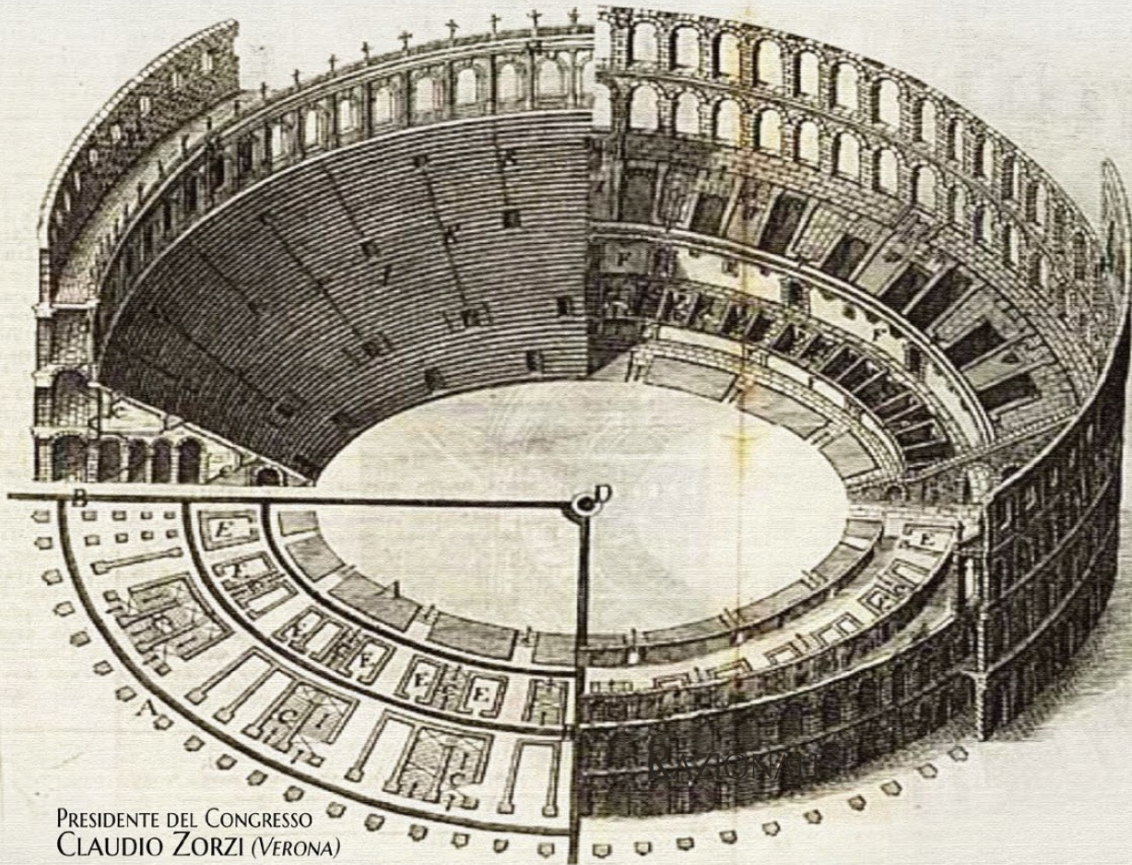


RIPROTESIZZAZIONE
IX CONGRESSO NAZIONALE
IL RECUPERO DELLE GEOMETRIE ARTICOLARI
NELLE REVISIONI PROTESICHE
VERONA | GRAN GUARDIA | 7-8 MARZO 2024



PRESIDENTE DEL CONGRESSO
CLAUDIO ZORZI (VERONA)

«Navigazione e PSI: nella revisione protesica»

