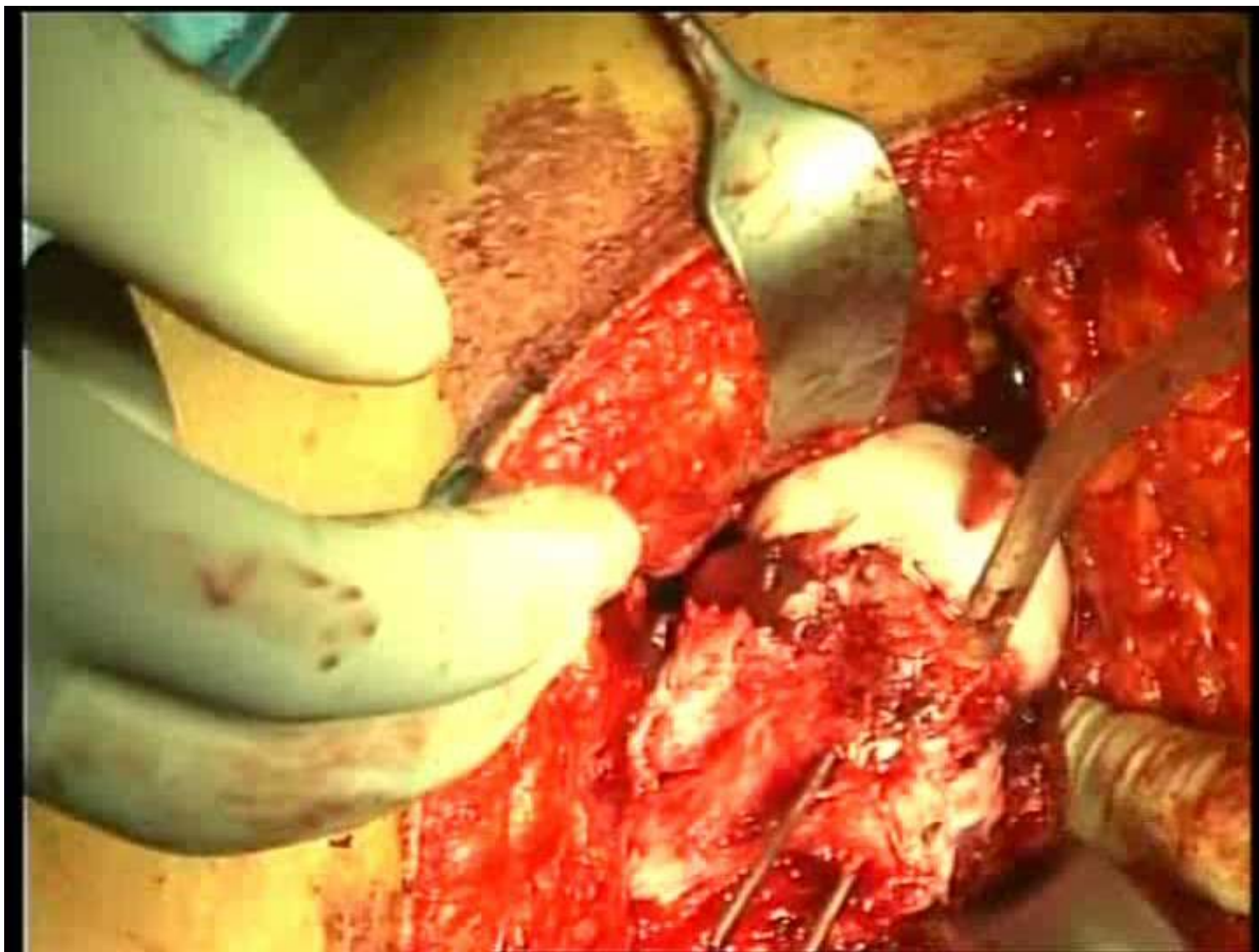


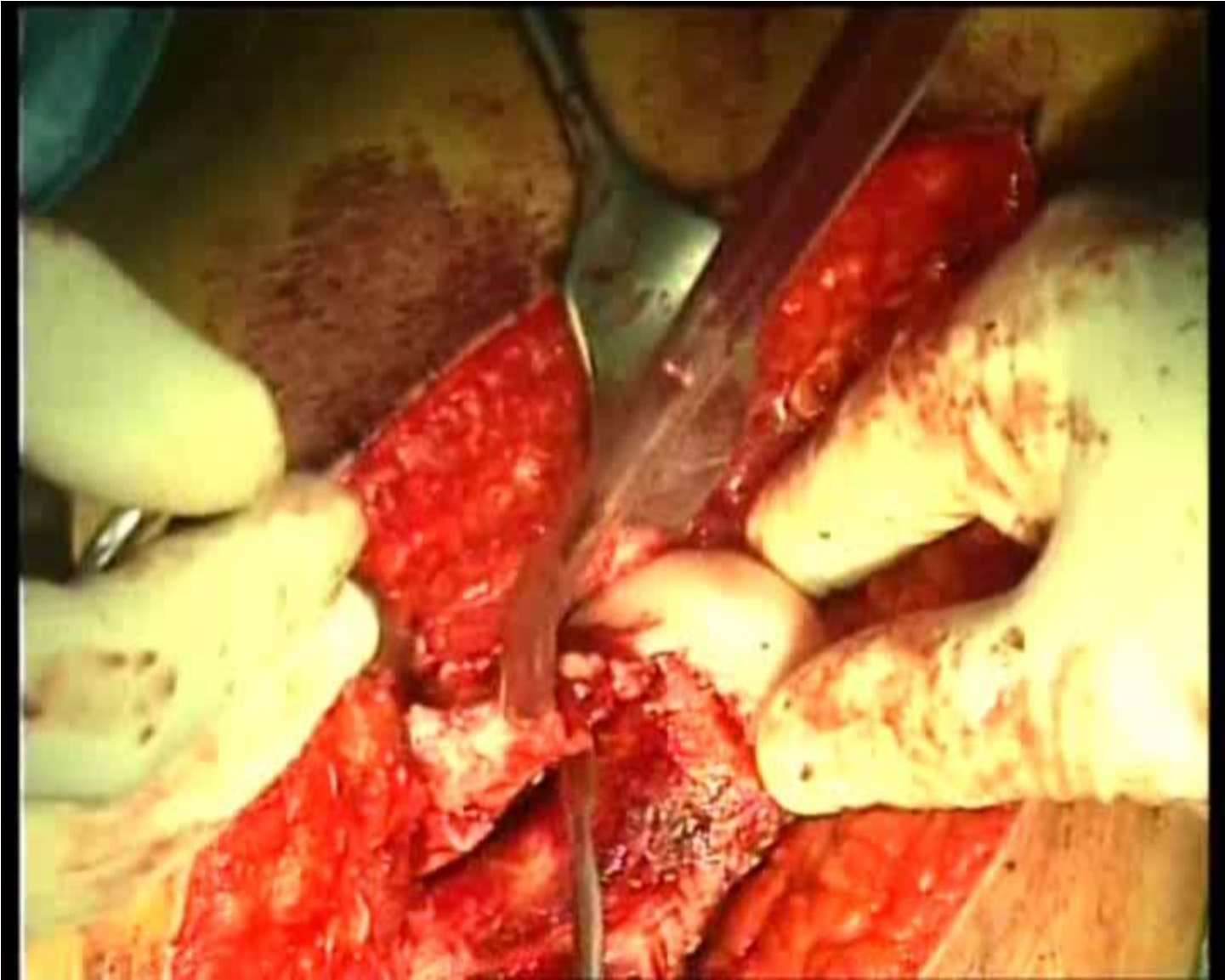
A



B

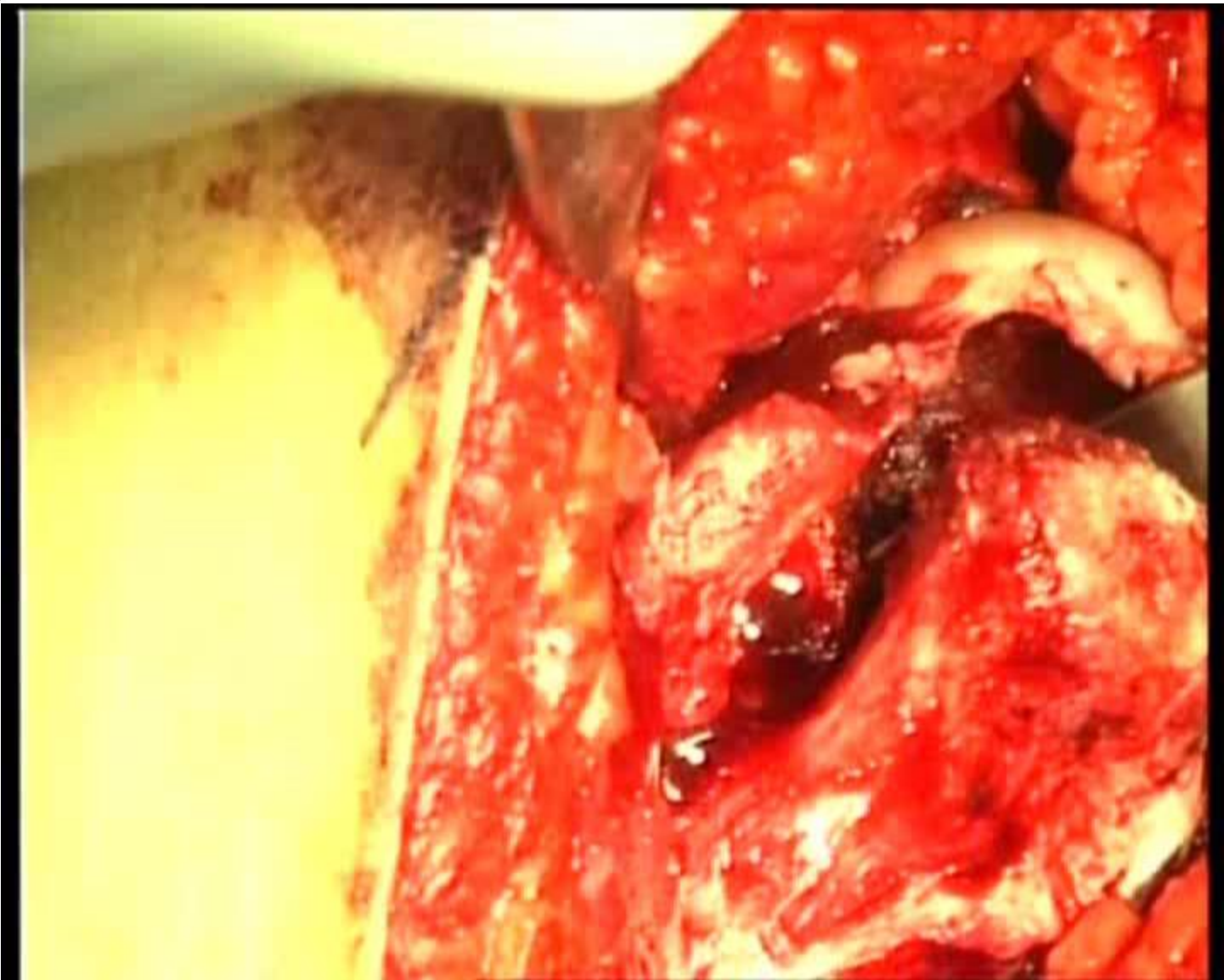
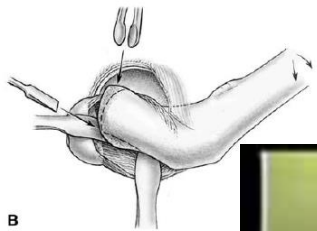




