UNIVERSITÁ DEGLI STUDI DI TORINO

S. Luigi Gonzaga

CHIRURGIA PROTESICA DI SPALLA

Live and relive surgery

7-8 febbraio 2019

Presidente
Prof. Filippo Castoldi

Polo Didattico Azienda Ospedaliero Universitaria S. Luigi Gonzaga
Regione Gonzole 10, Orbassano (TO)

Che cosa mi offre il mercato: la glena

Roberto Castricini

VILLA IGEA CASA DI CURA

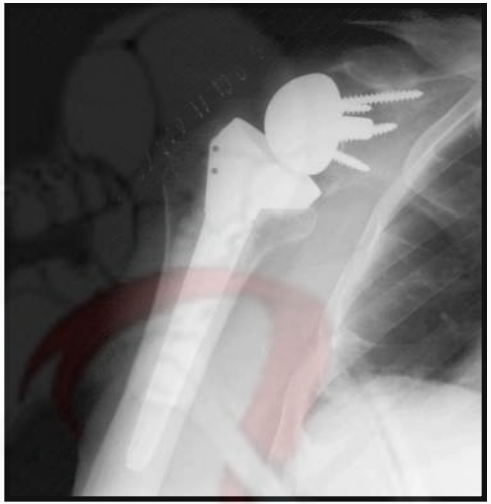
Casa di cura privata VILLA VERDE

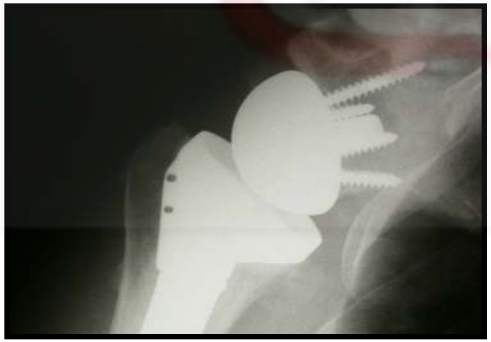
VILLA MARIA CECILIA HOSPITAL
GRUPPO VILLA MARIA

Studia il passato se vuoi prevedere il futuro

Confucio (551-479 a.C.), filosofo cinese

PROTESI INVERSA





Modello protesico semivincolato, in cui la componente protesica convessa è posta a livello della glena e quella concava a livello dell'omero

Protesi di Liverpool

Protesi di Kessel

Protesi di Kölbel

Protesi di Fenlin

Nel 1985, Paul-Marie Grammont progettò la prima protesi inversa per l' artrosi di spalla con rottura massiva della cuffia dei rotatori, in cui i risultati dell'impianto della protesi anatomica standard apparivano insoddisfacenti.

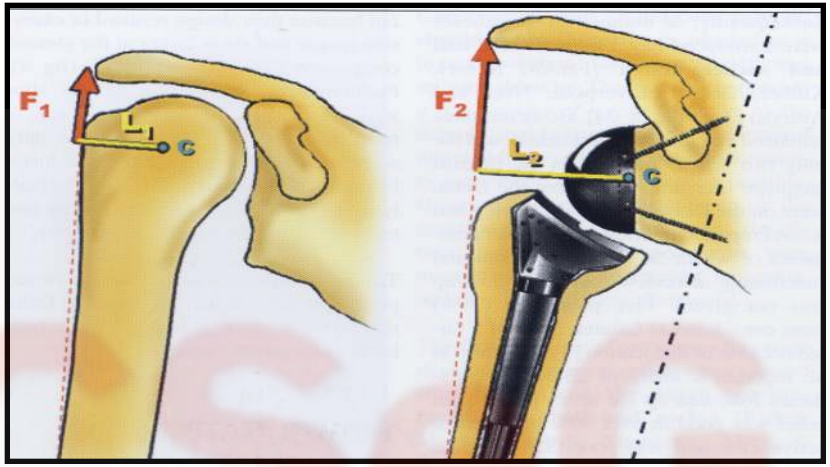
Grammont P, Trouilloud P, Laffay JP, et al. Concept study and realization of a new total shoulder prosthesis. Rhumatologie. 1987;39:407–18.

LA “TROMPETTE”

Grammont usò un modello a giunto sferico rovesciato, ma introdusse 2 innovazioni fondamentali nel design protesico:

- una grande sfera senza collo posizionata sulla glenoide;
- una piccola coppa, orientata con una inclinazione non anatomica di 155° e che copriva meno della metà dell’emisfera, sull’omero.

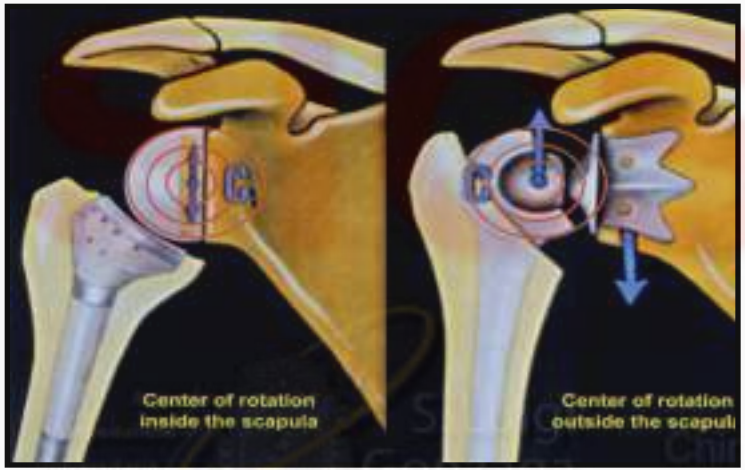
Principi fondamentali della protesi inversa:



1. un centro di rotazione fisso con una grande superficie articolare congruente;
2. un centro di rotazione medializzato per incrementare il braccio di leva del deltoide (L2 > L1) e ridurre le forze di torsione sulla componente glenoidea;
3. abbassamento dell'omero in relazione alla glena per incrementare la forza del deltoide (F2 > F1).

VANTAGGI BIOMECCANICI

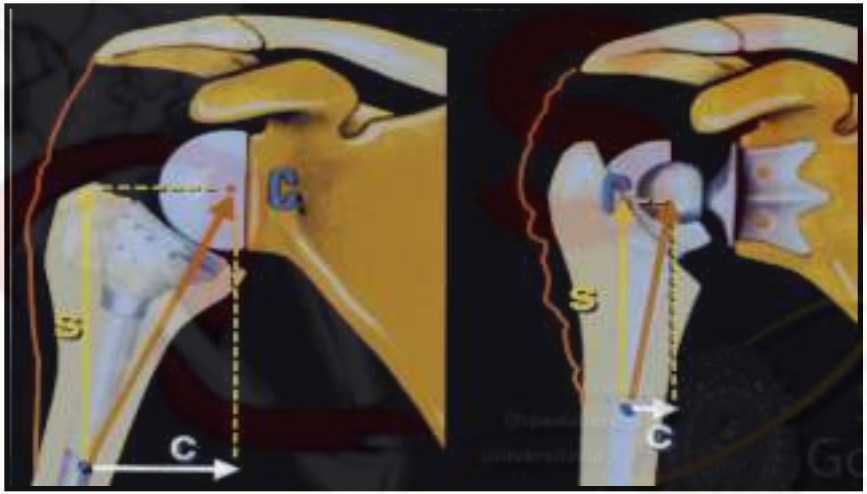
Ridotte forze di torsione sulla glena

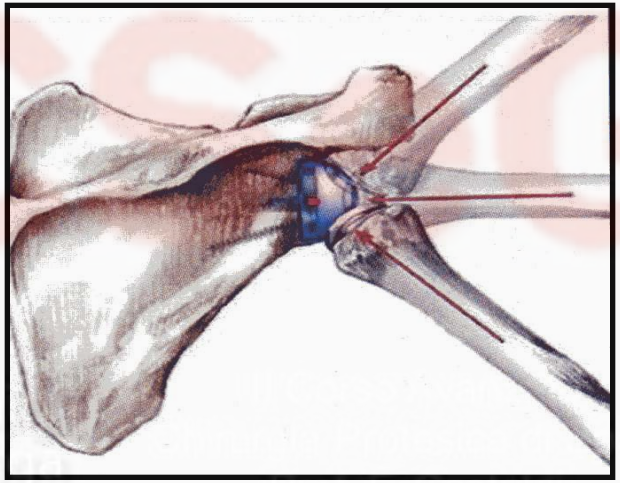


Il centro di rotazione è posto all'interfaccia tra la glena e la protesi

VANTAGGI BIOMECCANICI

Migliore stabilità





L’abbassamento dell’omero incrementa le forze compressive (C) del deltoide

VANTAGGI BIOMECCANICI

Migliore stabilità

Come nell'anca, una grande testa protesica
dà una maggiore stabilità

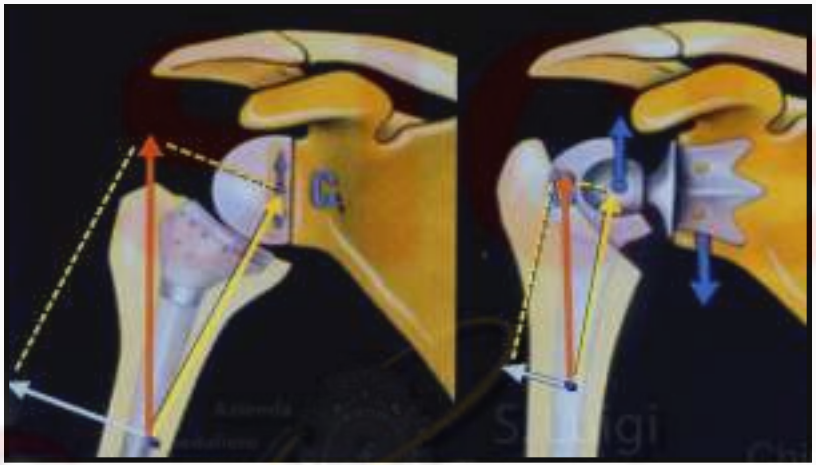
VANTAGGI BIOMECCANICI

Migliore mobilità

L'elevazione passiva è aumentata grazie alla componente glenoidea costituita da una testa grande (glenosfera)

VANTAGGI BIOMECCANICI

Migliore mobilità

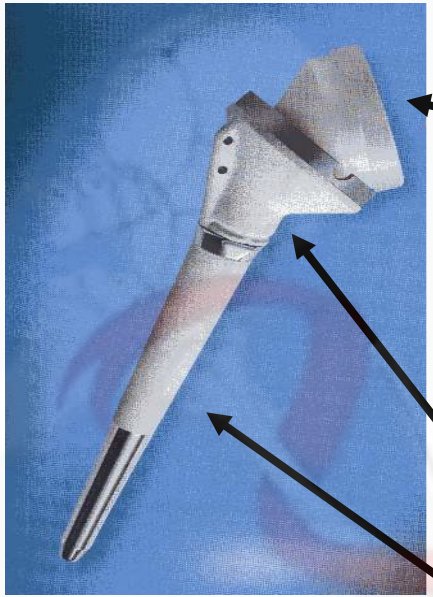


L'elevazione attiva è aumentata per l'incremento della forza del deltoide:

- maggior reclutamento di porzioni muscolari (porzioni I-IV vs II-III),

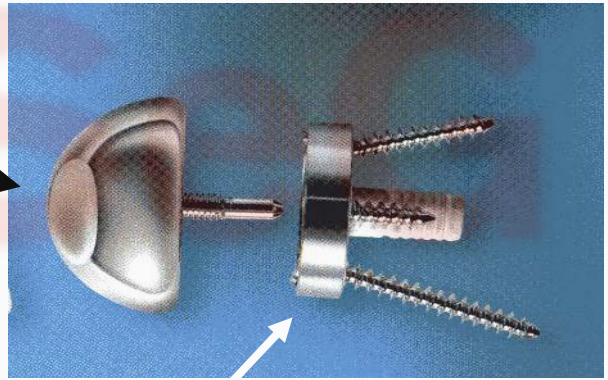
- tensionamento delle fibre muscolari dato dalla medializzazione del centro di rotazione e dall'abbassamento dell'omero.

1991: the Delta reverse prosthesis



polyethylene cup

glenosphere



humeral neck

humeral stem

metaglene

2006: protesi inversa Delta Xtend

Rispetta le caratteristiche principali della DELTA:

- centro articolare di rotazione sulla superficie ossea glenoidea,
- angolo cervico-diafisario non anatomico (155°).

Presenta alcune innovazioni:

- metaglena di dimensioni ridotte con parte posteriore ricurva.
- viti con angolazione variabile,
- maggiore diametro della glenosfera ed opzione eccentrica,
- design diversi per le coppe omerali in polietilene.

J Shoulder Elbow Surg (2013) 22, 1639-1649

ELSEVIER

Health-related quality of life and functionality after reverse shoulder arthroplasty

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

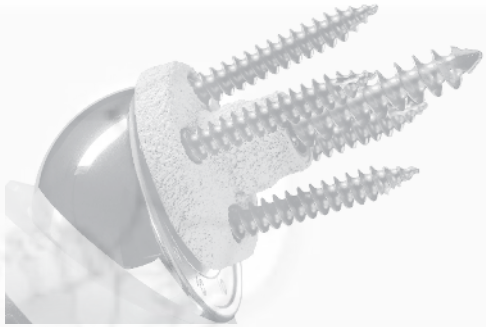
Roberto Castricini, MD[a], Giorgio Gasparini, MD[b,*], Francesco Di Luggo, MD[b], Massimo De Benedetto, MD[a], Marco De Gori, MD[b], Olimpio Galasso, MD[a]

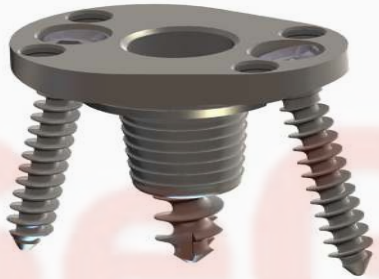
Methods: In this prospective cohort study, 80 patients were evaluated after an RSA for either primary oste- oarthritis, massive rotator cuff tear, or cuff tear arthropathy.