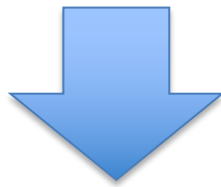
Dott. Andrea Lisai

Humanitas San Pio X

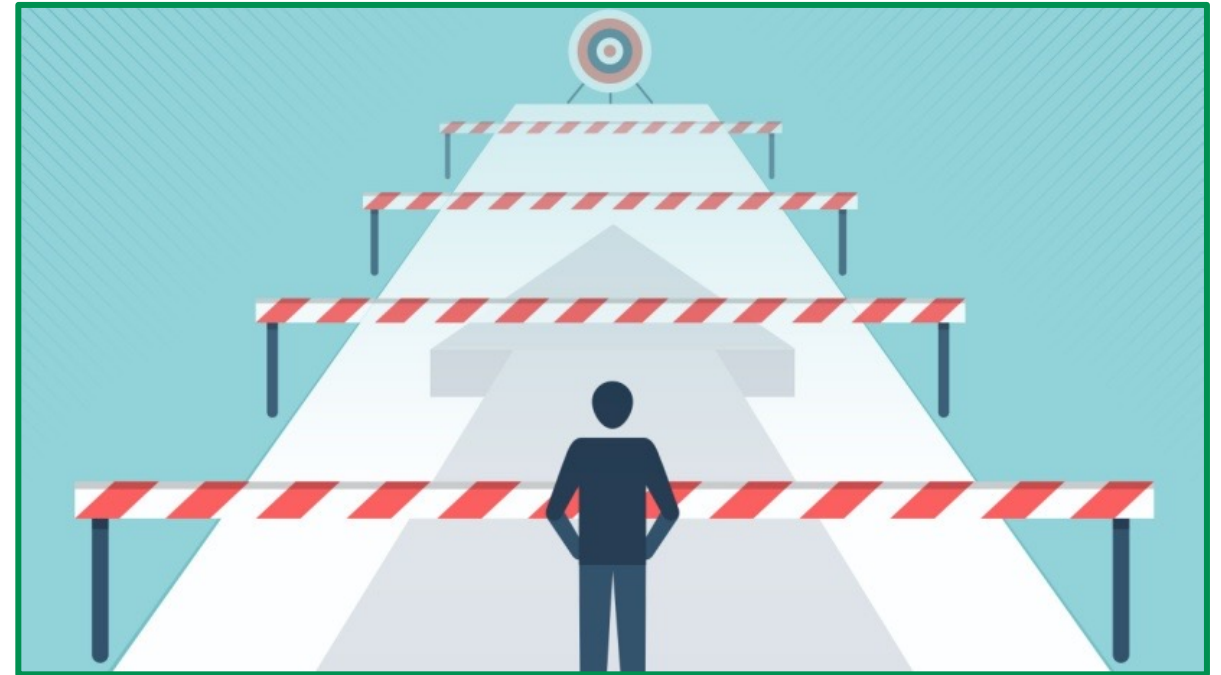
Milano

Revisione protesica = SFIDA

- Anatomia alterata:
 - Bone loss
 - Alterata tensione dei tessuti molli



- Malposizionamento
- Fissazione inadeguata



REVISIONE

Posizionamento
IDEALE
dell'impianto

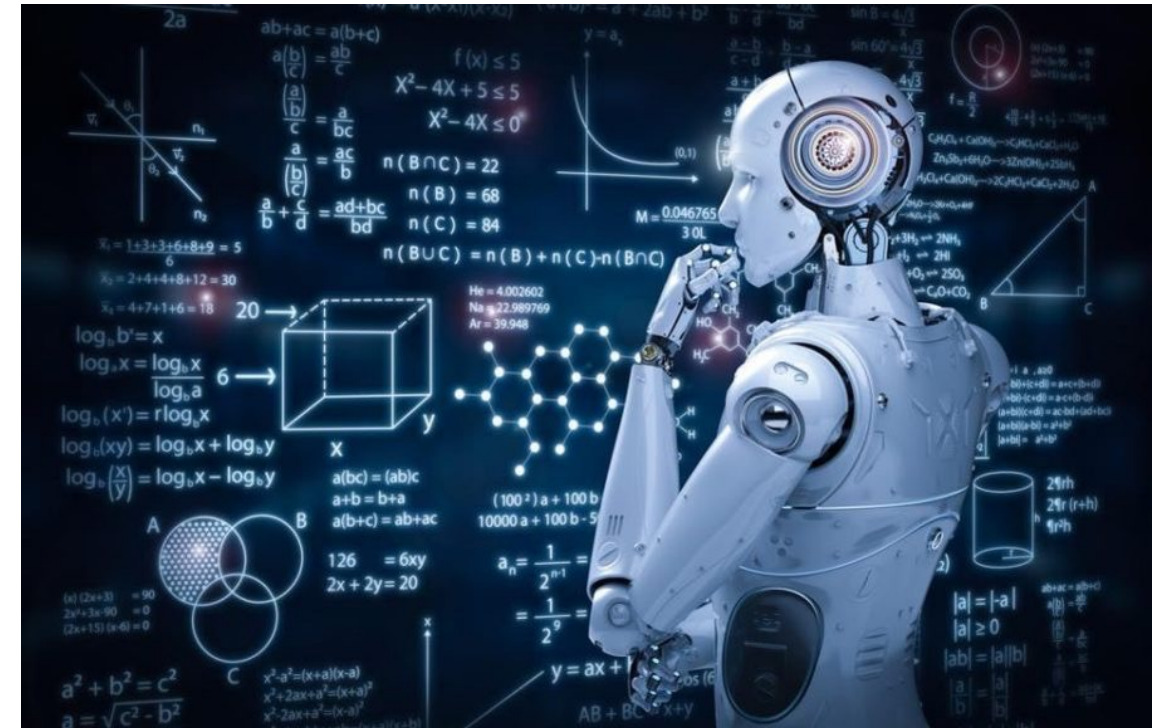


Posizionamento
OTTIMALE
dell'impianto



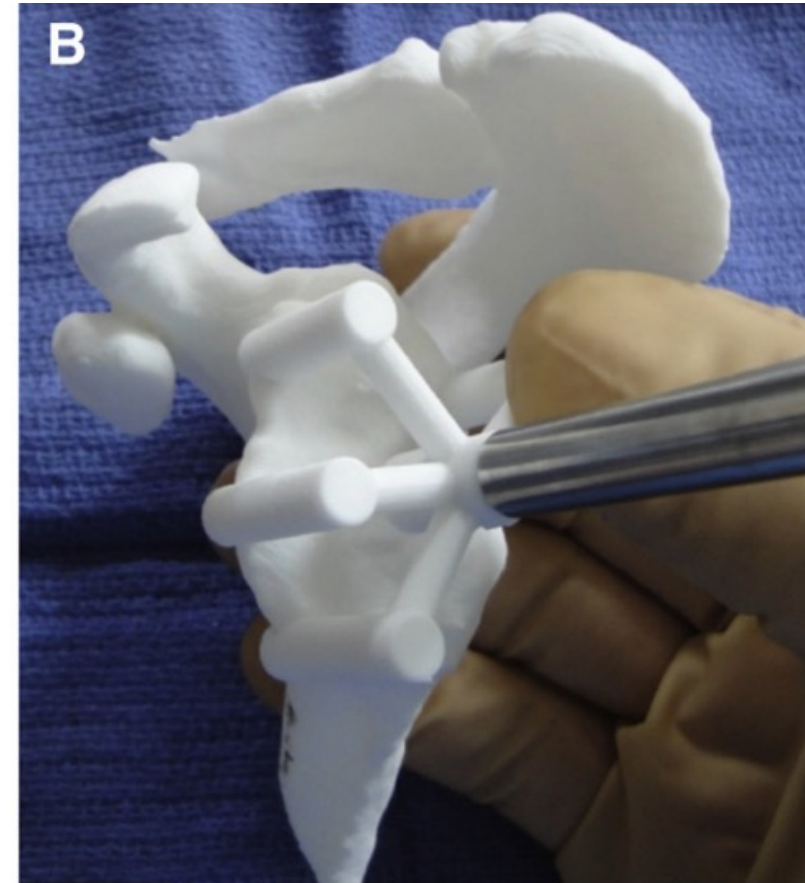
Nuove tecnologie

- Planning 3D
- Guide PSI
- Impianti PSI (componente glenoidea customizzata)
- Navigazione
- Realtà aumentata/Realtà mista/Realtà virtuale