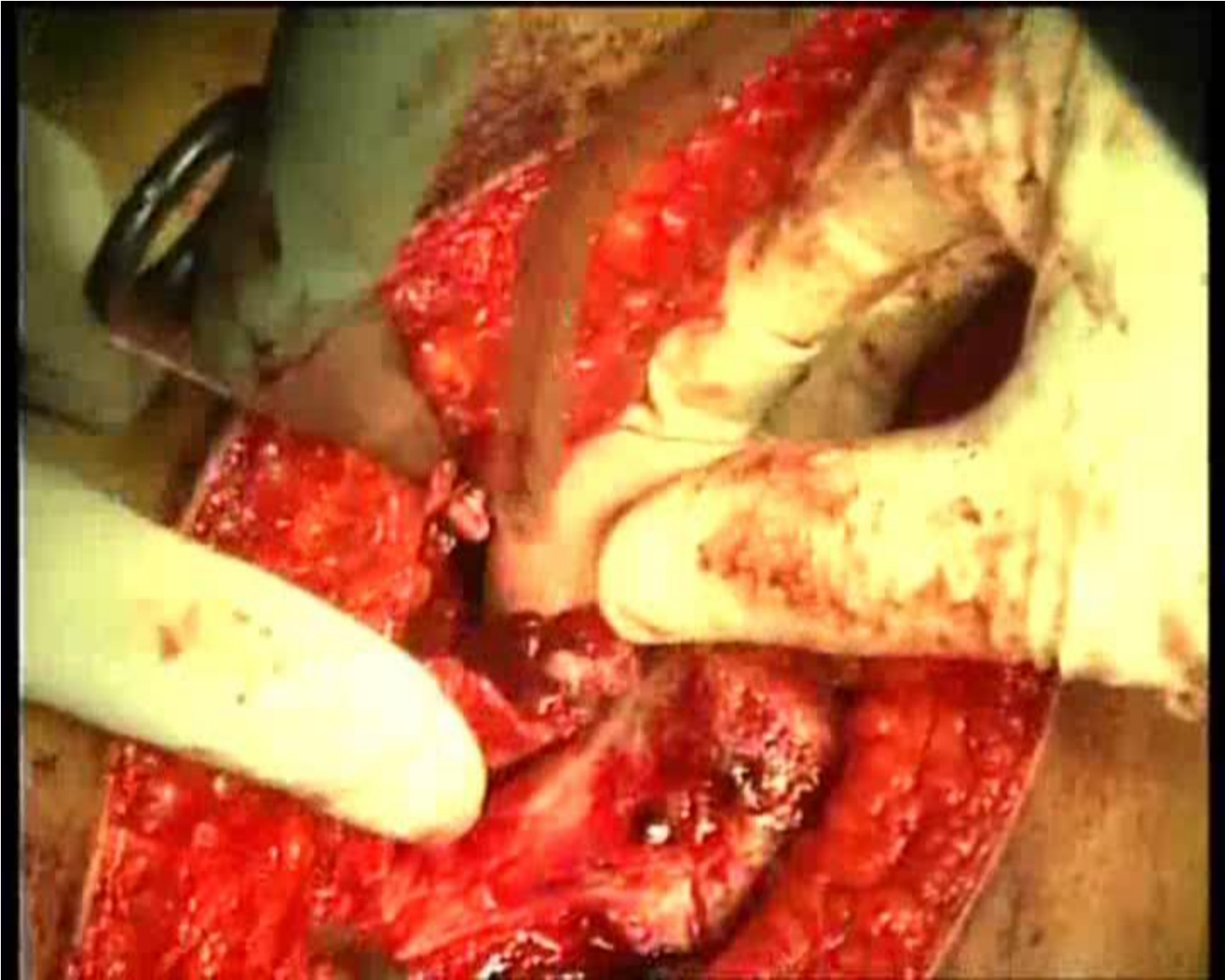


5. Epiphyseal dislocation

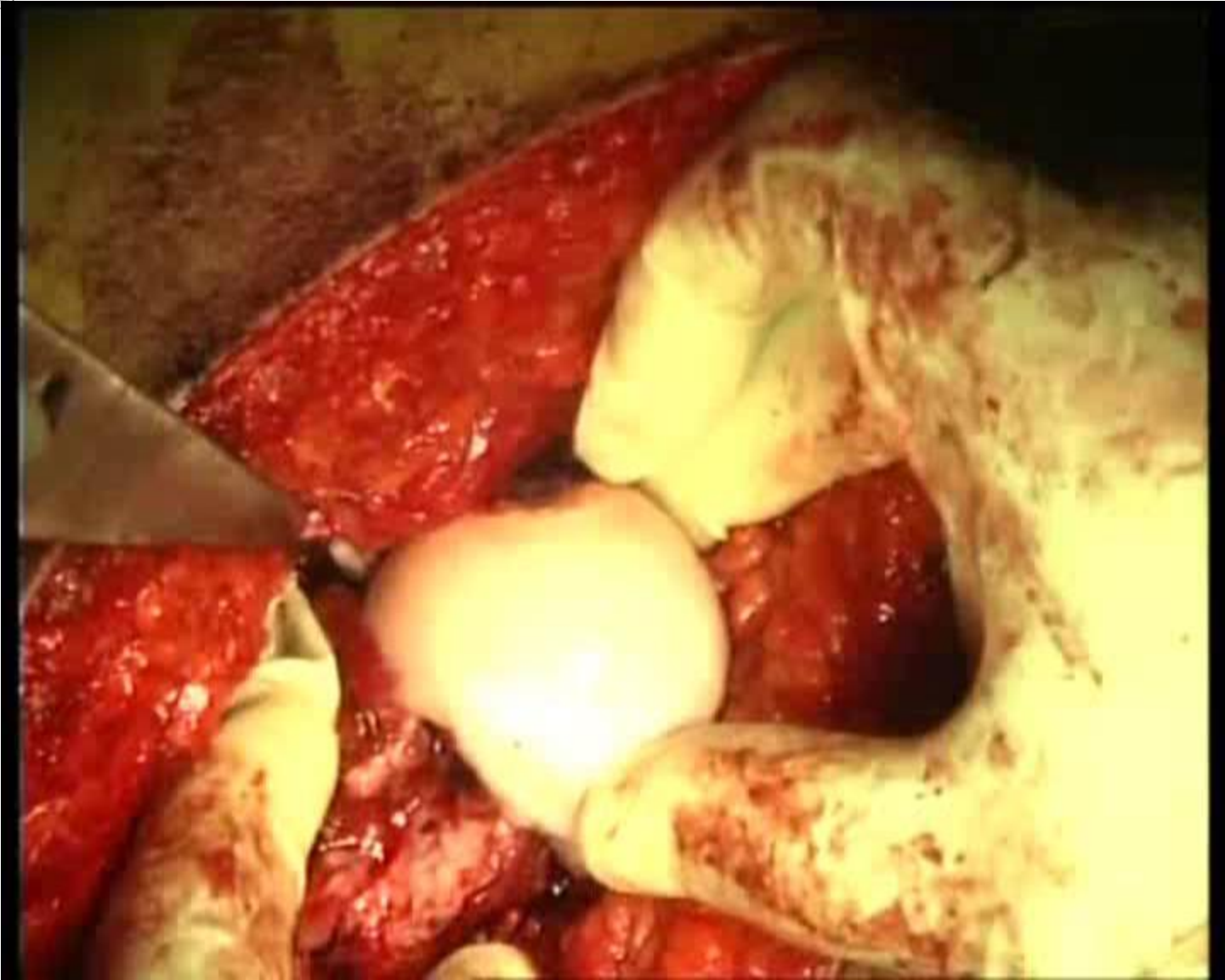
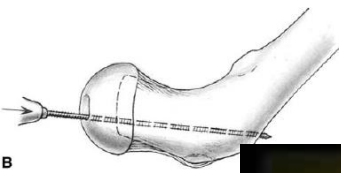