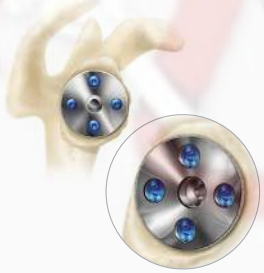
Results: At a mean 5-year follow-up, the cumulative survival rate was 97.3% and significant improve- ments in the CMS and ROM were observed when compared with the baseline values. The CMS was 93.2% of the sex- and age-matched normal values. The postoperative SF-36 scores showed no significant differences compared with normative data. Younger patients and subjects with worse preoperative condi- tions achieved the greatest benefit after RSA. The length of follow-up was found to be associated with the severity of scapular notching.

Conclusions: This study introduces new predictors for surgical outcomes, and it shows that patients who had undergone RSA a mean of 5 years earlier exhibit similar functionality and health-related quality of life with respect to healthy controls. Physicians should consider these results when discussing the outcomes of this surgery with patients.


Grande successo
Tanti imitatori



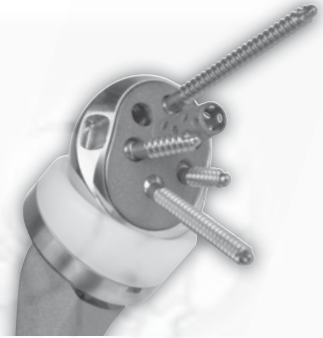




Comprehensive Reverse

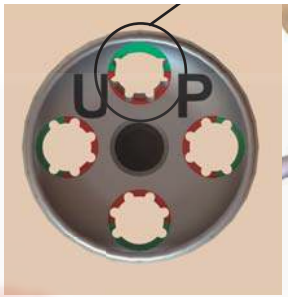
SMR LIMA

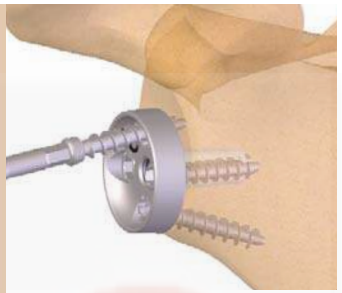
Universal glenoid Arthrex



Equinoxe Exactech

Delta Xtend DePuy

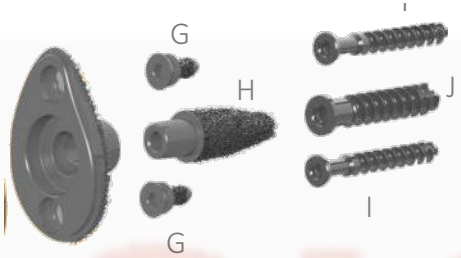




Fx-Solutions

Affinis Inverse Mathys

Medacta



Permedica

Gerber Zimmer

Aequalis Reverse

Titan Reverse Integra

Bigliani Zimmer

J Shoulder Elbow Surg (2018)

ELSEVIER

ORIGINAL ARTICLE

JOURNAL OF SHOULDER AND ELBOW SURGERY

www.elsevier.com/locate/ymse

Factors contributing to glenoid baseplate micromotion in reverse shoulder arthroplasty: a biomechanical study

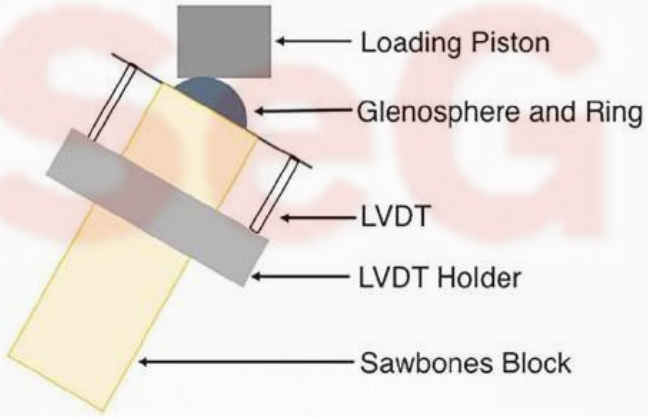
Tiffany S. Lung, BKin[a,*], David Cruickshank, MD[a,b], Heather J. Grant, MSc[a], Michael J. Rainbow, PhD[a,c], Timothy J. Bryant, PhD[a,c], Ryan T. Bicknell, MD[a,b,c]

Discussion: greater bone density, a longer central peg, and longer screws provide improved initial glenoid fixation in an RSA, whereas the number of screws, and the angle of screw insertion do not. These findings may help minimize baseplate failure and revision operations.

Stabilità primaria impianto: Fattori da considerare?

Fattori significativi

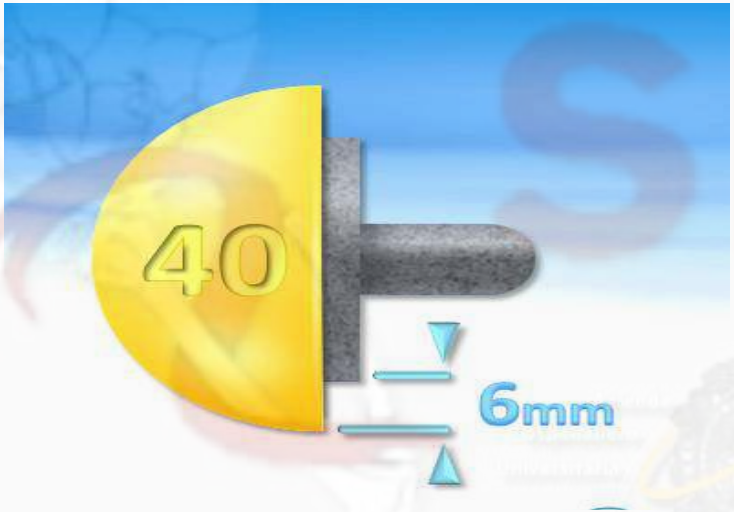
- Bone stock
- Peg centrale più lungo
- Viti lunghe

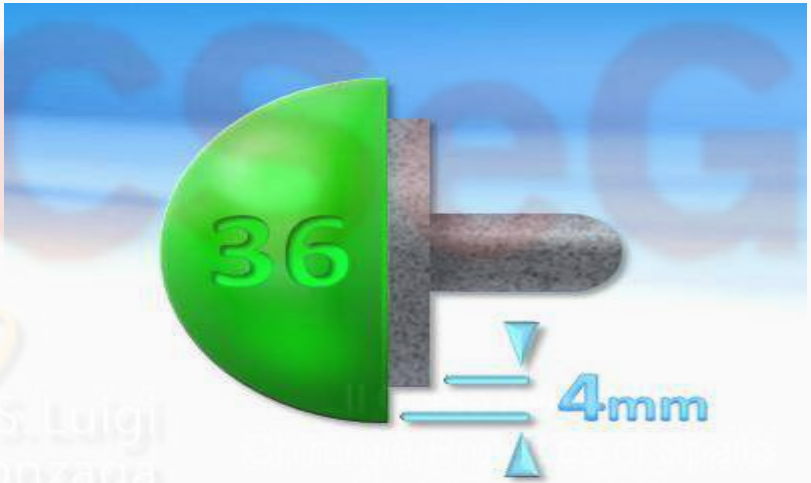


Non significativi

- Numero viti
- Angolazione delle viti

Scelta della glenosfera





Scelta della glenosfera

Patients treated with 42-mm glenospheres had greater improvements in aFE and aER when compared with 38-mm glenospheres.

Impact of glenosphere size on clinical outcomes after reverse total shoulder arthroplasty: an analysis of 297 shoulders. Mollon B. JSES. 2016 May;25(5):763-71.

Our findings do not support a strong role for glenosphere size as a singular factor affecting range of motion or patient-reported outcome following RSA

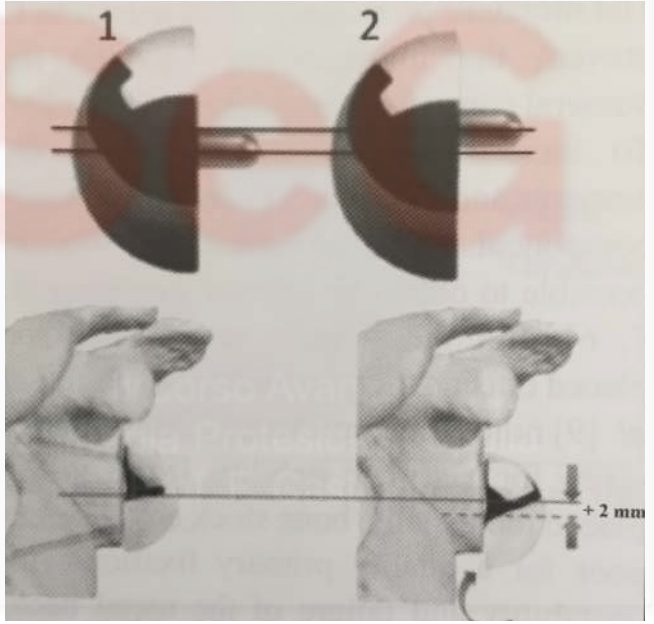
The effect of glenosphere size on functional outcome for reverse shoulder arthroplasty. Sabesan VJ. Musculoskelet Surg. 2016 Aug;100(2):115-20

Results of eccentric glenosphere

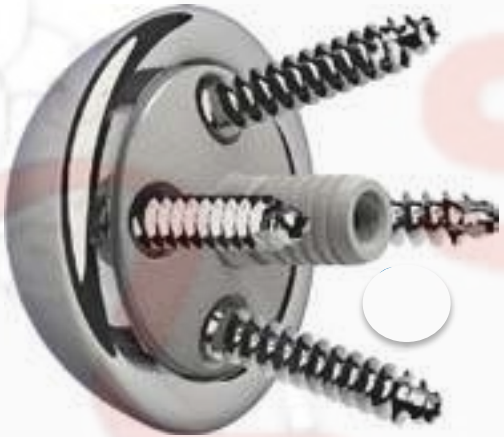
P. Collotte, P. Doms, G. Walch Nice Shoulder Course 2016

Using eccentric glenosphere seems to be a good option to prevent the scapular notching, but it does eradicate the risk of notching.

Eccentric glenosphere would allow the best results for the internal rotation.



Scelta dei materiali: trabecular metal?

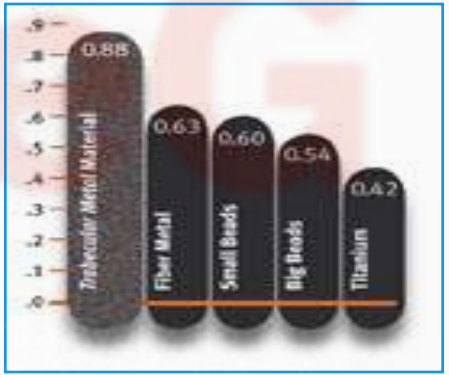


INITIAL FIXATION OF THE TRABECULAR METAL REVERSE SHOULDER GLENOID BASE PLATE IMPLANT

Matthew L. Mroczkowski M.S.
Roy Wiley

Conclusions

The *Trabecular Metal* Reverse Shoulder prosthesis provides initial stability necessary to achieve biological ingrowth enabling long-term fixation over a wide range of bone properties.



High Friction
Implant Stability

Reverse total shoulder arthroplasty using a trabecular metal glenoid base plate: functional and radiological outcomes at two to five years.

Theivendran K et al, Bone Joint J. 2016 Jul;98-B(7):969-75.