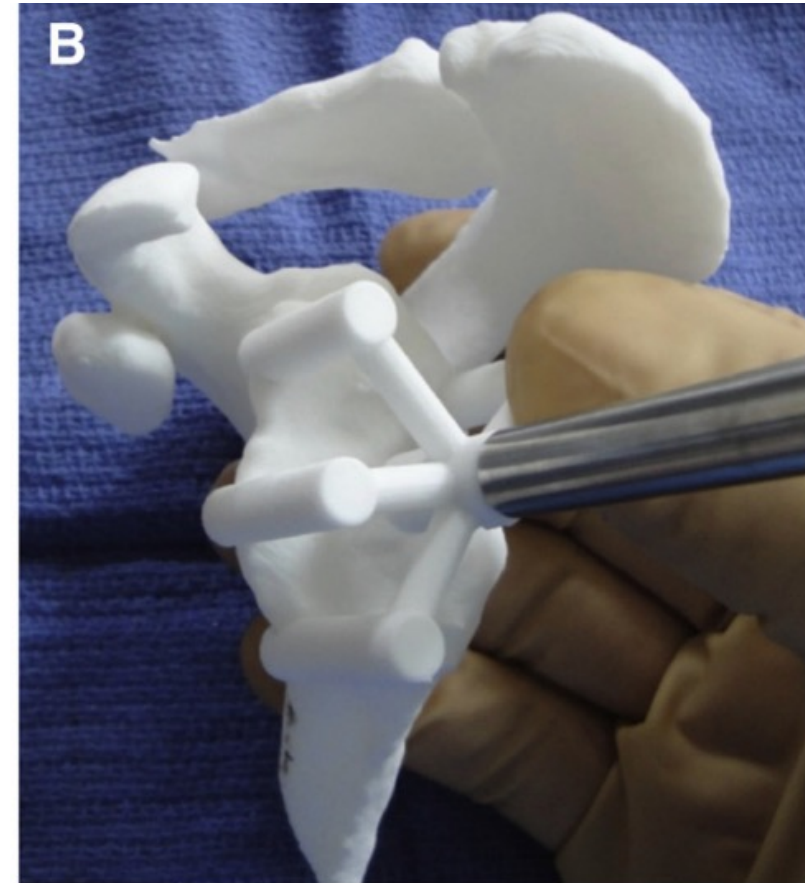
PSI: patient-specific instrumentation

- Guide customizzate create sulla base del planning 3D
- Facilita il posizionamento del filo guida → la baseplate
- Adattate alla superficie glenoidea per guidare il posizionamento del filo guida:
 - Punto ingresso
 - Versione
 - Inclinazione



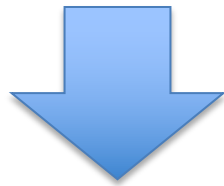
PSI: patient-specific instrumentation

- PRO:
 - Trasferisce il planning 3D pre-op nella realtà chirurgica
- LIMITI (legati al planning):
 - Artefatti metallici dovuti alla protesi in sede possono rendere inaccurato il planning
 - Non è prevedibile il bone loss residuo dopo la rimozione dell'impianto