6. Inferior cheiloplasty

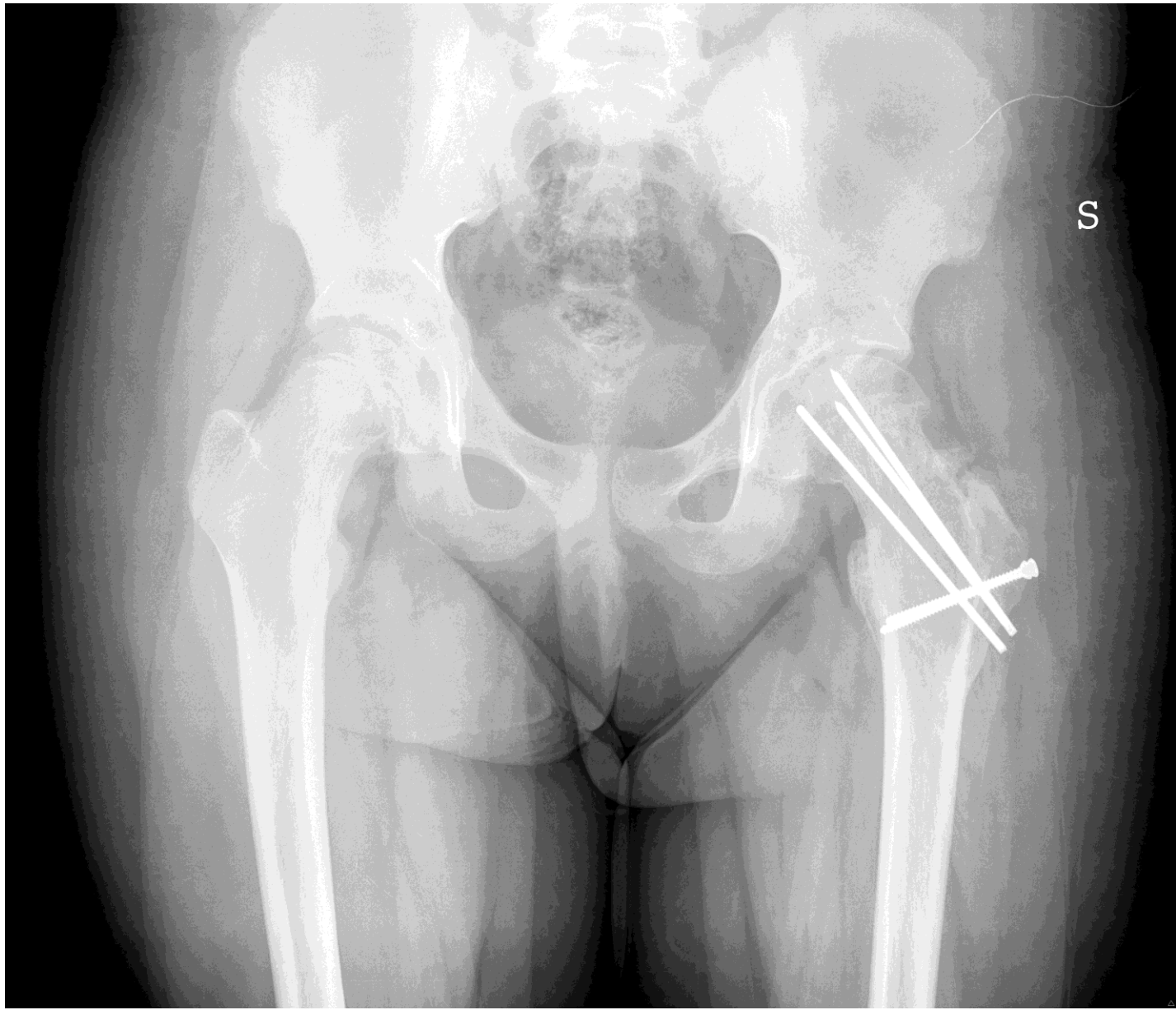


8. Head readuction

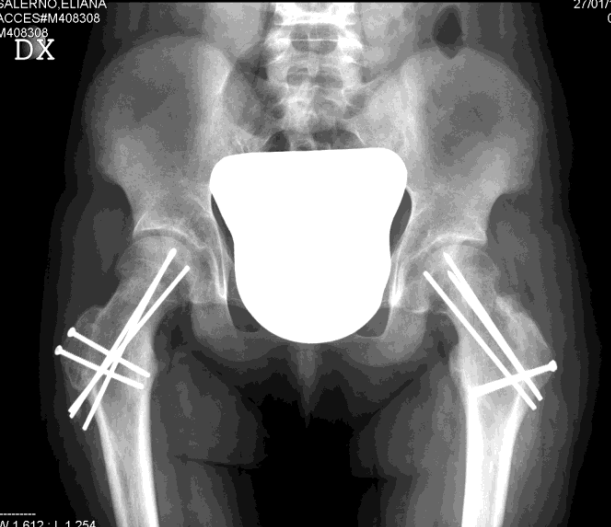


9. Fixation: 1° wire through the fovea capitis in a retrograde direction





10. Distalization of the greater trochanter



Clin Orthop Relat Res (2009) 467:704–716  
DOI 10.1007/s11999-008-0687-4

SYMPOSIUM: FEMOROACETABULAR IMPINGEMENT: CURRENT STATUS OF DIAGNOSIS  
AND TREATMENT

### **Capital Realignment for Moderate and Severe SCFE Using a Modified Dunn Procedure**

Kai Ziebarth MD, Christoph Zilkens MD,  
Samantha Spencer MD, Michael Leunig MD,  
Reinhold Ganz MD, Young-Jo Kim MD, PhD

- 40 cases (2 hospitals)
- f.u. 1-8 y
- AVN – chondrolysis 0%
- residual impingement : 1 case
- revision surgery: 3 cases (K wire failure)
- $\alpha$  angle correction: 100%

# Treatment of Slipped Capital Femoral Epiphysis with a Modified Dunn Procedure

By Theddy Slongo, MD, Diganta Kakaty, MD, Fabian Krause, MD, and Kai Ziebarth, MD

*Investigation performed at the Department of Paediatric Surgery, University Children's Hospital, Bern, and the Department of Orthopedic Surgery, University Hospital Bern, Bern, Switzerland*

**Results:** Twenty-one patients had excellent clinical and radiographic outcomes with respect to hip function and radiographic parameters. Two patients who developed severe osteoarthritis and osteonecrosis had a poor outcome. The mean