Survivorship at five years was 96.7%

Notching:

- 63 shoulders (50.4%) grade 0
- 51 (40.8%)grade 1
- 10 (8.0%) grade 2
- 1 (0.8%) had grade 4

Radiolucency around the glenoid base plate: 1 patient (0.8%)

Radiolucency around the humeral stem in 5 (4.0%)

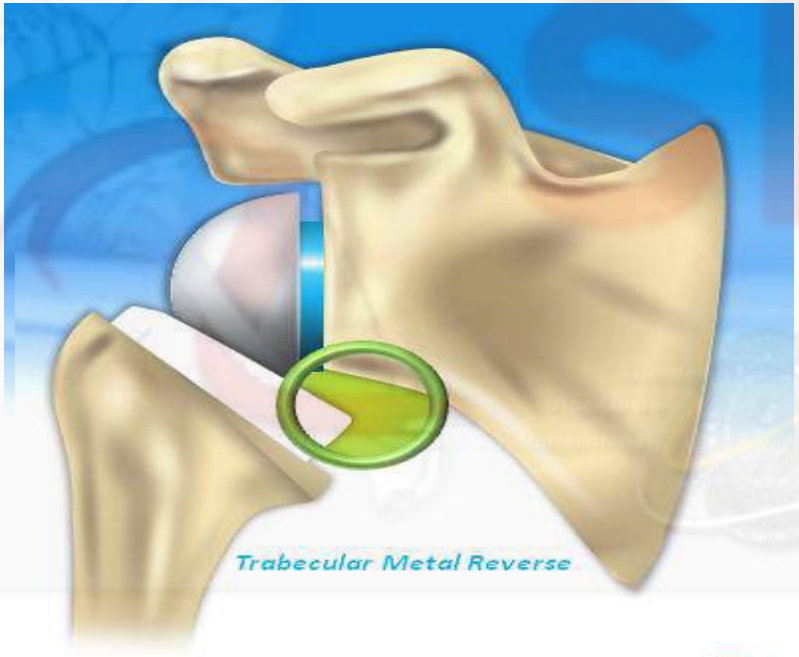
3 RTSA (2.4%) underwent revision surgery for aseptic mechanical failure

CONCLUSION:

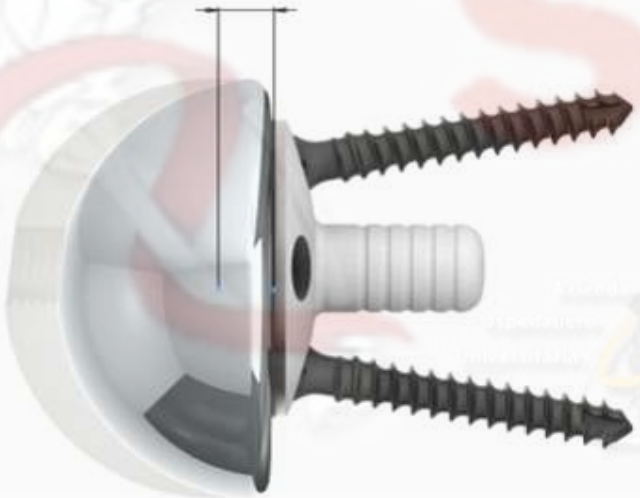
The clinical results of this large independent single unit series are comparable to those from previous series of RTSA reported in the literature.

A trabecular metal base plate is safe and effective in the medium-term.

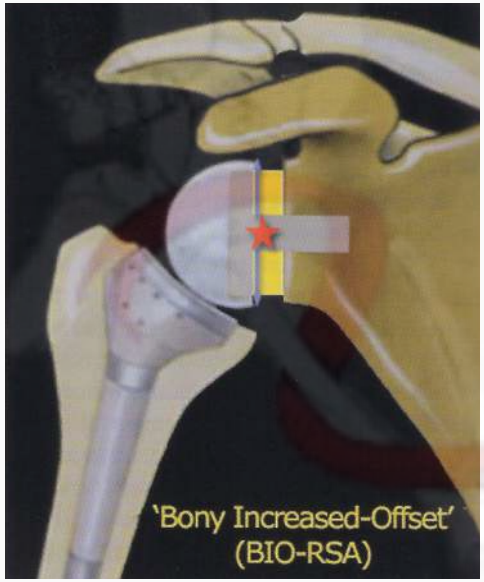
Lateralization of center of rotation (COR) by chenging design of baseplate

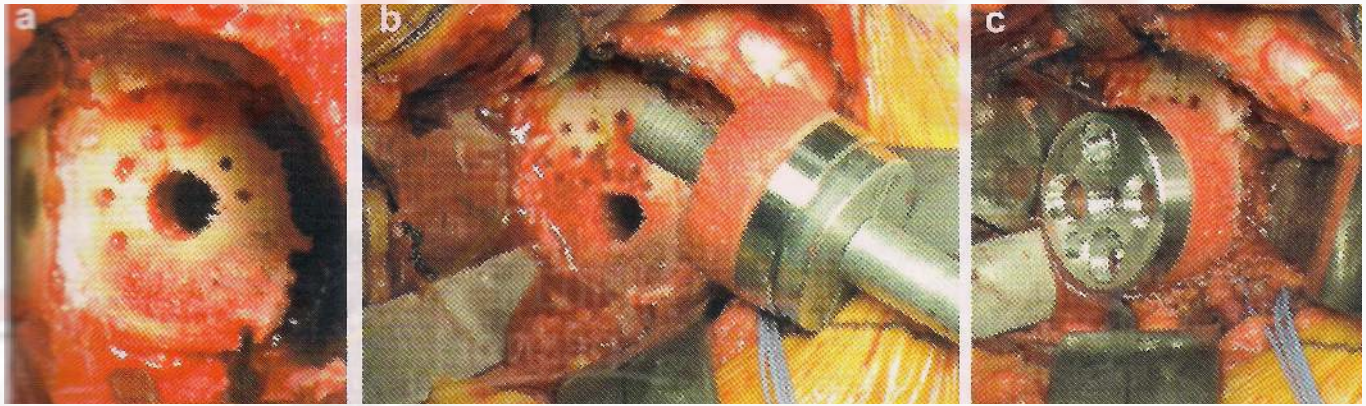


Lateralization of center of rotation (COR) by chenging design of glenosphere



Lateralization of center of rotation (COR) by BIO-RSA technique of Boileau





P.Boileau, G. Moineau, Y Roussanne, K. O'Shea Bony increased-offset reversed shoulder arthroplasty (BIO-RSA): the benefits of bony lateralization. Shoulder Concepts 2010. The glenoid. Sauramps medical-Nice Shoulder Course, 371-387.

J Shoulder Elbow Surg (2018) 27, 2099–2107

ELSEVIER

JOURNAL OF SHOULDER AND ELBOW SURGERY

www.elsevier.com/locate/ymse

REVIEW ARTICLE

The clinical and radiographic impact of center of rotation lateralization in reverse shoulder arthroplasty: a systematic review

Joshua K. Helmkamp, BA[a,*], Garrett S. Bullock, DPT[b], Nnamdi R. Amilo, BS[a], Evan M. Guerrero, MD[b], Leila S. Ledbetter, MLIS[c], Timothy C. Sell, PhD[b], Grant E. Garrigues, MD[b]

Risultati: COR Mediale Vs Laterale

- No differenze nell'outcome clinico
- COR mediale: maggior incidenza scapular notching
- COR laterale: aumento ROM post-op (rotazione esterna)
- Complicanze: nessuna differenza

Evoluzione modelli protesici: sistemi modulari

Clin Orthop Relat Res (2015) 473:651–660
DOI 10.1007/s11999-014-3985-z

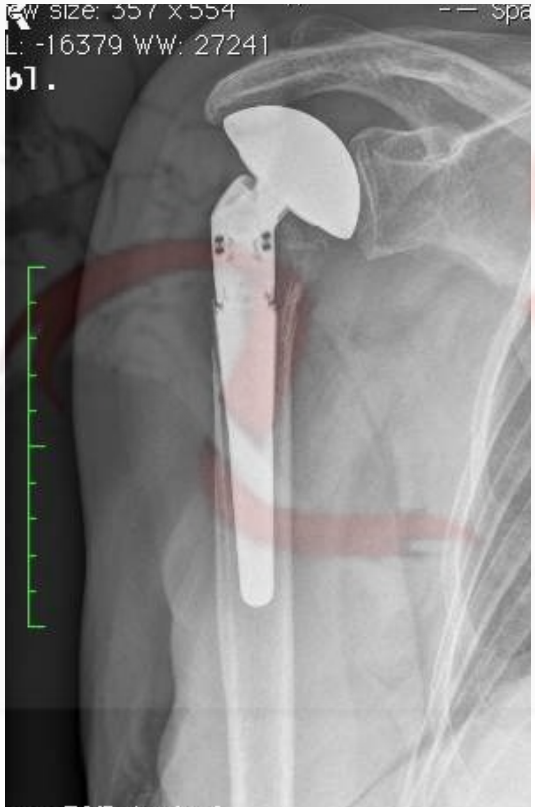
Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

CLINICAL RESEARCH

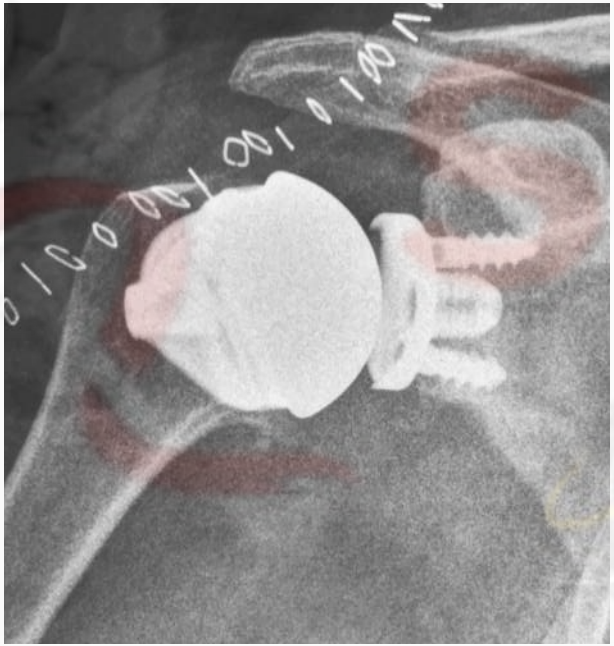
Conversion of Stemmed Hemi- or Total to Reverse Total Shoulder Arthroplasty: Advantages of a Modular Stem Design

Karl Wieser MD, Paul Borbas MD, Eugene T. Ek MBBS, PhD,
Dominik C. Meyer MD, Christian Gerber MD, FRCS

Sistemi modulari



Sistemi modulari



J Shoulder Elbow Surg (2011) 20, 146-157

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Problems, complications, reoperations, and revisions in reverse total shoulder arthroplasty: A systematic review

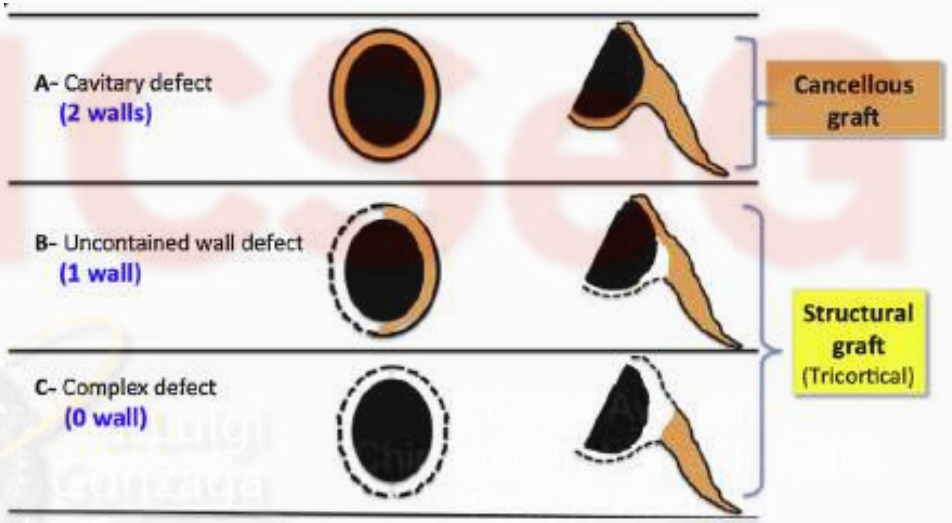
Matthias A. Zumstein, MD[a,b], Miguel Pinedo, MD[a,d], Jason Old, MD, FRCSC[a,c], Pascal Boileau, MD[a,*]

Postoperative complications, total	164		
Instability	37	6.9	4.7
Infection	30	5.6	3.8
Aseptic glenoid loosening	27	5.0	3.5
Acromion and scapular spine fractures	12	2.2	1.5
Glenoid disassembly	12	2.2	1.5
Humeral disassembly, polyethylene dislocation	12	2.2	1.5
Humeral fracture	11	2.1	1.4
Humeral loosening	10	1.9	1.3
Neurologic complications (axillary, radial)	9	1.7	1.2
Miscellaneous	4	0.7	0.5

Revisione componente glenoidea inversa

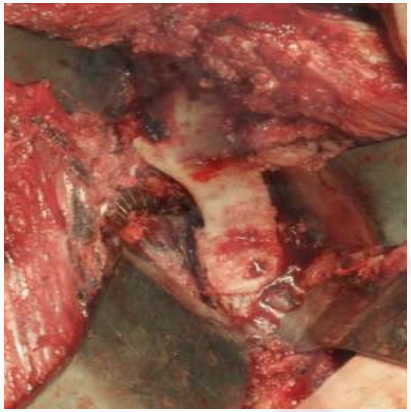
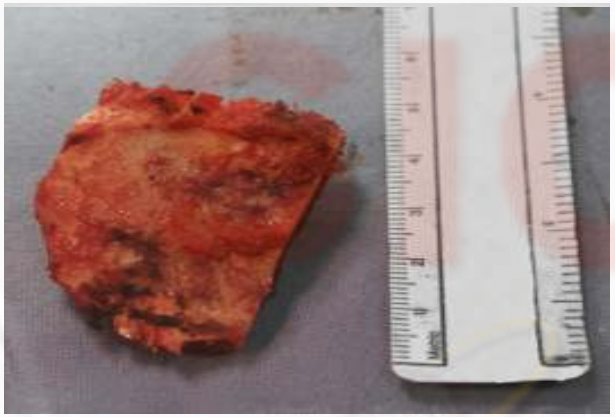
Tipo A:
Innesto osseo: allograft

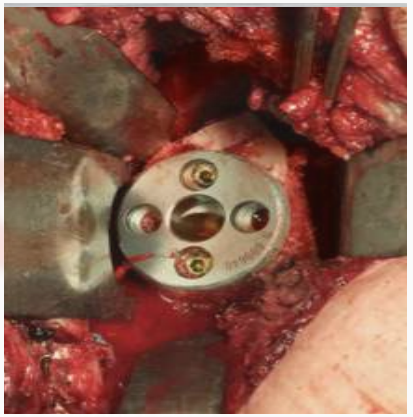
Tipo B,C:
Innesto tricorticale autologo



Review article Complications and revision of reverse total shoulder arthroplasty P. Boileau