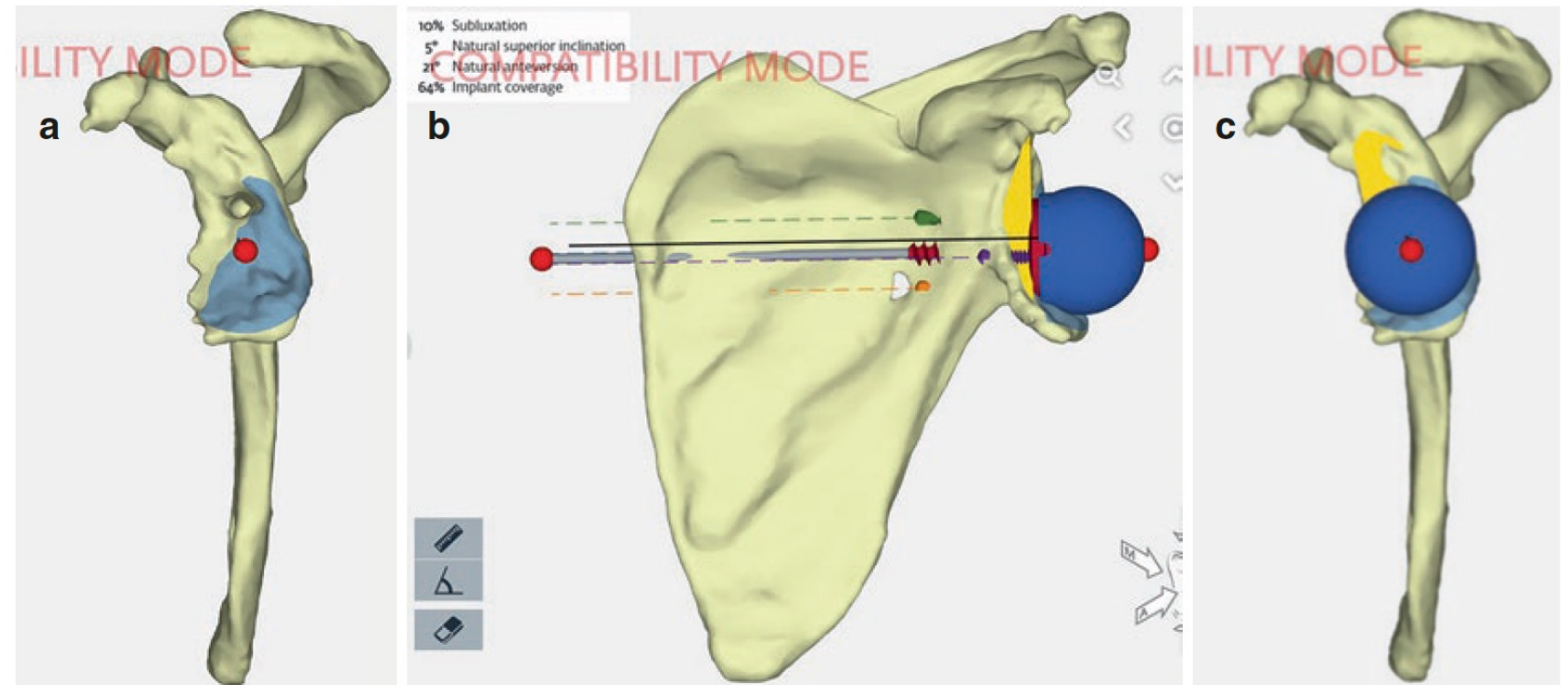


PSI: patient-specific instrumentation