- 23 cases
- f.u. 2-5
- AVN 2/23

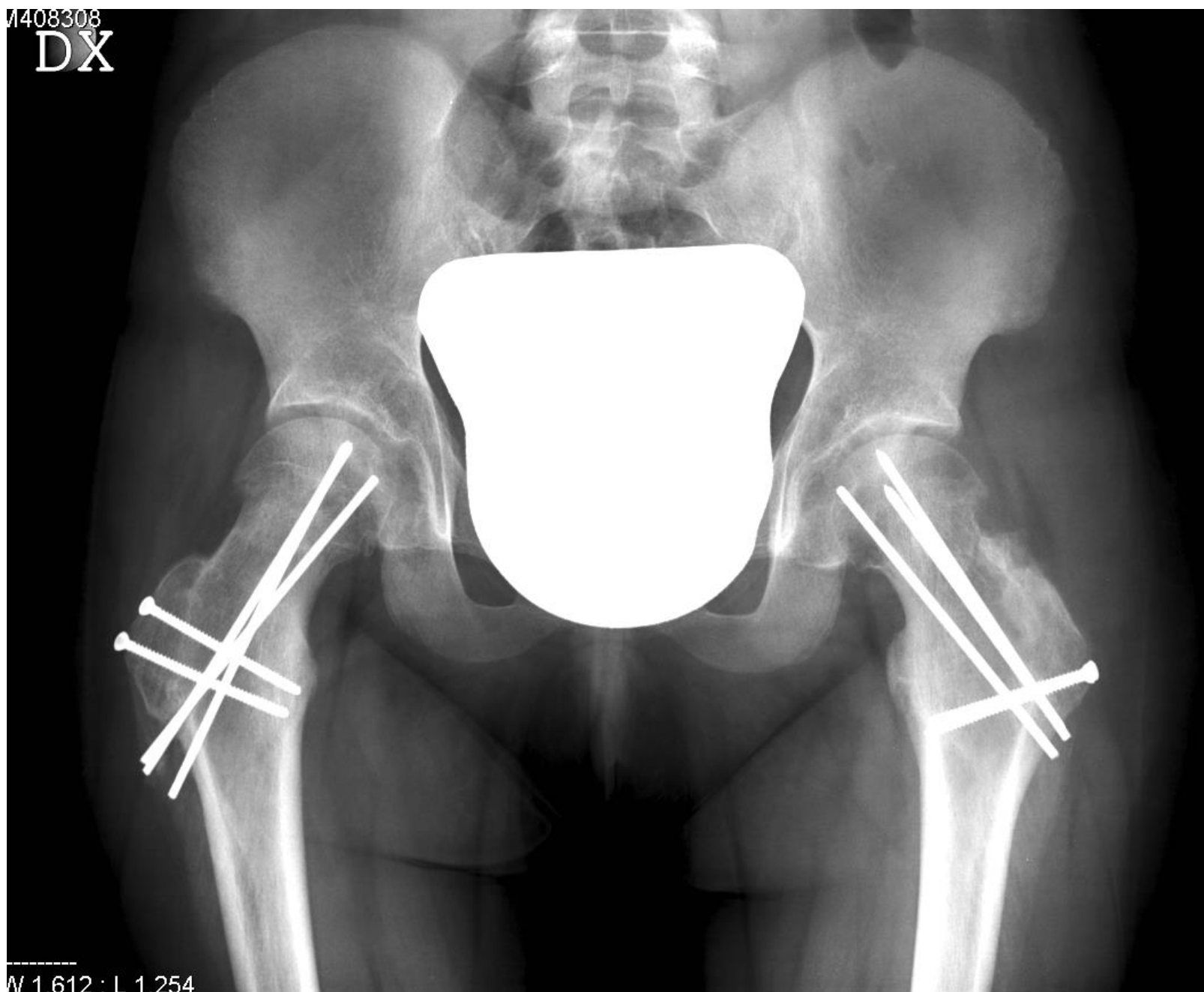




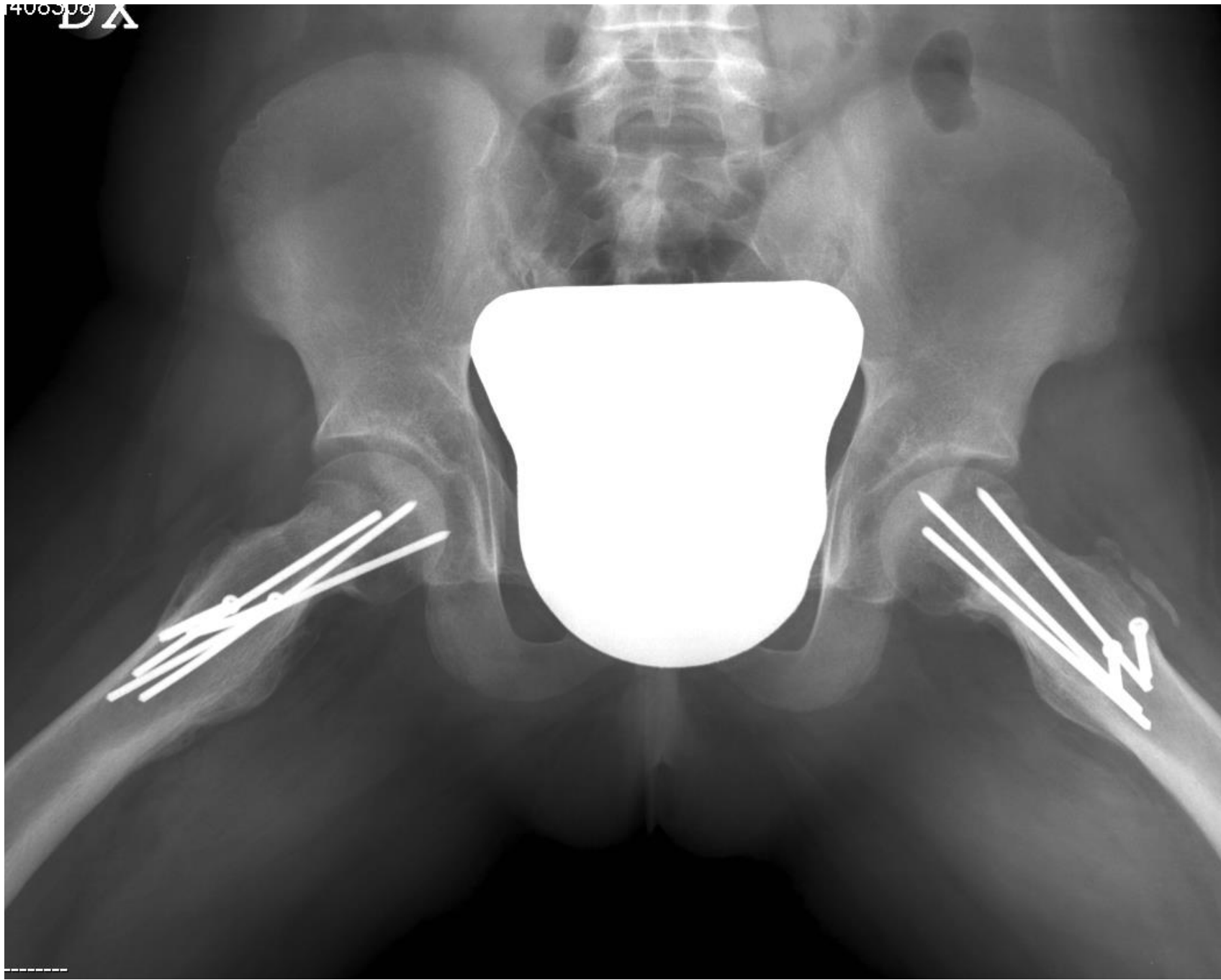
S.E. female, 12 y.o.