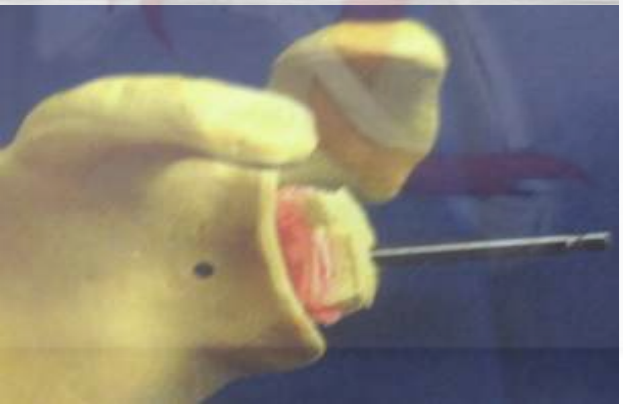
Autograft da cresta iliaca

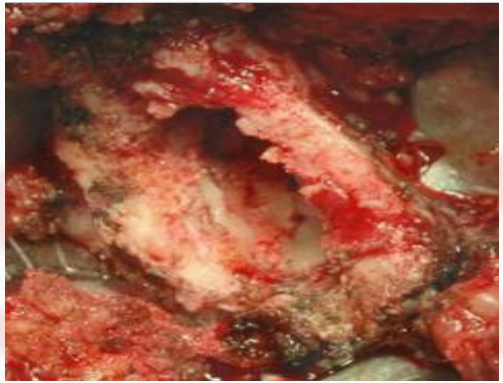



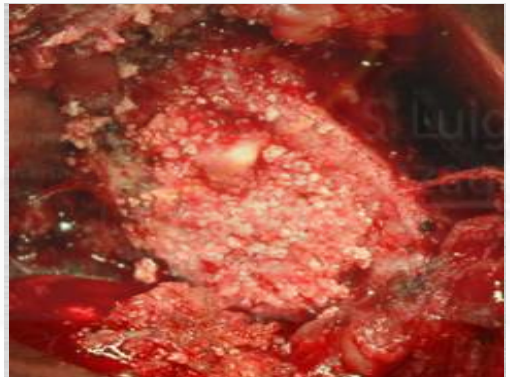


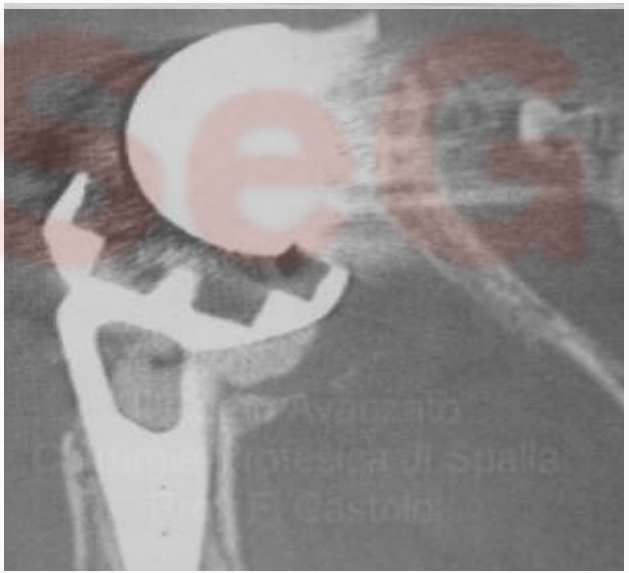
Norris Tr, Kelly JD, Humphrey CS: Management of glenoid bone defects in revision shoulder arthroplasty: a new application of reverse total shoulder prosthesis. Tech Shoulder El Surg 37-46 (2007).

Allograft da testa di femore



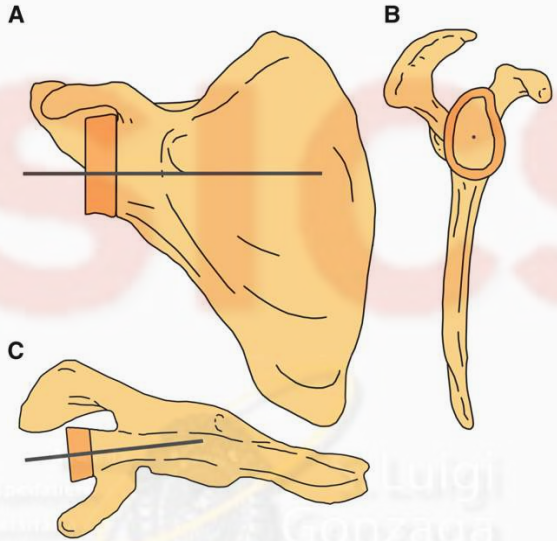


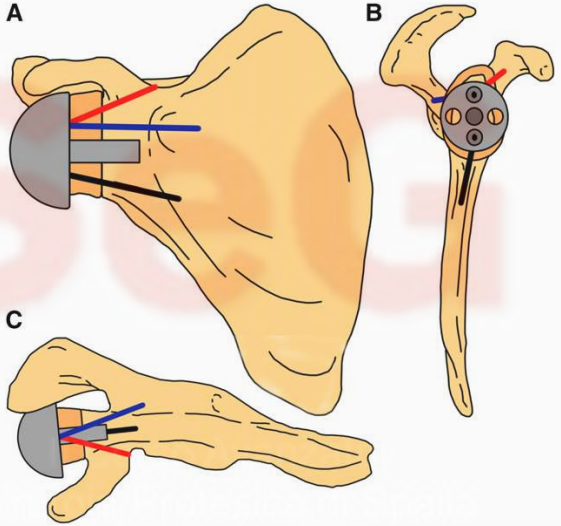




Walker M et al JSES 2012

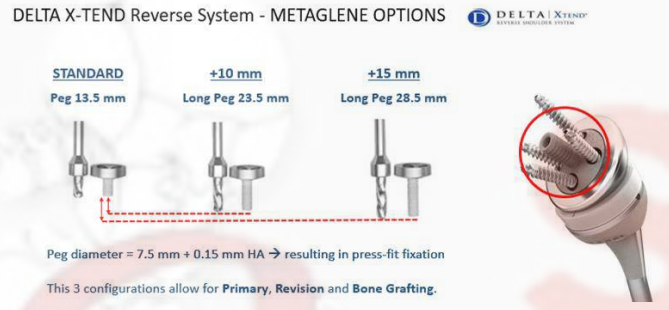
Autograft & Allograft (fresh frozen)



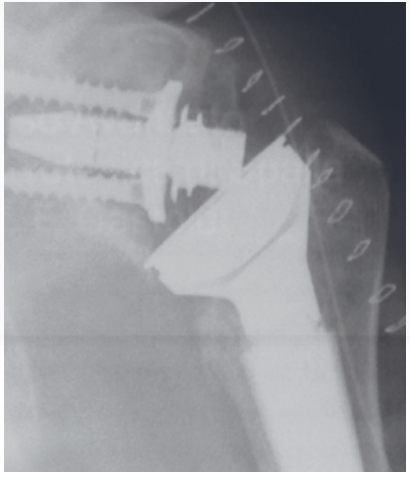


E Bateman, S M. Donald Reconstruction of massive uncontained glenoid defects using a combined autograft-allograft construct with reverse shoulder arthroplasty: preliminary results. J Shoulder Elbow Surg (2012) 21, 925-934

PEG lunghi



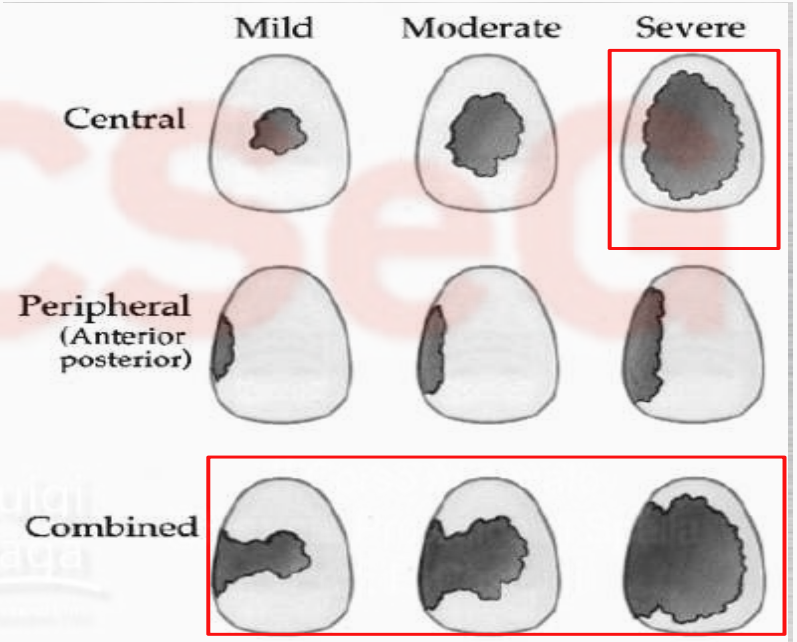
Exactech® Equinoxe®



Caso clinico: allograft + baseplate con peg +15

Classificazione di Antuna

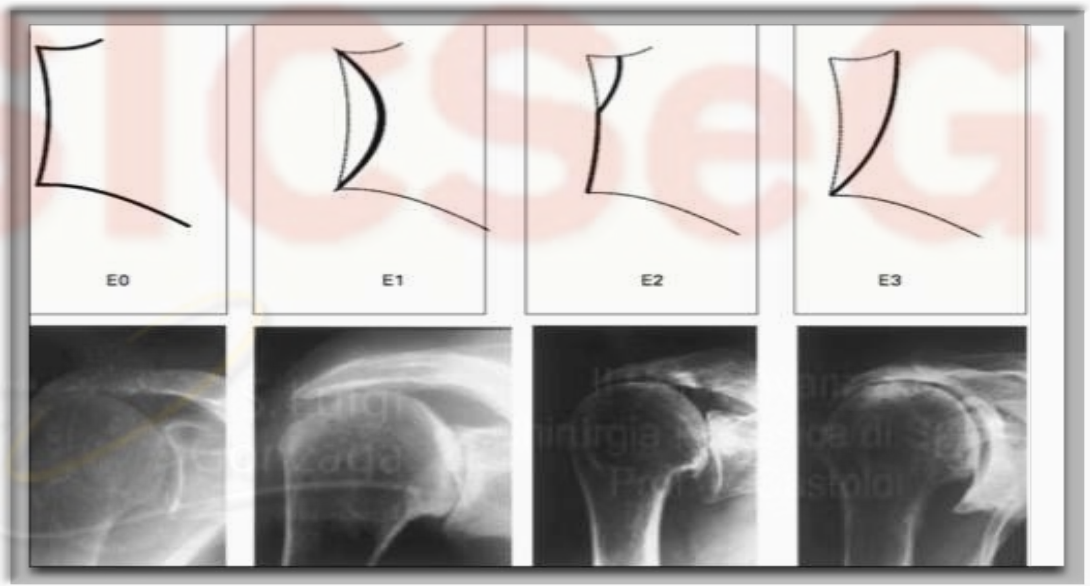
"..replacement with a new glenoid component is usually possible when central o peripheral bone deficiencies are limitated o moderate….
….cancellous bone auto-allograft was used in the majority of patients in this study. It is reliable enuogh to avoid the use of iliac crest bone graft. Filling of the central defects with impactation of the cancellous chips appears to be important…"



Antuna SA, Sperling JW, Cofield RH, Rowland CM. Glenoid revision surgery after total shoulder arthroplasty. J Shoulder Elbow Surg 2001;10:217—24.

Classificazione di Favard

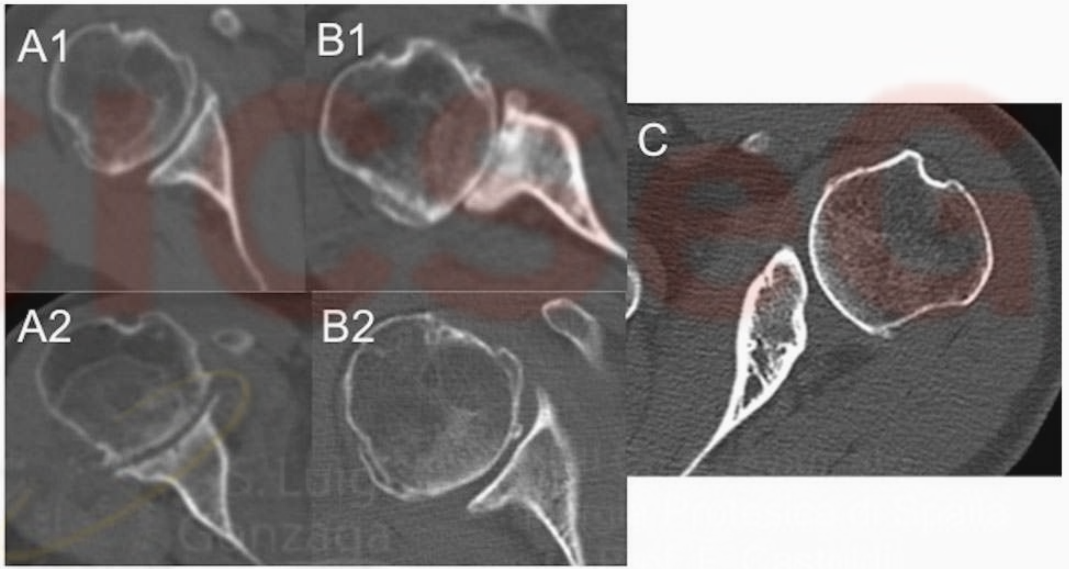
E0: Migrazione superiore
E1: Erosione concentrica
E2: Erosione superiore
E3: Supero-mediale



Lévigne C, Boileau P, Favard L, et al. Scapular notching in reverse shoulder arthroplasty. *J Shoulder Elbow Surg.* 2008; 17(6):925- 935.