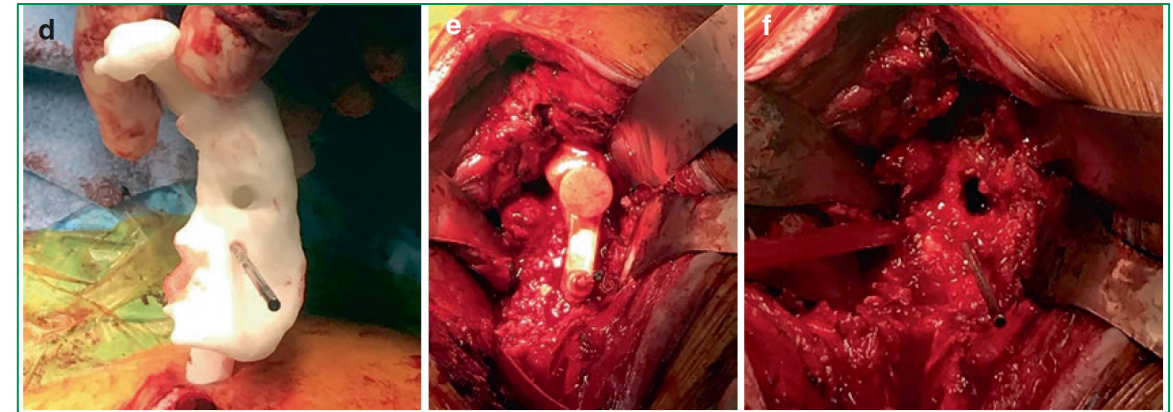
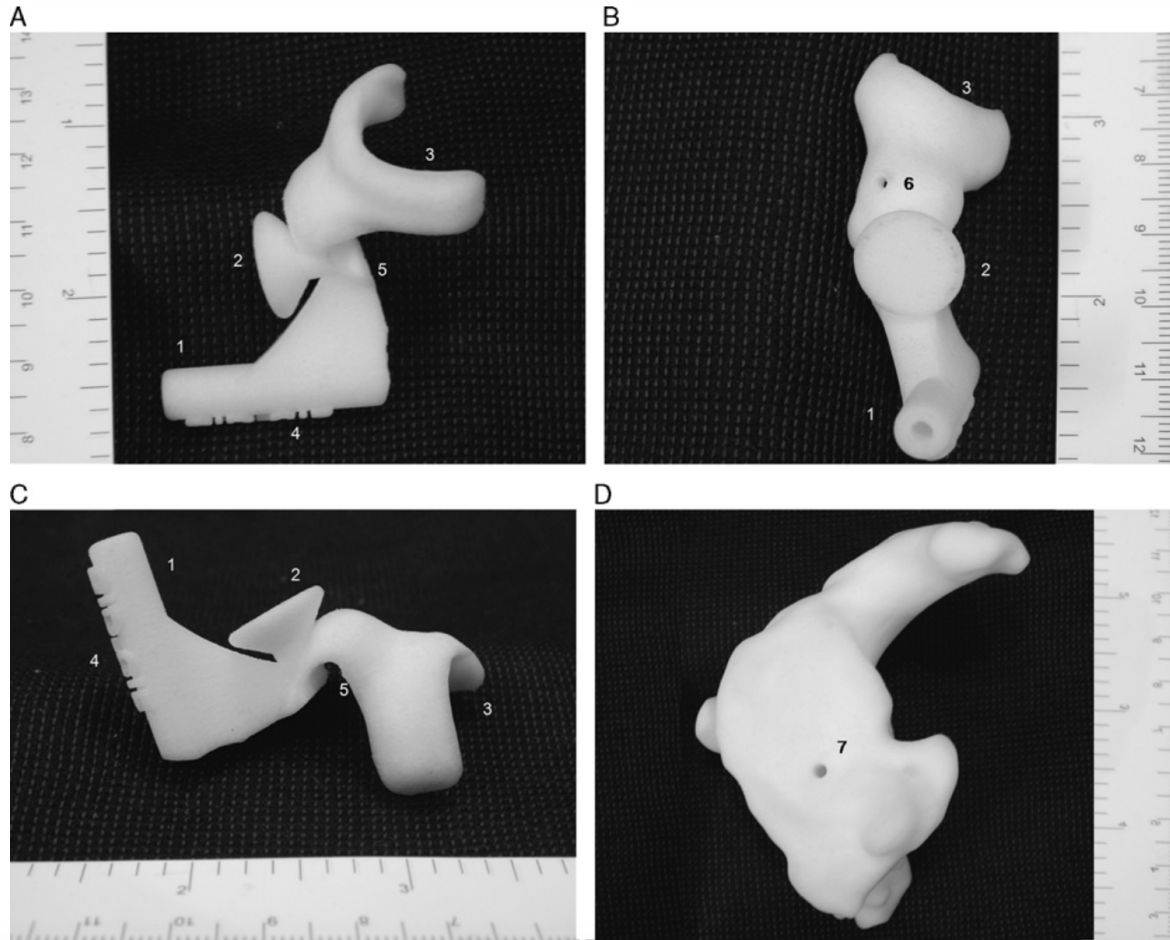
Caso ideale:



2° stage di una
revisione protesica
(componente
glenoidea già
rimossa)



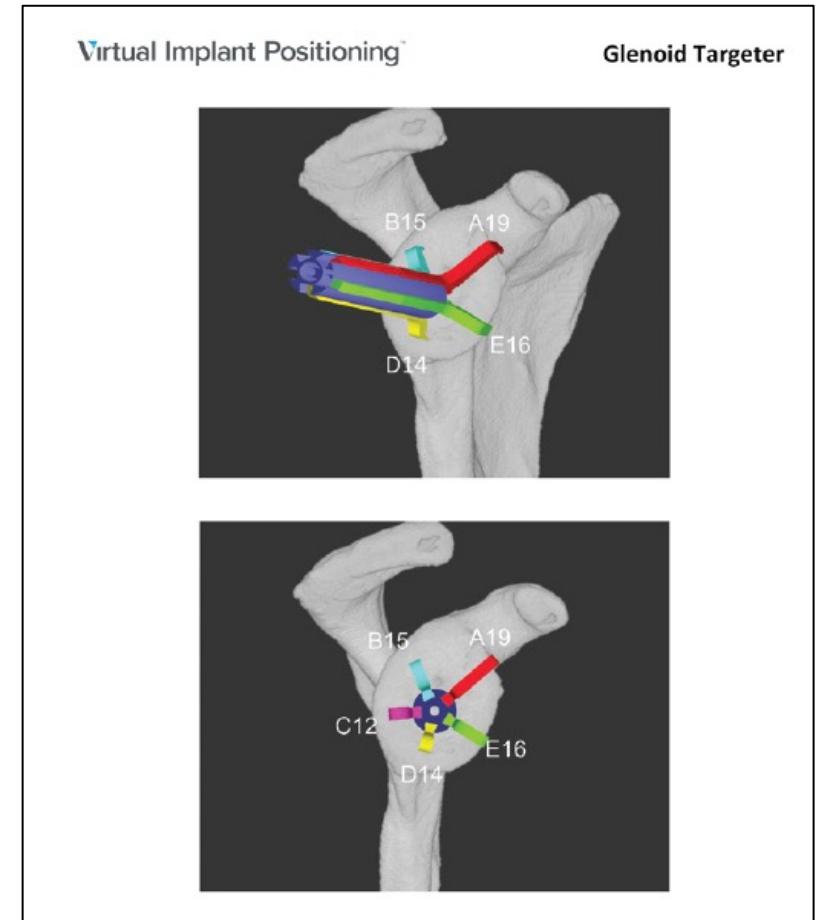
PSI «SINGLE USE»




LIMITI:


- Costi
- Tempi di spedizione


PSI «REUSABLE»




Istruzioni di assemblaggio <48h



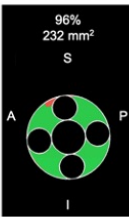




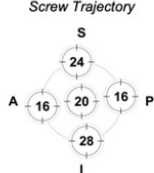
Preoperative Plan and Glenoid Targeter Instructions	
Patient	CLCH01021940
MRN	CLCH01021940
Surgeon	Dr. Dirk Petre
Customer Order Number	12-22-06-0236
Procedure / Side	RSA / Left
Date of Surgery	2022-Jun-09
Native Version (deg)	-5.6
Native Inclination (deg)	11.6
Implant	Arthrex MGS BP
Implant Size	24mm \varnothing , 20mm Screw
Augment	None
Glenosphere or Inlay	33mm \varnothing Lateralized
Implant Version (deg)	-3
Implant Inclination (deg)	0
Implant Roll (deg)	97
Humeral Head Size (mm)	46.0
Backside Seating (%/mm ²)	96% / 232mm ²
Max Depth/Max Gap (mm)	-8mm / <0.5mm
Planning Engineer	VIP_Support@Arthrex.com
Expiration Date	2022-Nov-23
Comments	Perforated implant to maximize backside seating - Arthrex