M408308  
DX

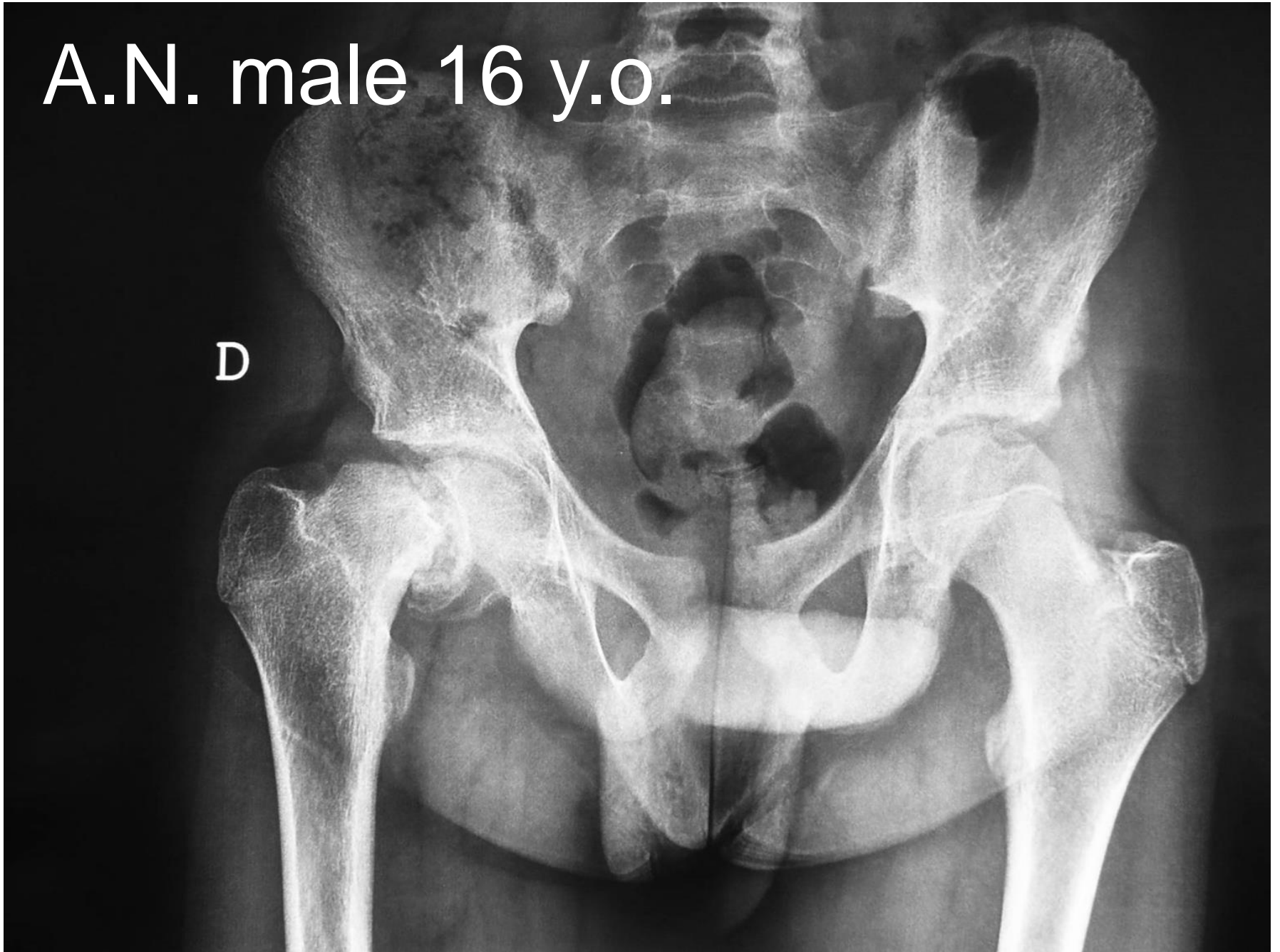


W 1.612 : L 1.254

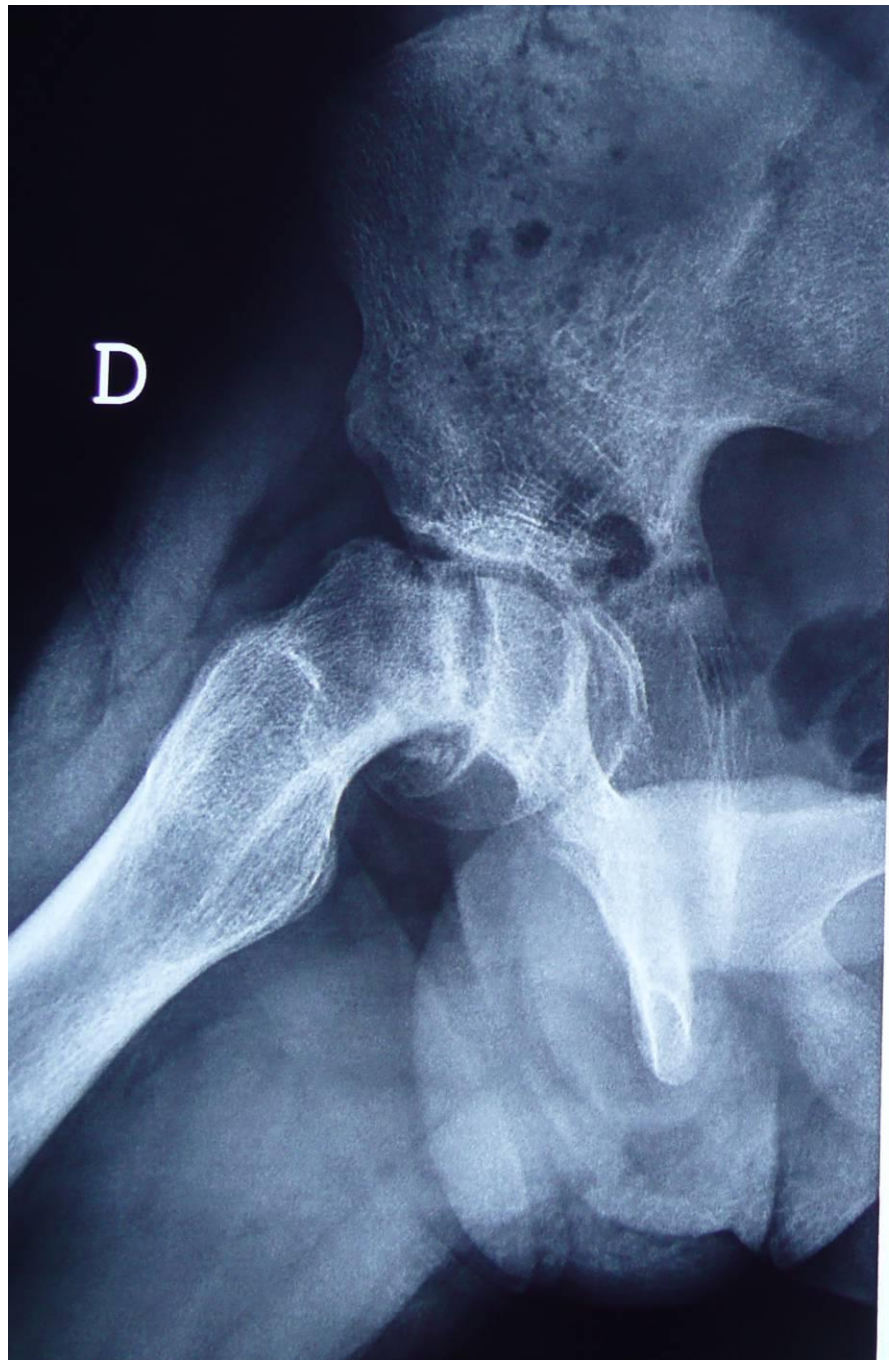


A.N. male 16 y.o.