Classificazione di Walch

A1 mild concentric glenoid wear
A2 marked concentric glenoid wear
B1 eccentric posterior glenoid erosion
B2 with a biconcave glenoid
C greater than 25 retroversion.



Walch G, Badet R, Boulahia A and Khoury A. Morphologic study of the glenoid in primary glenohumeral osteoarthritis. J Arthroplasty 1999; 14: 756–60.

Seebauer´s Classification of Glenoid Defects

(SECEC Rome 2005, AAOS Las Vegas 2009)

Difetto centrale

C1 Superficiale

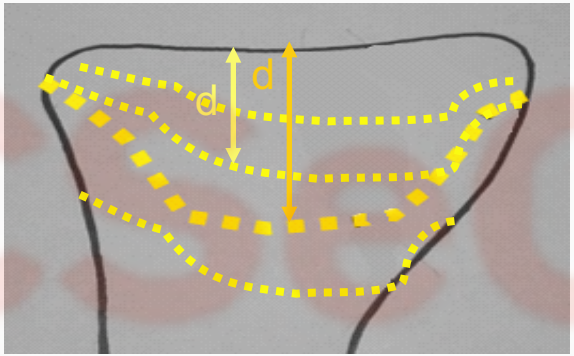
C2 Profondo (d>50% ap glena)

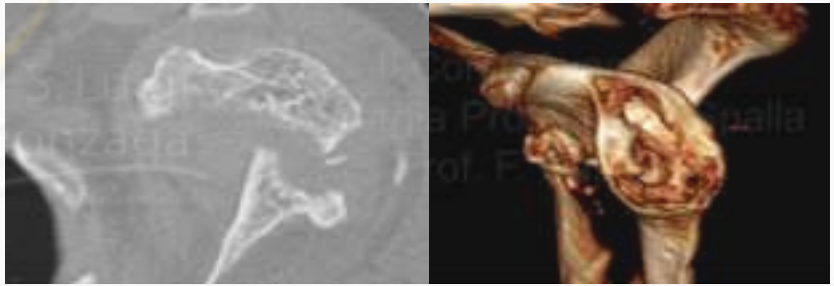
C3 Cavitario (d>50% AP glena)

C4 Erosione

Indicazione terapeutica indipendente

da eziologia e patomeccanica



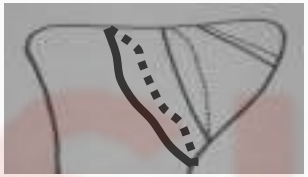


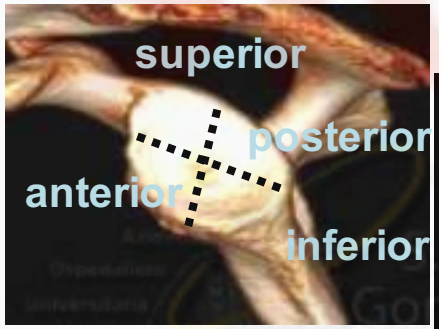
Seebauer‘s Classification of glenoid defects

(SECEC Rome 2005, AAOS Las Vegas 2009)

Difetto eccentrico:

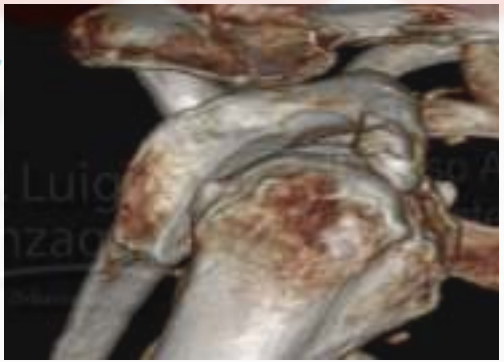
- Anteriore
- Posteriore
- Inferiore
- Superiore

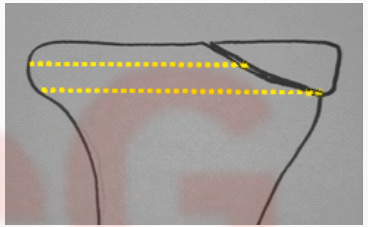


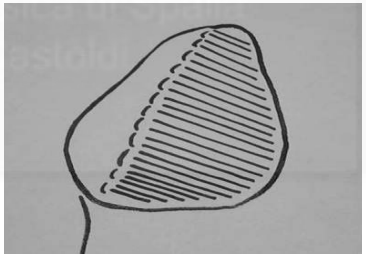


Combined defect

E2/C2







E1 piccolo

E2 medio (- 30%)

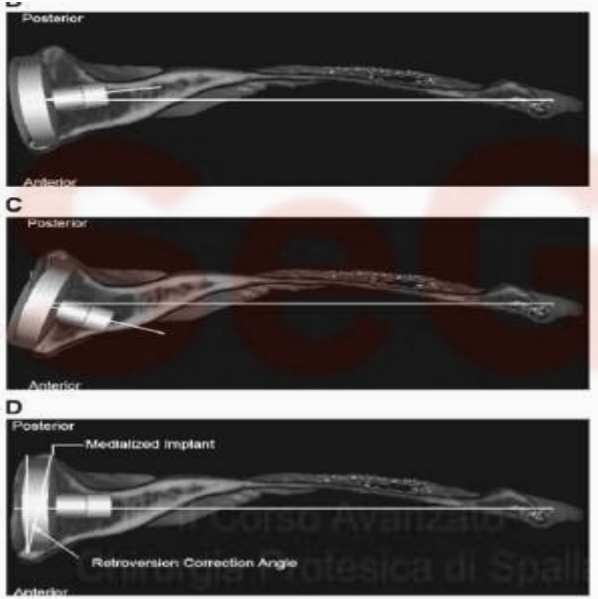
E3 ampio (30-60%)

E4 massivo (>60%)

Riming eccentrico

Fattori da considerare:

- Bone stock
- Supporto osseo subcondrale
- Perforazione peg



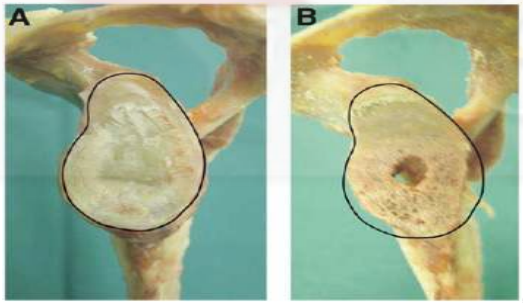
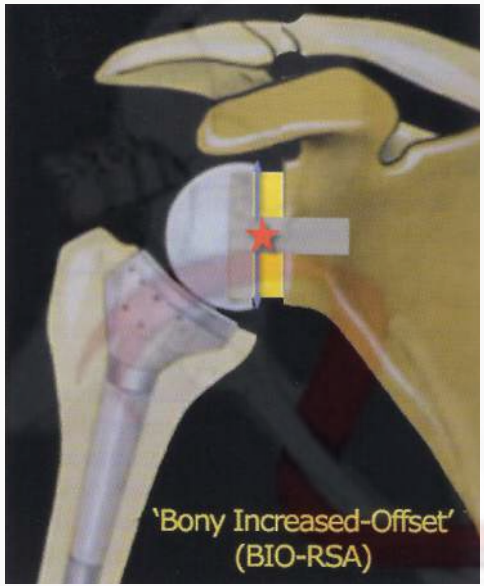
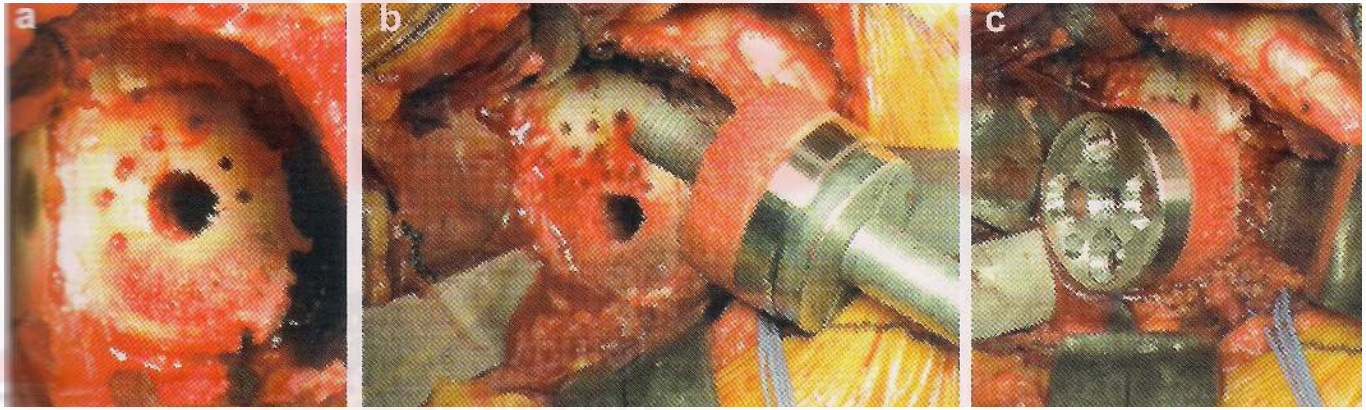


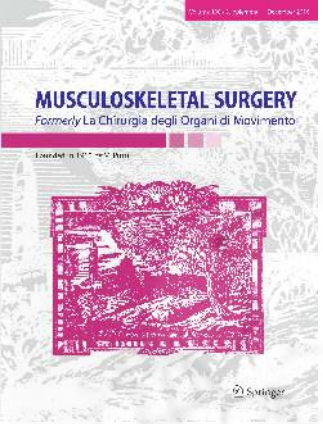
Figure 1 (A) Intact scapula, (B) the same scapula following initial reaming to flatten the glenoid, and (C) after an additional 5 mm of reaming.

BIO-RSA

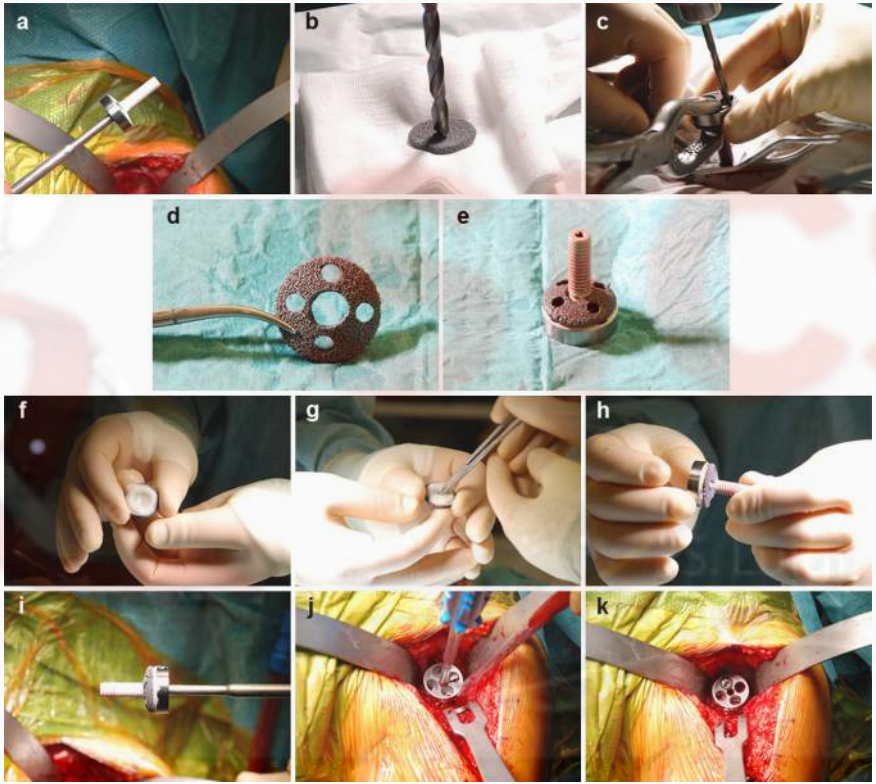


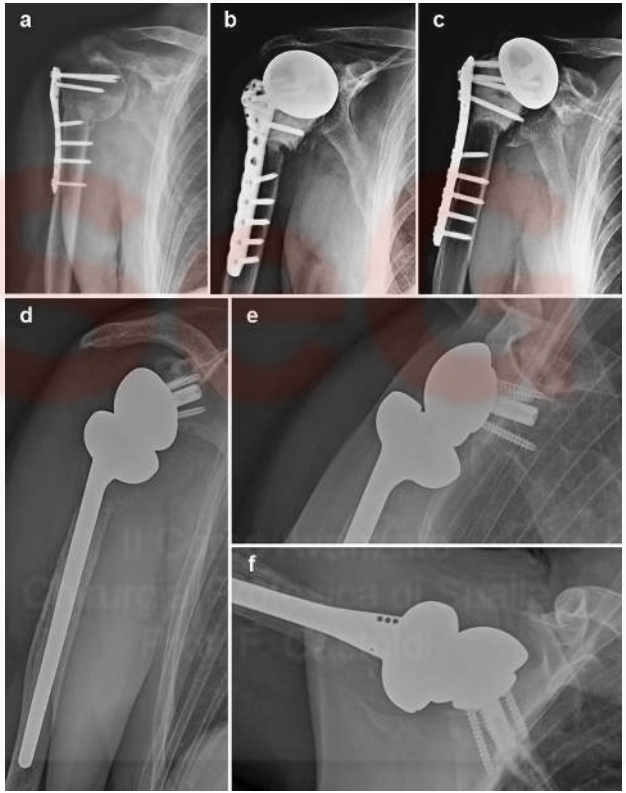


P.Boileau, G. Moineau, Y Roussanne, K. O'Shea Bony increased-offset reversed shoulder arthroplasty (BIO-RSA): the benefits of bony lateralization. Shoulder Concepts 2010. The glenoid. Sauramps medical-Nice Shoulder Course, 371-387.