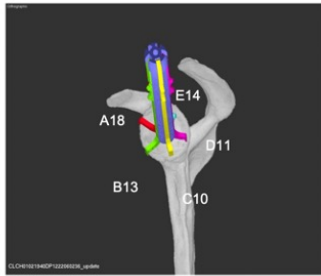
Glenoid Targeter



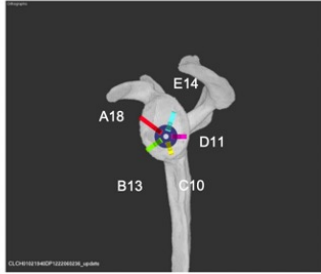
Backside Seating



Screw Trajectory



Slot	Targeter Leg Length (mm)	Glenoid Calibrator/GTII Height Settings
A	18 mm	X - 29 Anterior Overhang
B	13 mm	X - 33 Anterior Overhang
C	10 mm	Z - 43 On Surface
D	11 mm	W - 36 On Surface
E	14 mm	W - 32 On Surface



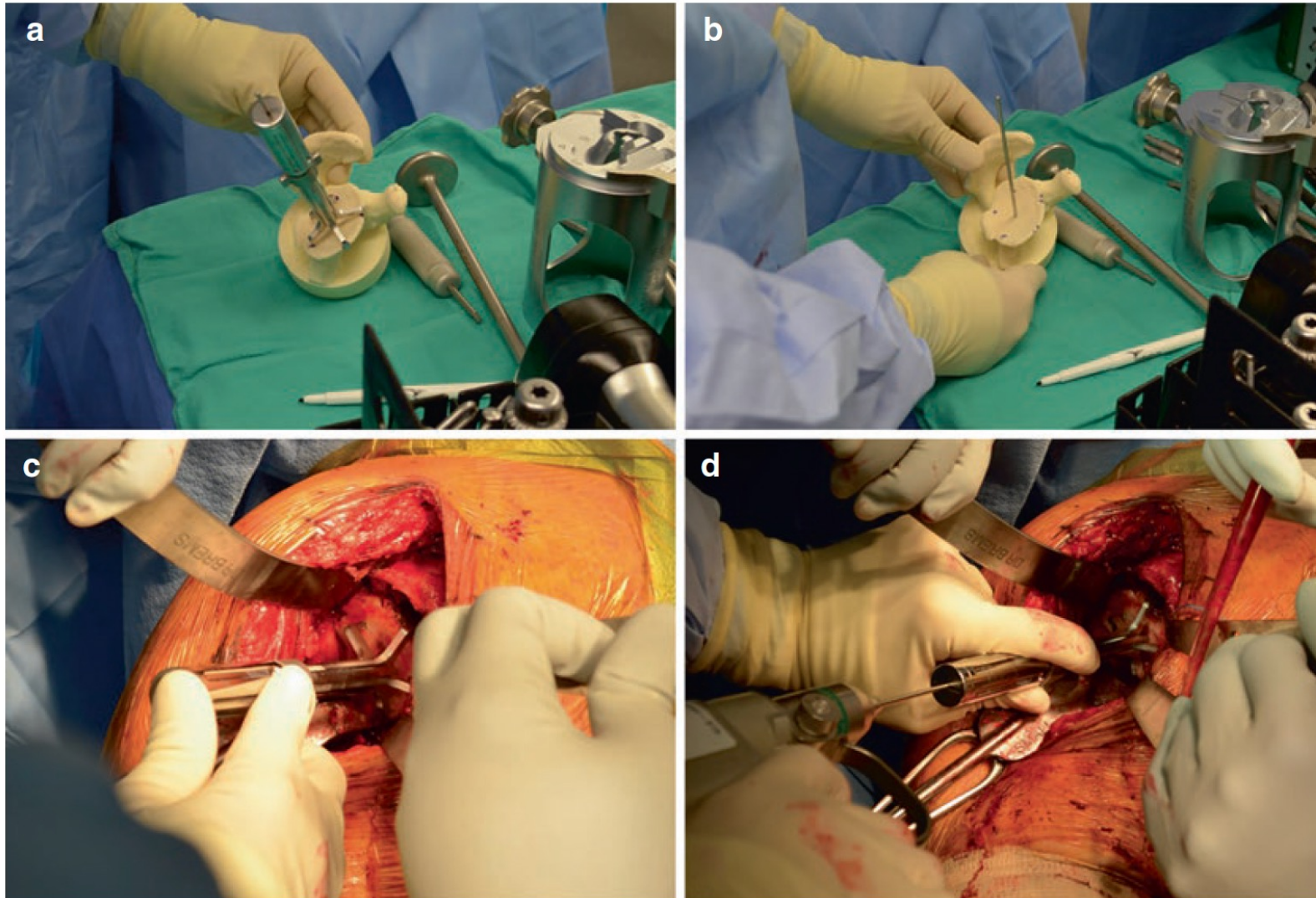
Order Number: 12-22-06-0236
Page 1 of 5

This document is confidential and proprietary and it may not be reproduced, used, or disclosed to others without written consent of Arthrex, Inc. This report has been validated and verified for use.