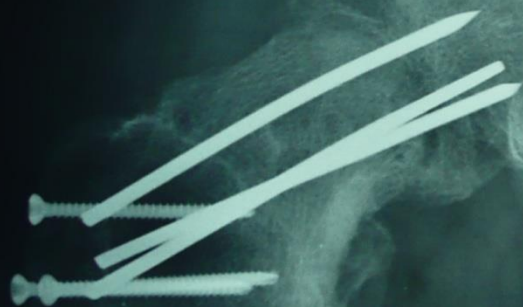
D







D





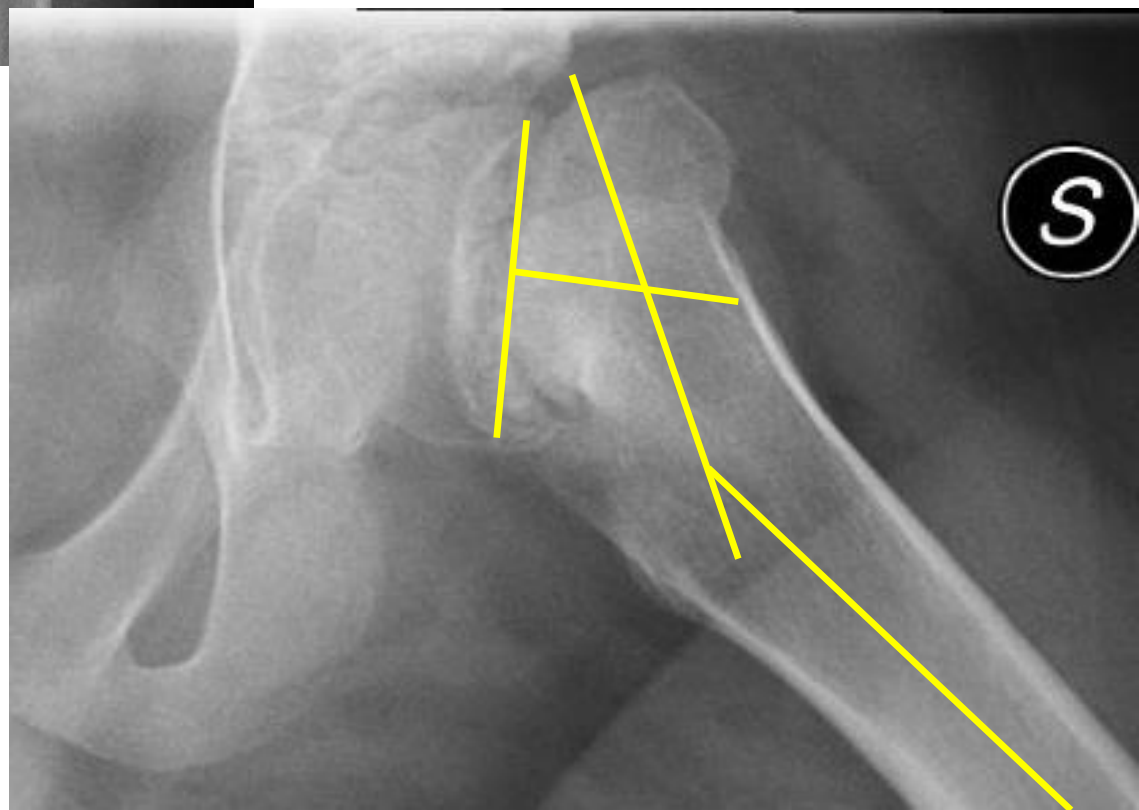


*D*

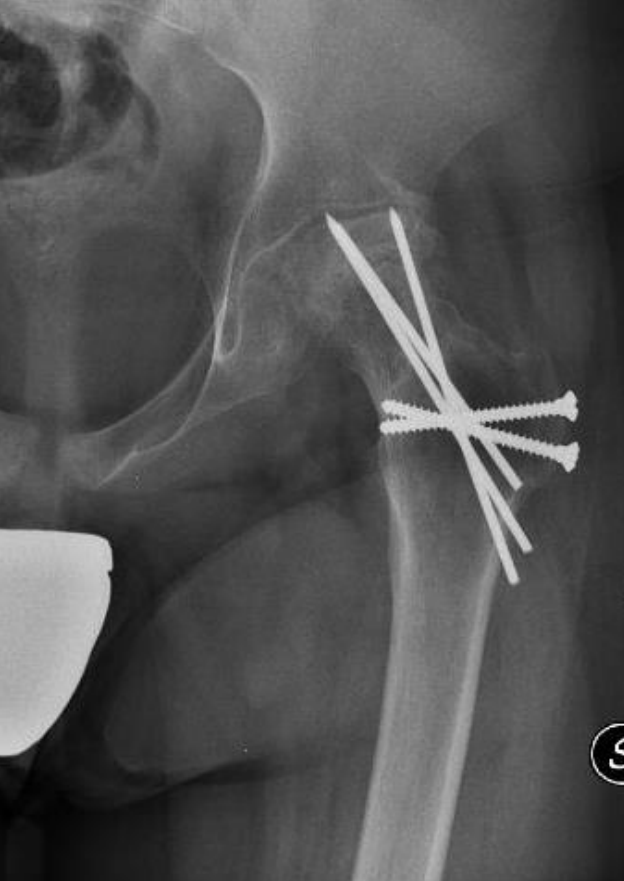
9y f.u.

S

ASL TO 4 POLINBULATORIO CALUSO R  
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Bacino AP 1  
Exam Time: 22/09/2010 15:09 TSM





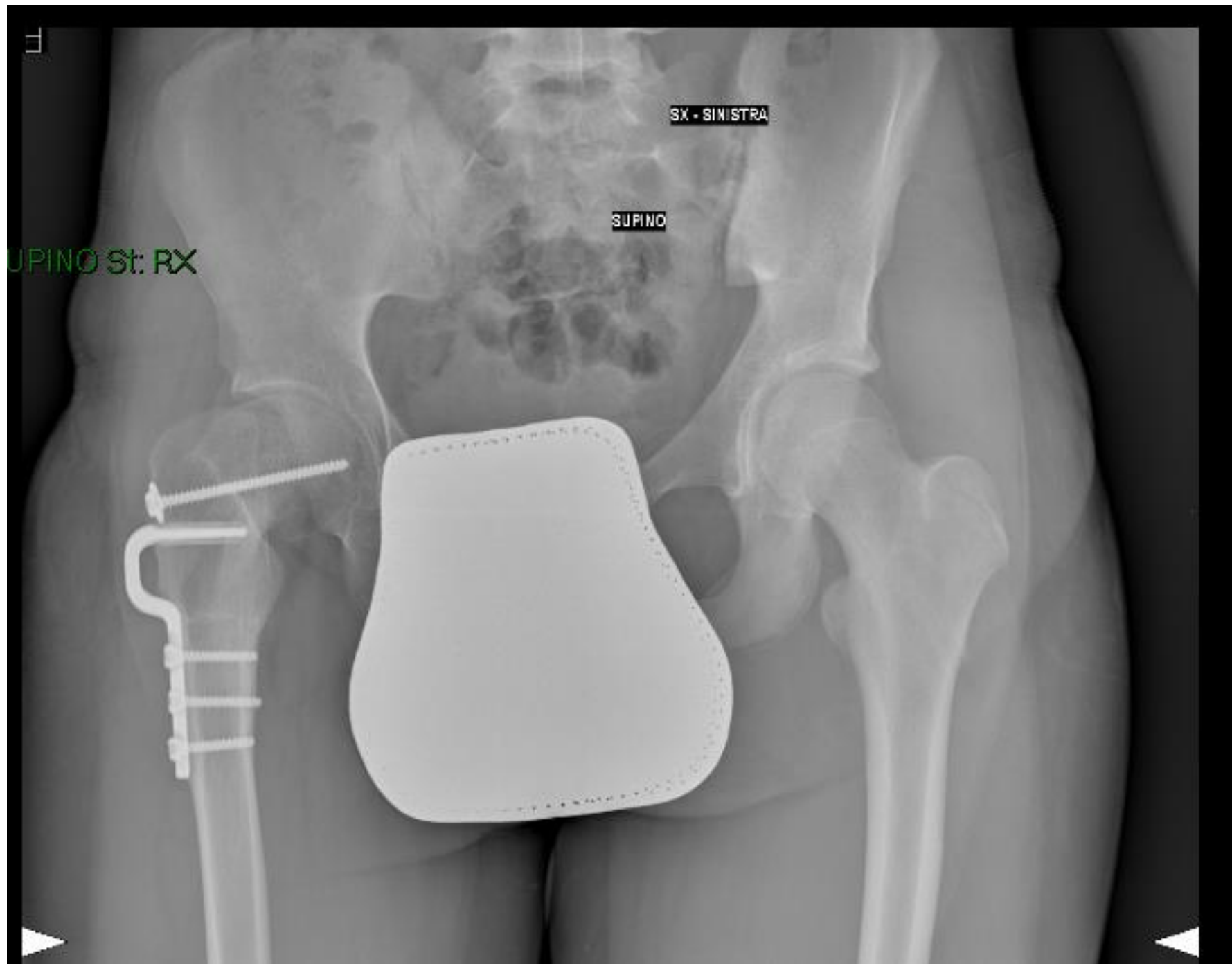


FL

SX - SINISTRA

SUPINO

UPINO St: RX



View Pos: AP  
Study Desc: RX BACINO  
Series Desc: AP  
Plate ID: 9104362288  
<1-1>