Customized tantalum-augmented RSA



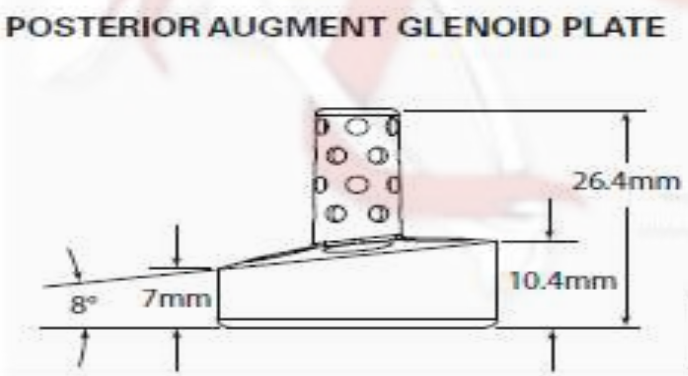


N. Ivaldo et al. Customized tantalum-augmented reverse shoulder arthroplasty for glenoid bone defect and excessive medialization: description of the technique. Musculoskelet Surg (2016) 100 (Suppl 1):S13–S18

Augmentation glenoideo

Correzione 8°

Augmentation anteriore o posteriore

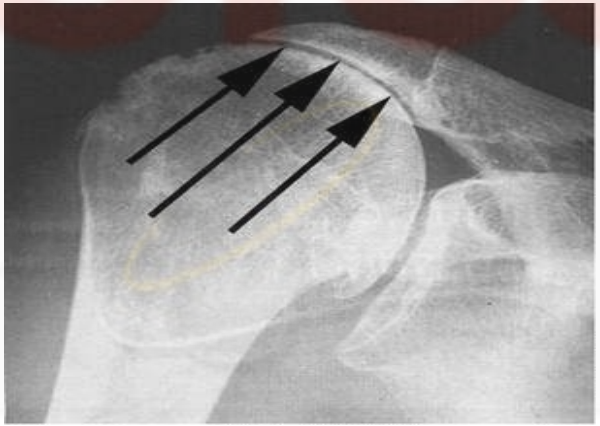


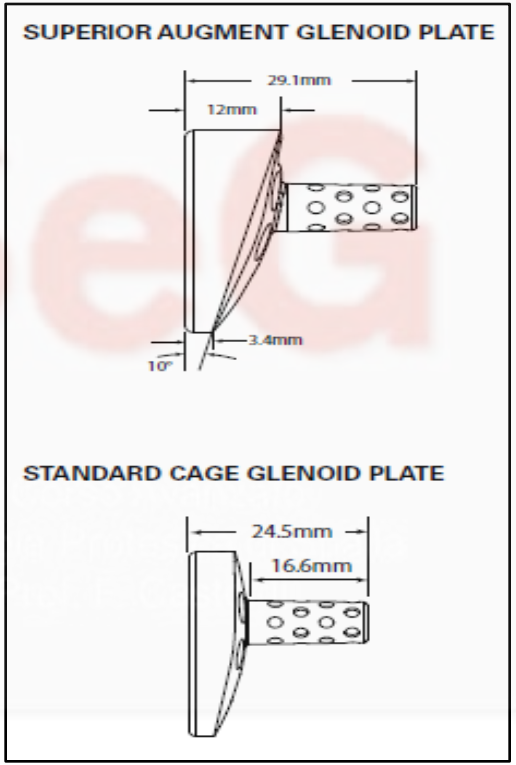
Augmentation glenoideo superiore

Correzione dell'inclinazione glenoidea

nei casi di usura superiore

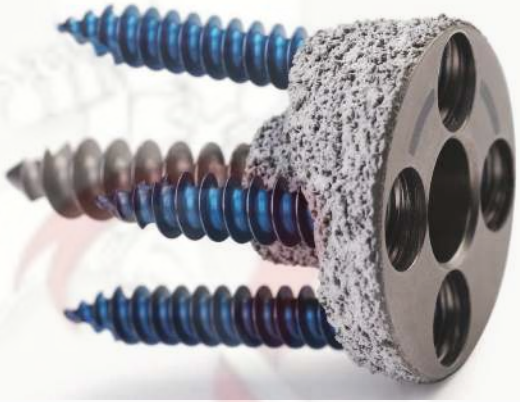
Evitare eccessivo reaming inferiore





Comprehensive® Reverse Shoulder System Augmented Baseplate

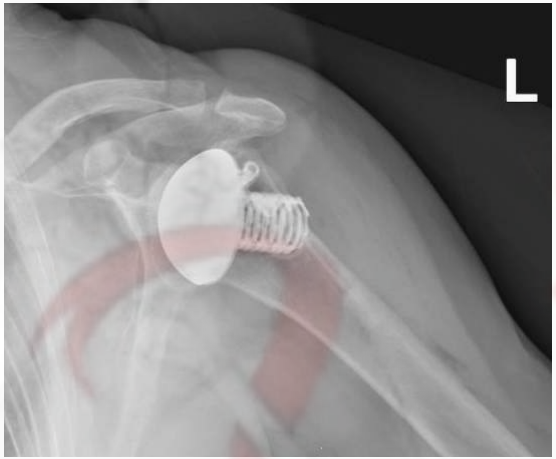
Surgical Technique Addendum

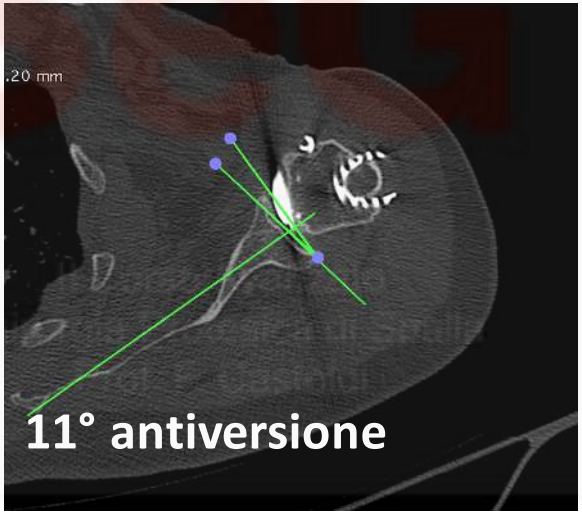


Augmentation glenoideo

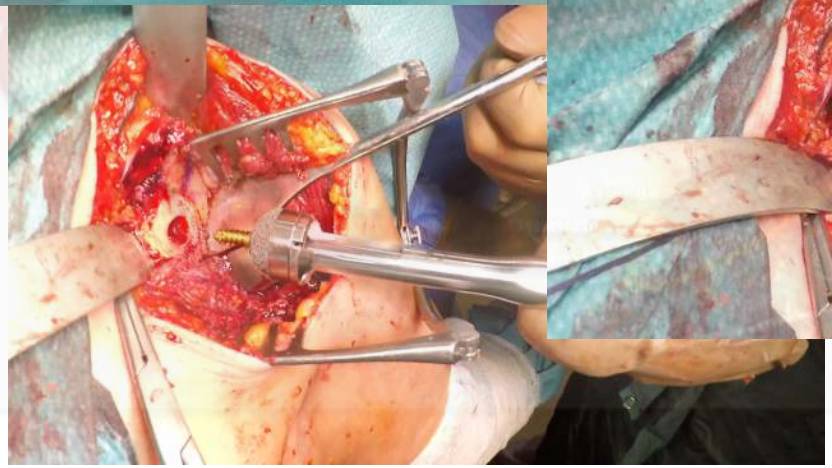
AEQUALIS™ PERFORM™ REVERSED Glenoid | AEQUALIS™ PERFORM™+ REVERSED Glenoid