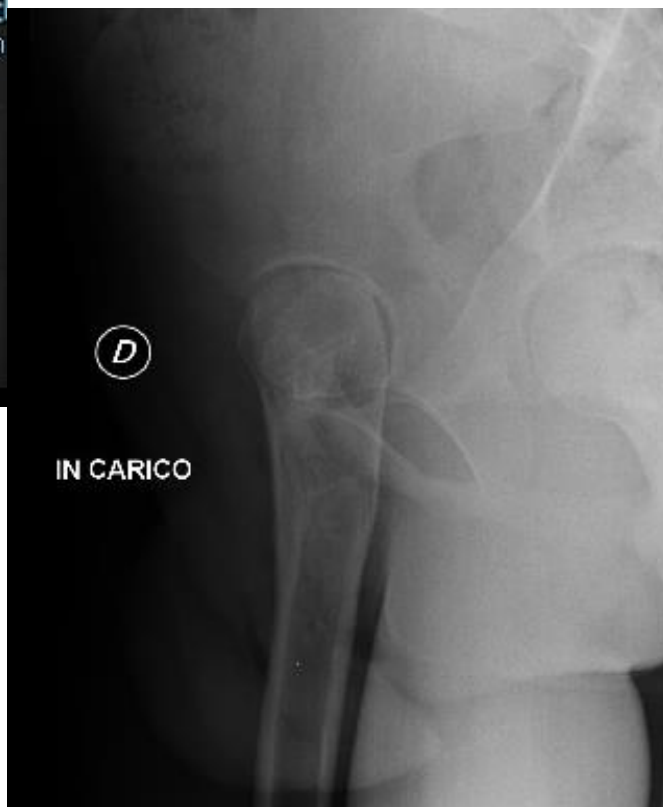
24% Pixel  
DFOV 42.0 x 42.0 cm

D

10 cm

D

IN CARICO





Tra

Ec:1

Fr:1

Patient Pos: HFS

Study Desc: RM ANCA DX SENZA

Series Desc: T1W\_aTSE

< 701 - 17 >

SW 3,00 mm

R

599,45//20,00

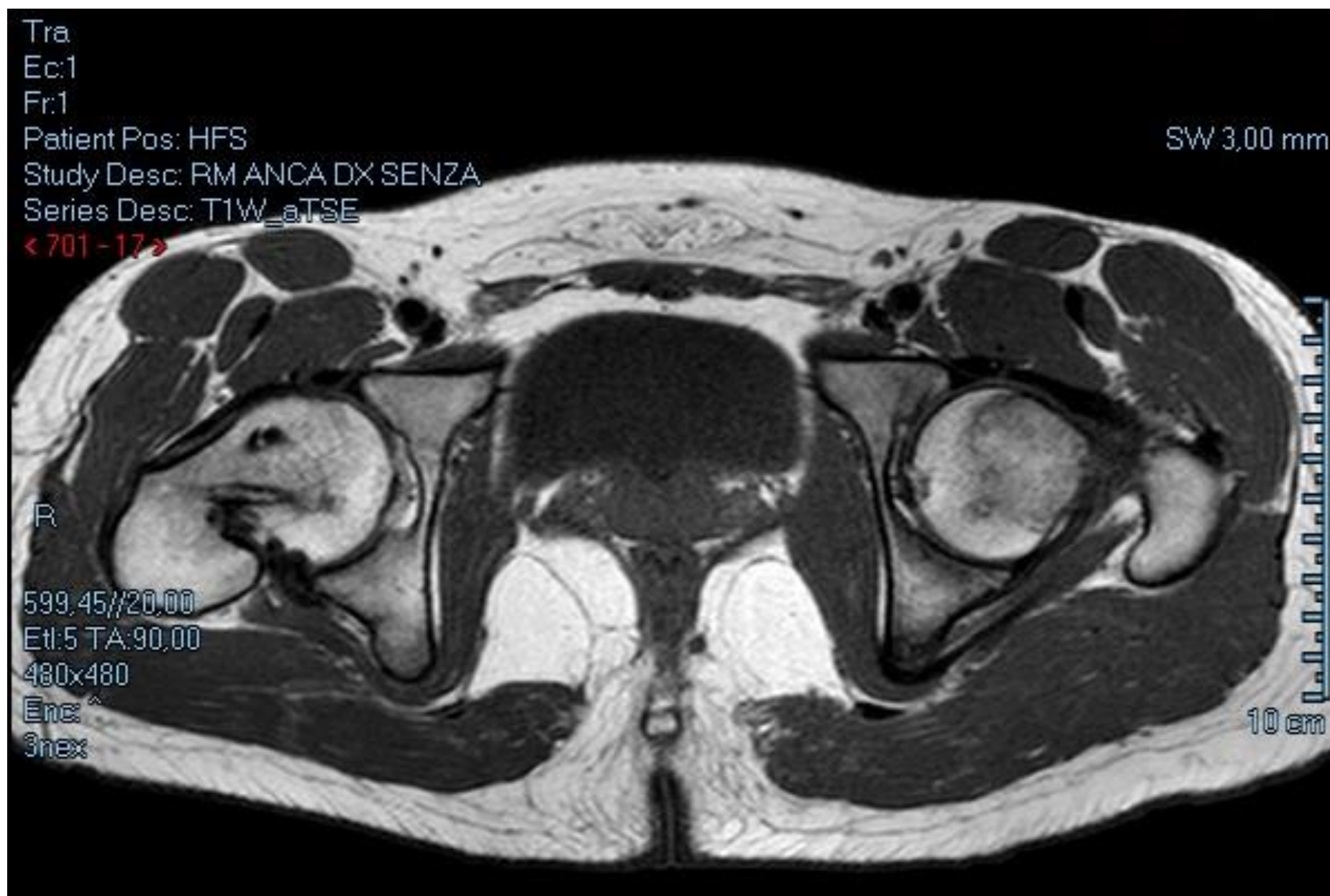
EtI:5 TA:90,00

480x480

Enc: ^

3nex

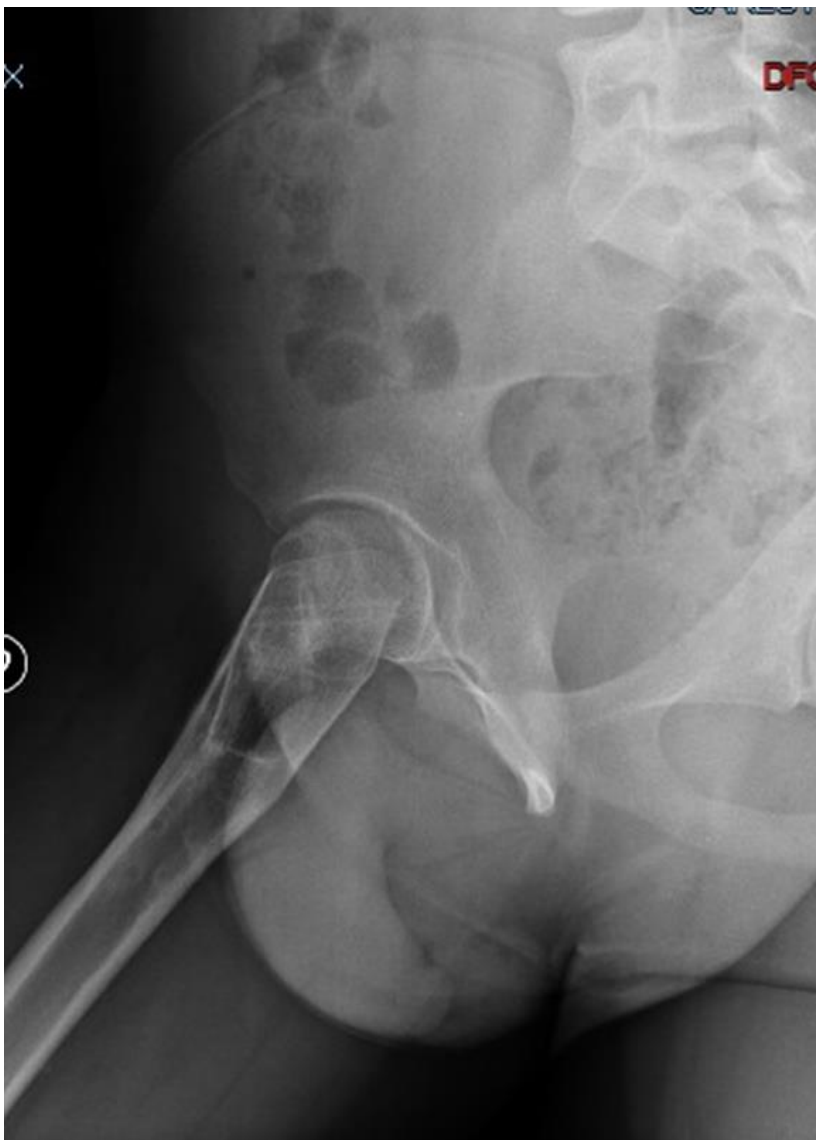
10 cm



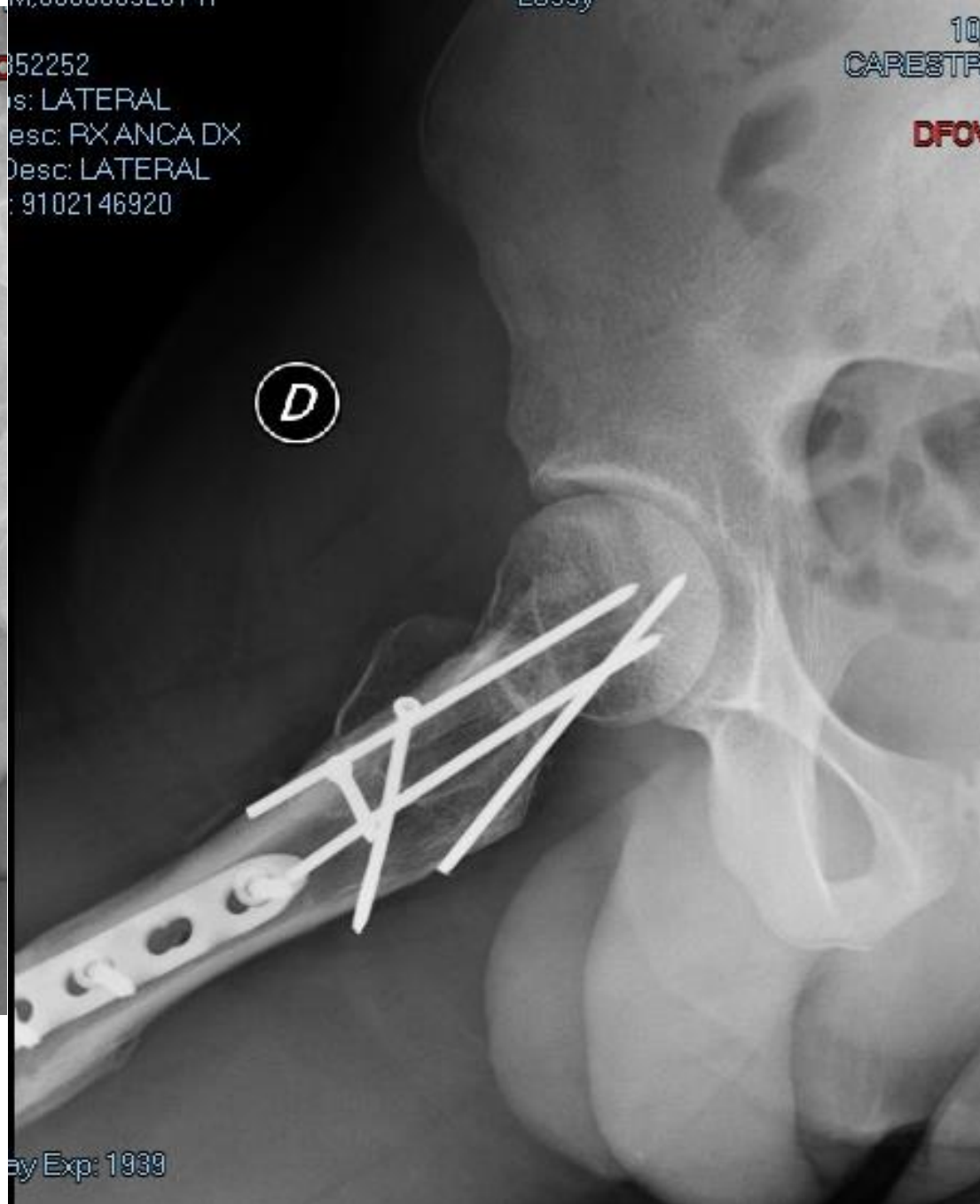
D







DF052252  
s: LATERAL  
esc: RX ANCA DX  
Desc: LATERAL  
c: 9102146920



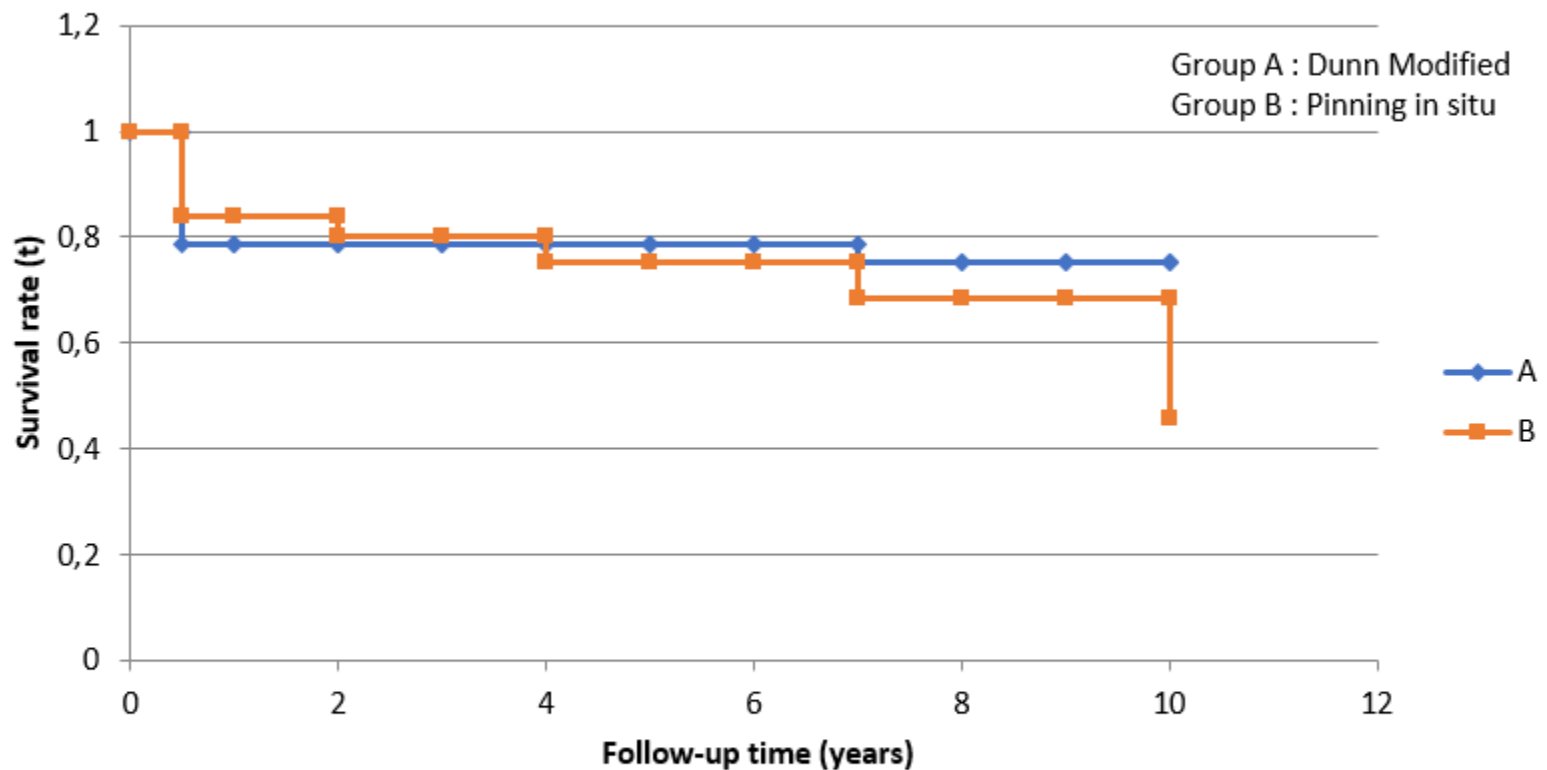
10  
CARESTP  
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ay Exp: 1939

Variable	In situ pinning (n=25)	Modified Dunn (n=66)	P value*
Patient-reported outcomes			
Merle d' Aubigné and Postel score, median (range)	N/A	18 (8 to 18 )	-
HHS , median (range)	N/A	100 (50 to 100)	-
HOOS total score, median (range)	N/A	100 ( 62 to 100)	-
WOMAC score, median (range)	N/A	0 (0 to 30)	-
Positive Drehmann's sign at follow up, %	N/A	0	-
Total of hips with subsequent surgeries (number/% of all hips)	5/20	18 /27.2	0.4
Screw removal (number/ % of all hips)	5/20	12/18.2	0.8
Total hip arthroplasty (number/% of all hips)	0	5/7.5	-