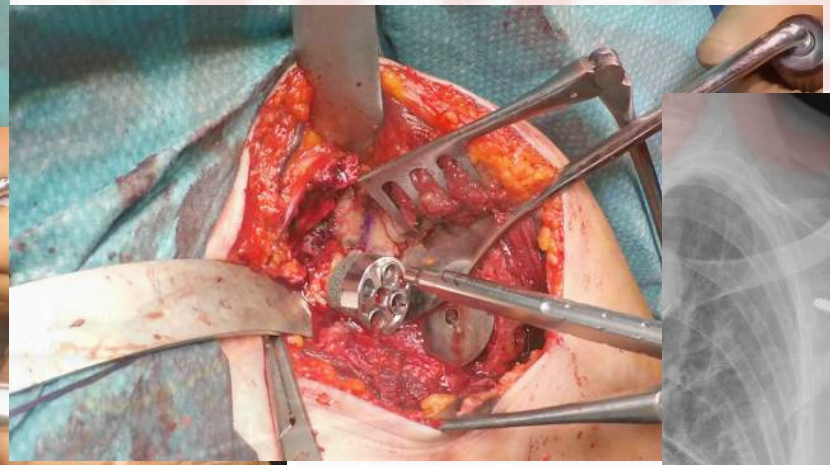
Caso Clinico

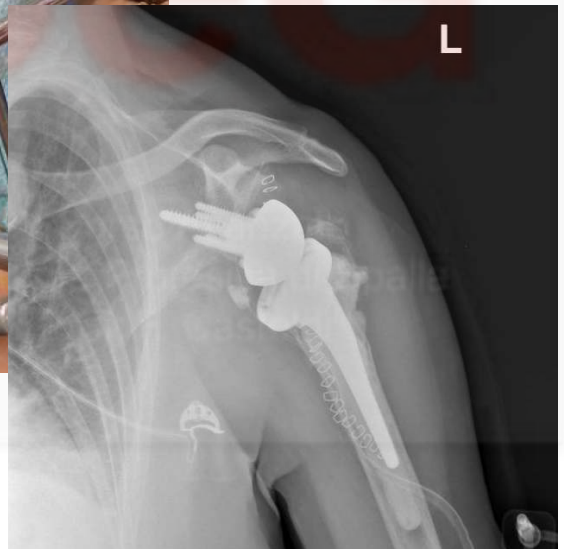




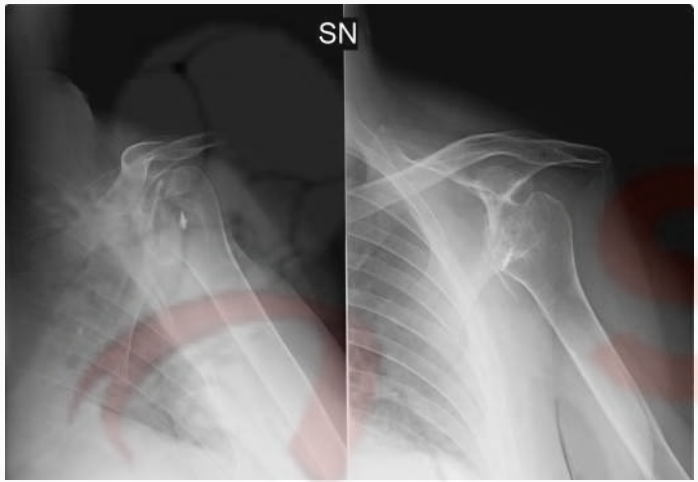
Caso Clinico

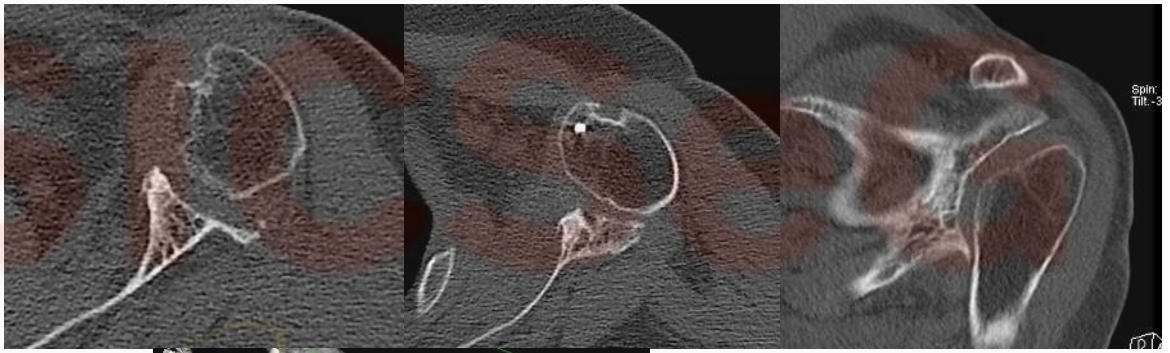


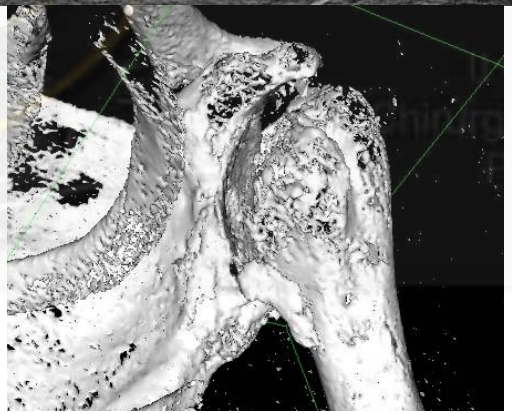




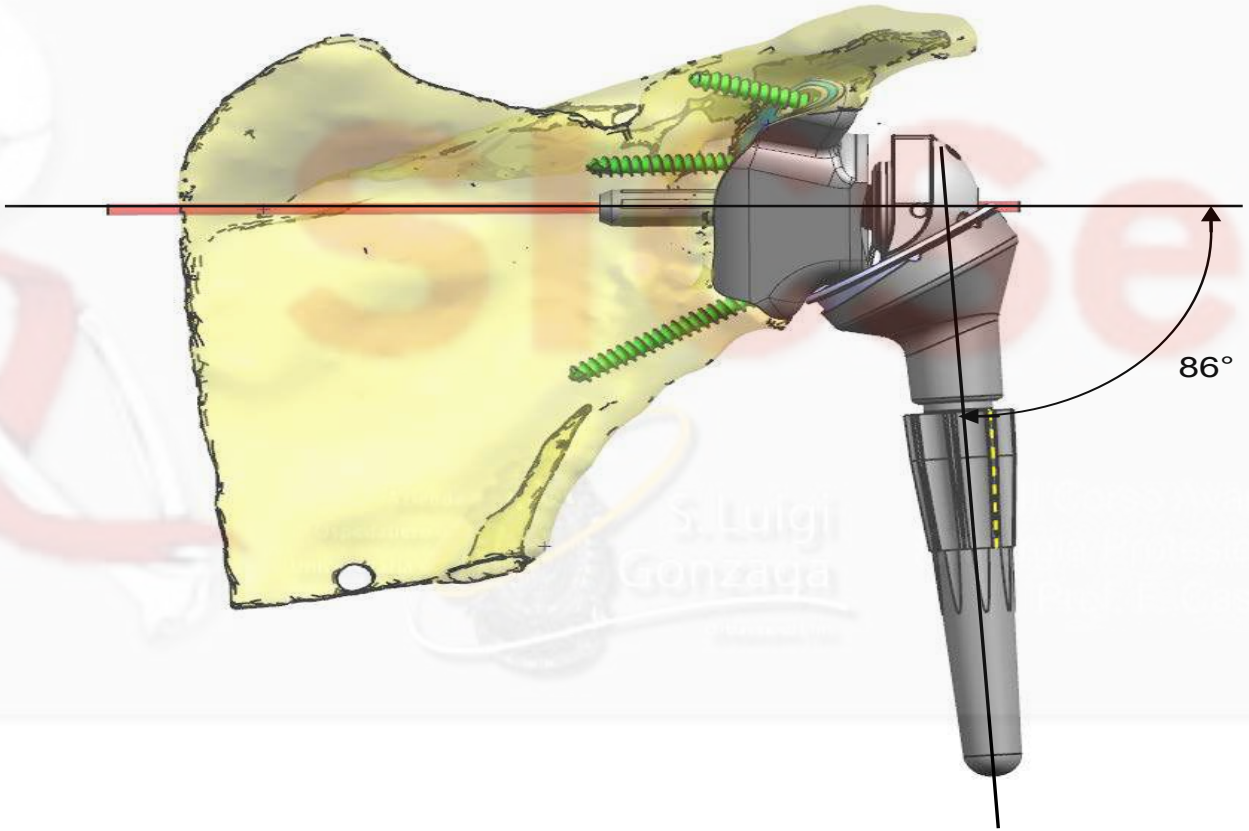
Custom-made metaglena



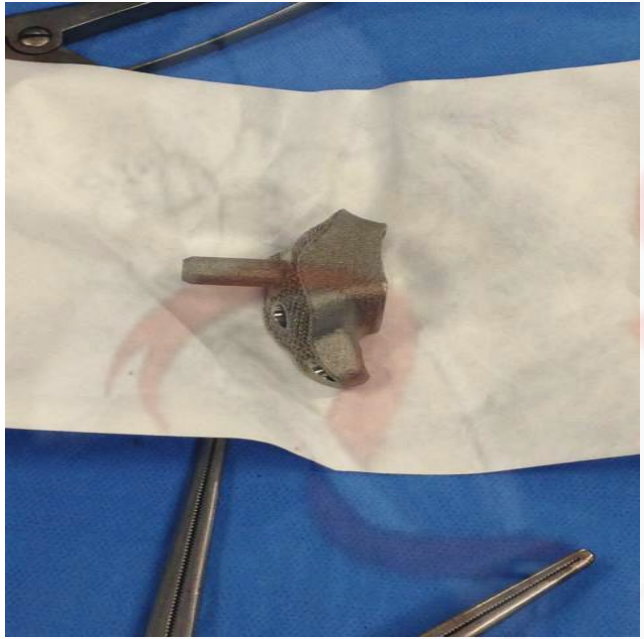


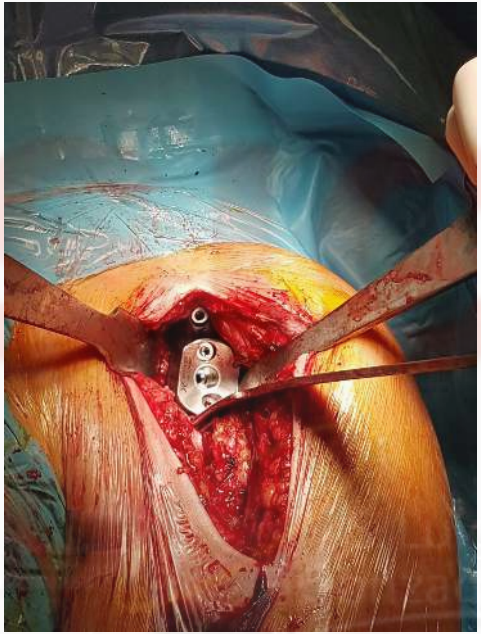


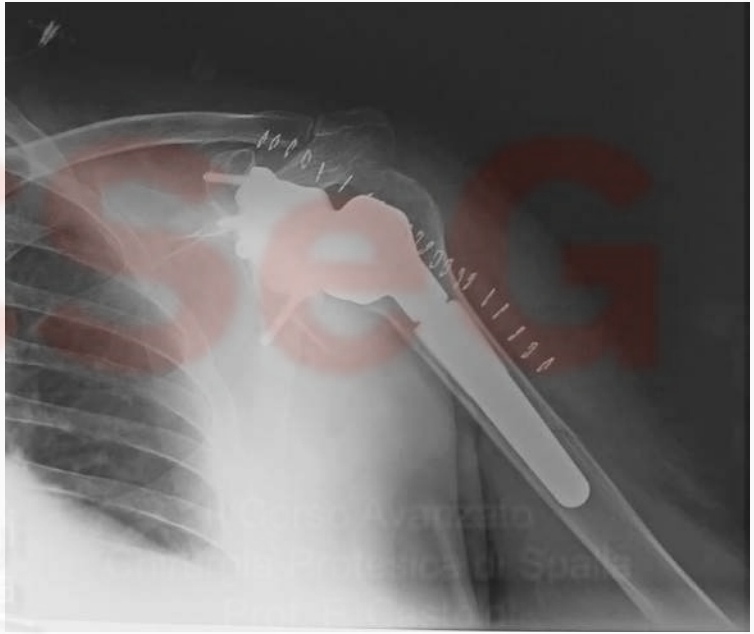
Custom made metaglena



Custom-made metaglena







Bone Grafting the Glenoid Versus Use of Augmented Glenoid Baseplates with Reverse Shoulder Arthroplasty.

Jones RB, Wright TW, Roche CP. Bull Hosp Jt Dis (2013)

RESULTS: all patients demonstrated significant improvements in pain, ROM, and functional scores.

- No complications for the augmented glenoid baseplate cohort
- 6 complications (14.6%) for the glenoid bone graft cohort

DISCUSSION:

- The results of this study suggest that either augmented glenoid baseplates or glenoid bone graft can be used to address large glenoid defects during rTSA with significant improvement in outcomes.
- Augmented glenoid baseplates may achieve a lower complication and scapular notching rate, but additional and longer-term clinical follow-up is required to confirm these results.

Pre-Op 3D Planning

TORNIER

BLUEPRINT™

3D Planning + PSI

Patient Specific Instrument

Pre-Op 3D Modelling

m3dics
tools for medicine

Computer Navigation Experience

Utilization of computers has brought widespread improvements in execution & process efficiencies to nearly every industry.

In mid 2000s, Praxim (CT based) and Kinamed (imageless) were the first to offer navigation in the shoulder…however, those systems were limited & cumbersome.

Computer navigation improves accuracy and precision of implant placement, which offers real potential for more predictable outcomes and the elimination of outliers.

J Shoulder Elbow Surg (2009) 18, 515-520

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Journal of Shoulder and Elbow Surgery

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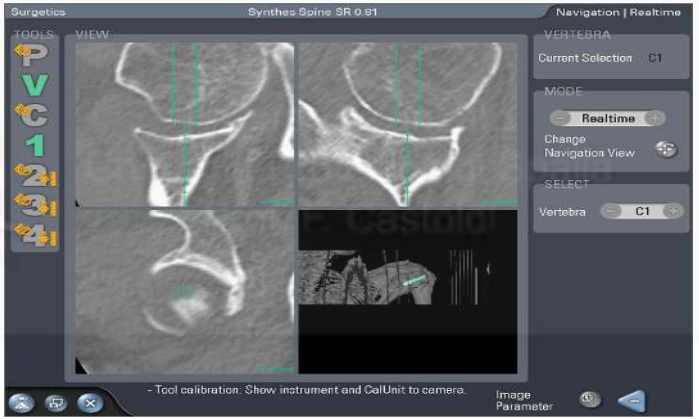
SHOULDER

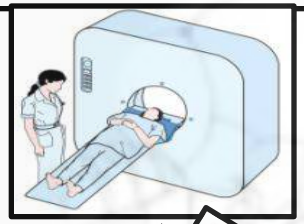
Improved accuracy of glenoid positioning in total shoulder arthroplasty with intraoperative navigation: A prospective-randomized clinical study

Jörn Kircher, MD*, Markus Wiedemann, MD, Petra Magosch, MD, Sven Lichtenberg, MD, Peter Habermeyer, MD

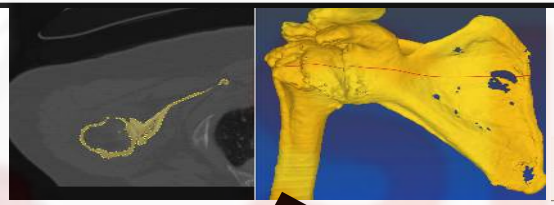


ExactechGPS Shoulder Navigation Workflow

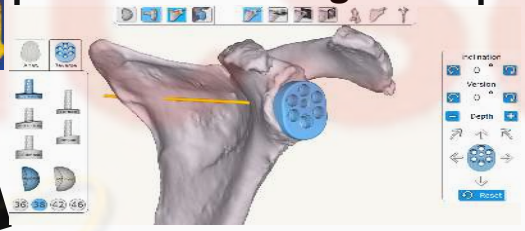
1. CT data collection (1mm)



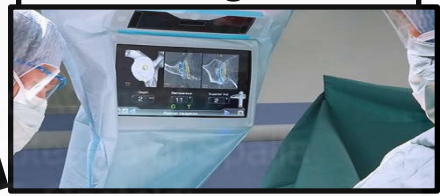
2. CT Segmentation → Blue Ortho



3. Planning

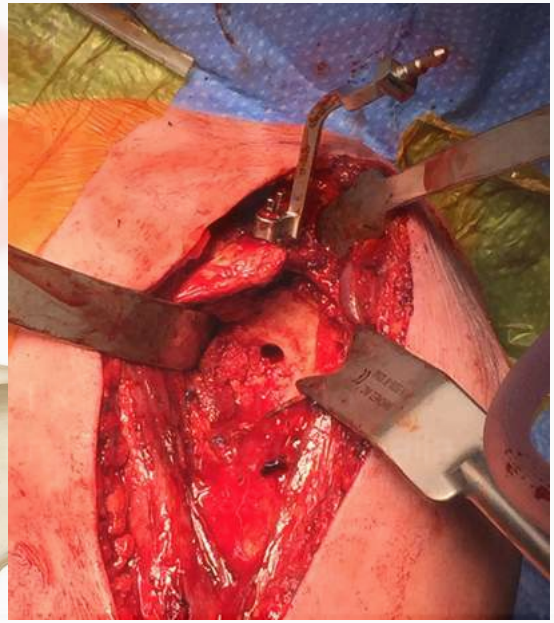


4. Navigation



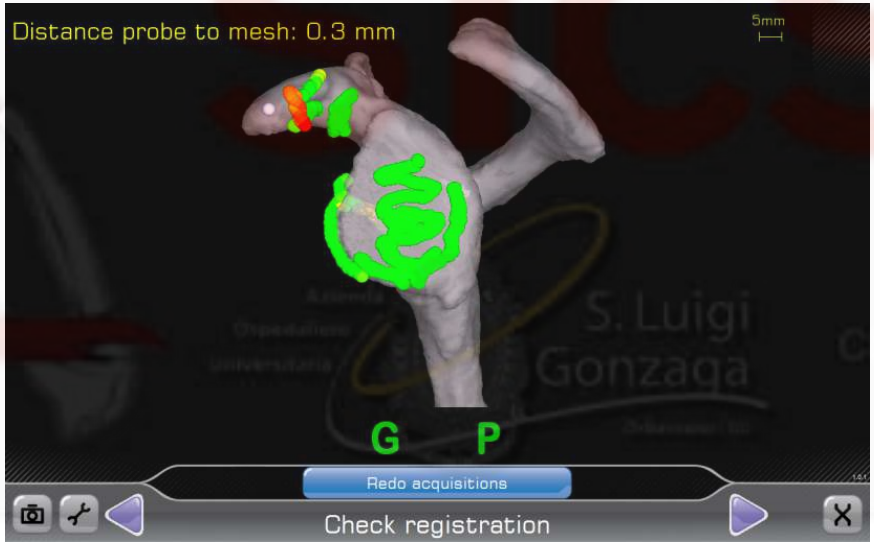
ExactechGPS Shoulder

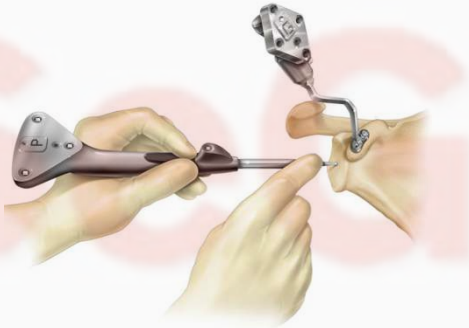
•Tracker placed on coracoid with a block, via a slightly longer incision.