Refixation of the epiphysis (number/% of all hips)	0	1/1.5	-
Total of hips with complications (number/% of all hips)	12/48	27/40.9	0.5
AVN of the femoral head (number/% of all hips)	8/32	15/22.7	0.3
Time to develop AVN ,months (range)	36.3 (3 to 120)	5 (2 to 7)	<0.001



## Kaplan-Meier analysis



Cumulative ten-year survivorship is 75% for Dunn Modified procedure, 66 hips (95% confidence interval (CI) 65 to 82). Cumulative ten-year survivorship is 45% for Pinning in situ procedure, 25 hips (95% confidence interval (CI) 27 to 62).



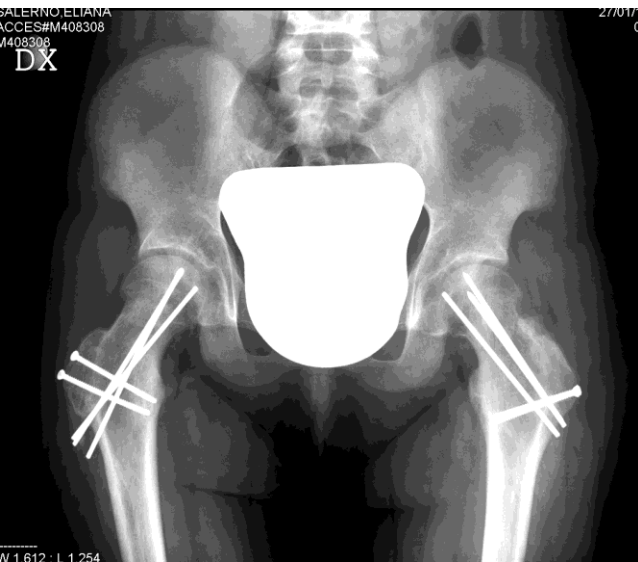


## ADVANTAGES

1. Treatment of the articular damage
2. Restoration of the anatomy
3. Restoration of abductors lever arm
4. Correction of limb length

## DRAWBACKS

1. Learning curve
2. Complications potentially severe at short term



## TAKE HOME MESSAGES:

- pinning in situ is the treatment of choice for slips up to 30°.
- For more severe slips modified Dunn re-alignment provides high amount of excellent results with comparable complication rate.
- The results are reproducible by trained surgeons



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