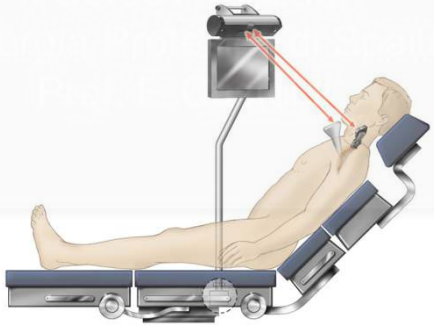


ExactechGPS Shoulder

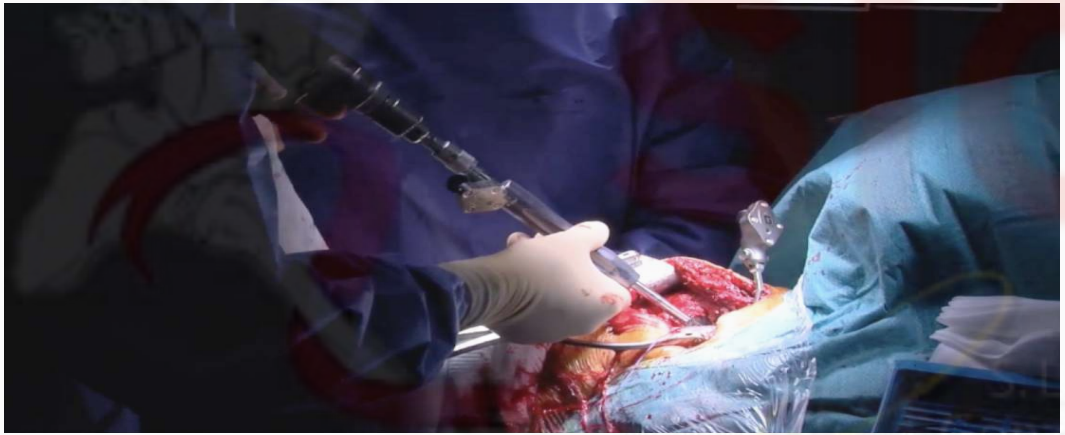
- Acquisition of anatomic landmarks registers the CT scan and plan to the patients anatomy.
- Registration is simple & takes ~2 minutes.

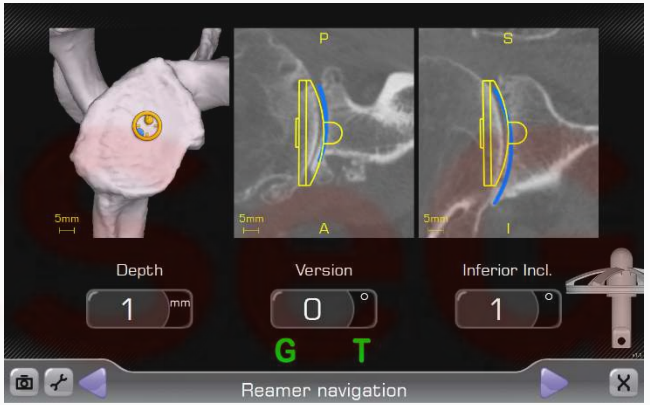


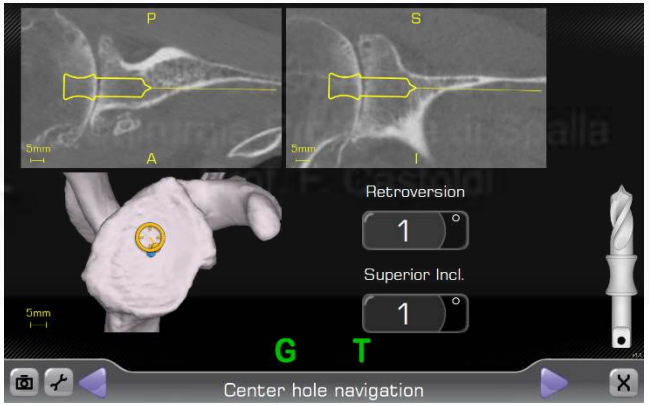


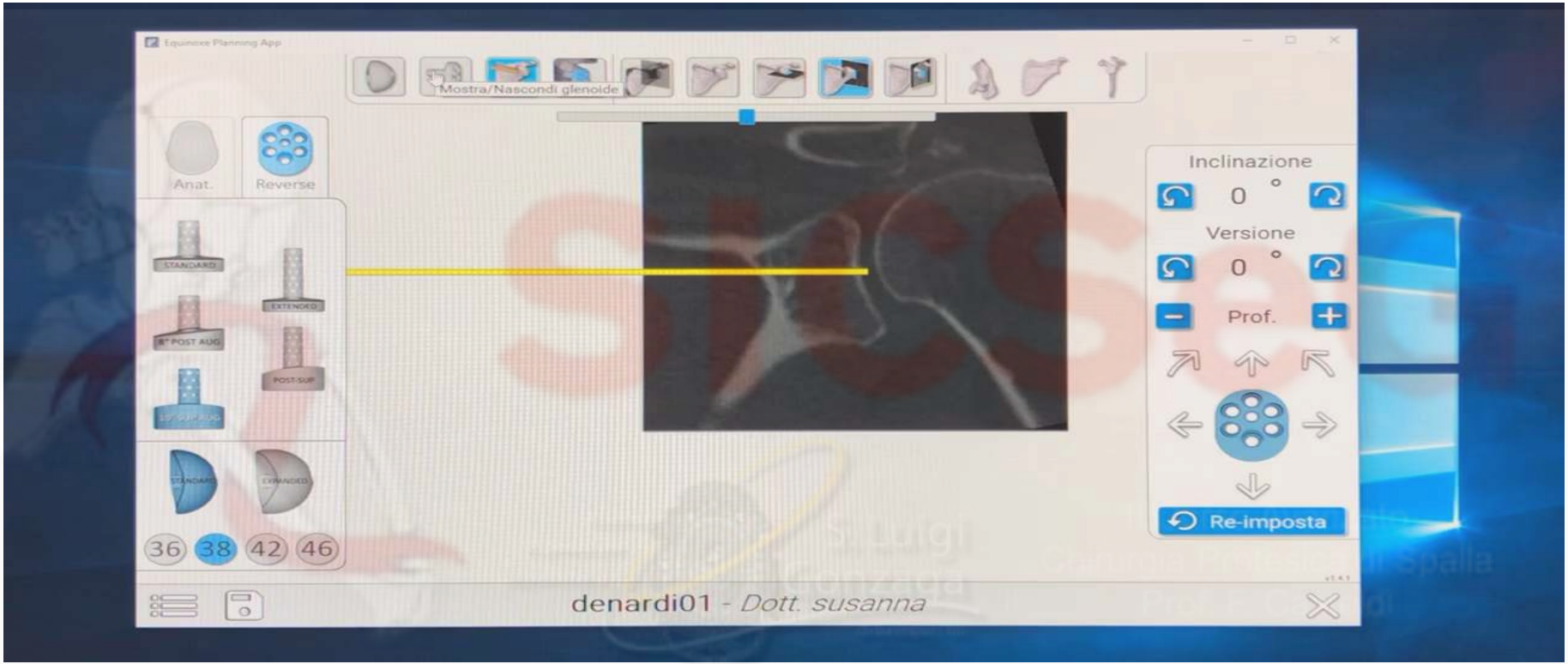


Exactech GPS Shoulder

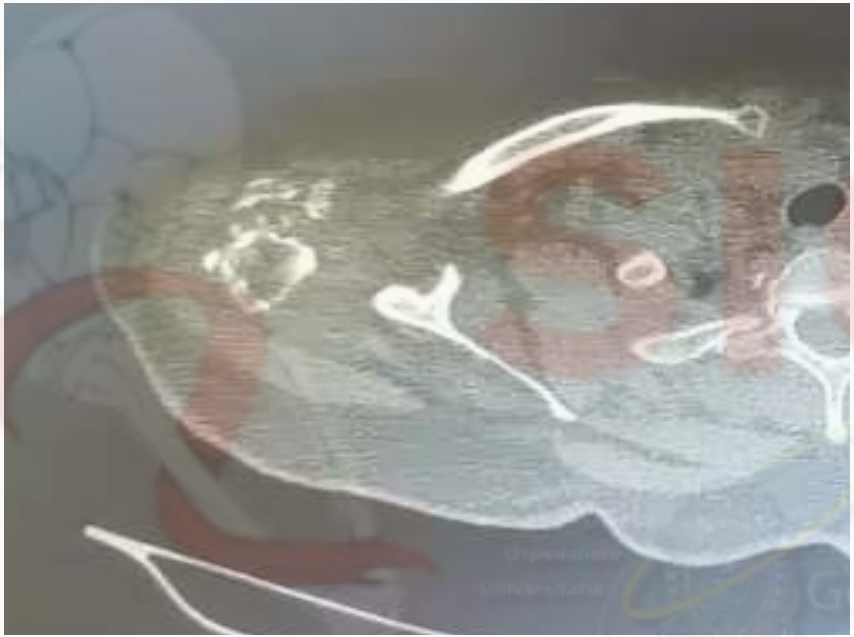


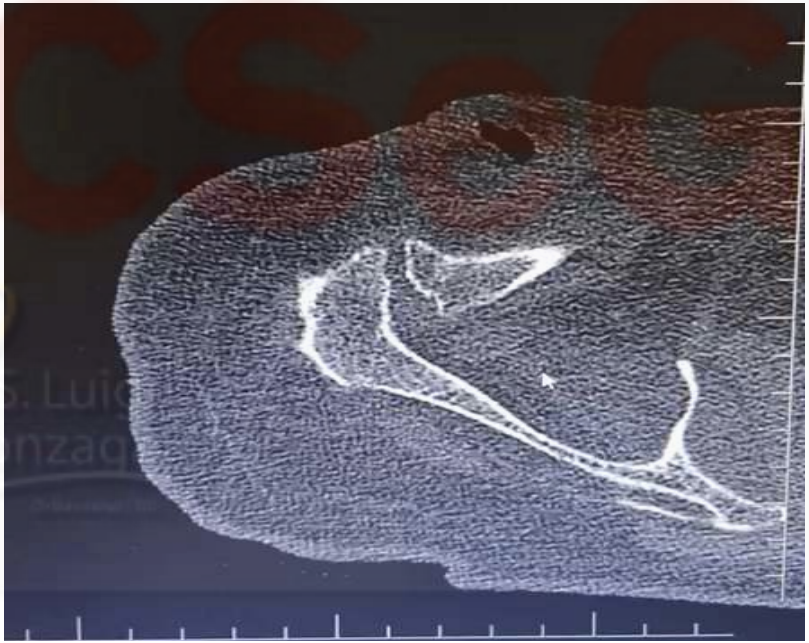





Equinoxe Planning App
Mostra/Nascondi glenoide
Anat.
Reverse
STANDARD
EXTENDED
8° POST AUG
POST-SUP
STANDARD
EXPANDED
36
38
42
46
Inclinazione
0
Versione
0
Prof.
Re-imposta
denardi01 - Dott. susanna

Caso Clinico





Courtesy A. Di Giunta

Conclusioni

- Oggi abbiamo a disposizione moltissimi modelli protesici, che, se pur simili, vanno studiati attentamente nelle loro caratteristiche peculiari, prima di avventurarsi in sala operatoria.

- Lo sviluppo recente più significativo riguarda le augmented baseplate per la correzione dei difetti ossei più o meno gravi. In questo campo lo sviluppo e la diffusione delle glene custom made sarà sempre più importante per la risoluzione di casi complessi, altrimenti difficilmente risolvibili.

- L'accurato studio del paziente rappresenta e rappresenterà sempre più la maggiore discriminante per il successo della nostra chirurgia. In questo ambito la navigazione potrebbe dare un ulteriore aiuto per migliorare i nostri risultati.

Grazie per l’attenzione

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