Order Number: 12-22-06-0236
Page 2 of 5

This document is confidential and proprietary and it may not be reproduced, used, or disclosed to others without written consent of Arthrex, Inc. This report has been validated and verified for use.





PSI «REUSABLE»

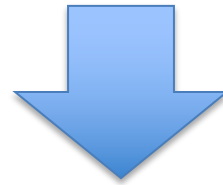



Vantaggi:

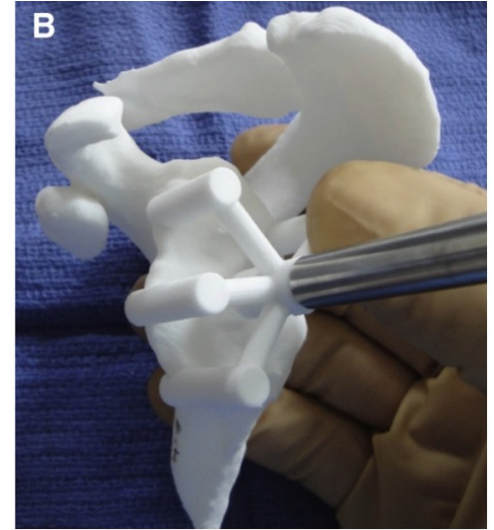
- No costi
- No tempi di spedizione

Cosa dice la letteratura?

Gli studi che riguardano l'uso del PSI nelle revisioni sono limitati



dobbiamo estrapolare i risultati dagli studi più rilevanti relativi a PSI in casi primari (ricordandoci la presenza degli artefatti metallici) 



JB&JS

THE Journal OF Bone
& Joint Surgery

Three-Dimensional Preoperative Planning Software and a Novel Information Transfer Technology Improve Glenoid Component Positioning

Joseph Iannotti, MD, PhD, Justin Baker, PhD, Eric Rodriguez, BS, John Brems, MD, Eric Ricchetti, MD, Mena Mesiha, MD, and Jason Bryan, MS

Investigation performed at the Department of Orthopaedic Surgery, Cleveland Clinic, Cleveland, and Custom Orthopaedic Solutions, Cleveland, Ohio

Background: We hypothesized that a novel surgical method, in which three-dimensional (3-D) preoperative planning software is generated to create a patient-specific surgical model that is used with a reusable and adjustable tool, could substantially improve the positioning accuracy of the glenoid guide pin used in total shoulder arthroplasty. We tested this method using bone models from patients with shoulder pathology and compared the results with those achieved using surgical methods representing the current standard of care.

Methods: Three surgeons with a variety of surgical experience placed a guide pin in nine bone models from patients with a variety of glenohumeral arthritis severity using (1) standard instrumentation alone, (2) standard instrumentation and 3-D preoperative surgical planning, and (3) the reusable transfer device and 3-D preoperative surgical planning. A postoperative 3-D computed tomography scan of the bone model was made and registered to the preoperative plan, and the differences between the actual and planned pin locations and trajectories were measured.

Results: Use of the standard instrumentation combined with 3-D preoperative planning software improved guide pin positioning compared with standard instrumentation and preoperative planning using 2-D imaging. The accuracy of pin positioning increased by $4.5^\circ \pm 1.0^\circ$ in version ($p < 0.001$), $3.3^\circ \pm 1.3^\circ$ in inclination ($p = 0.013$), and 0.4 ± 0.2 mm in location ($p = 0.042$). Use of the adjustable and reusable device and the 3-D software improved pin positioning by a further $3.7^\circ \pm 0.9^\circ$ in version, $8.1^\circ \pm 1.2^\circ$ in inclination, and 1.2 ± 0.2 mm in location ($p < 0.001$ for all) compared with standard instrumentation and the 3-D software; the improvement compared with use of standard instrumentation with 2-D imaging was $8.2^\circ \pm 0.9^\circ$ in version, $11.4^\circ \pm 1.2^\circ$ in inclination, and 1.7 ± 0.2 mm in location ($p < 0.001$ for all).

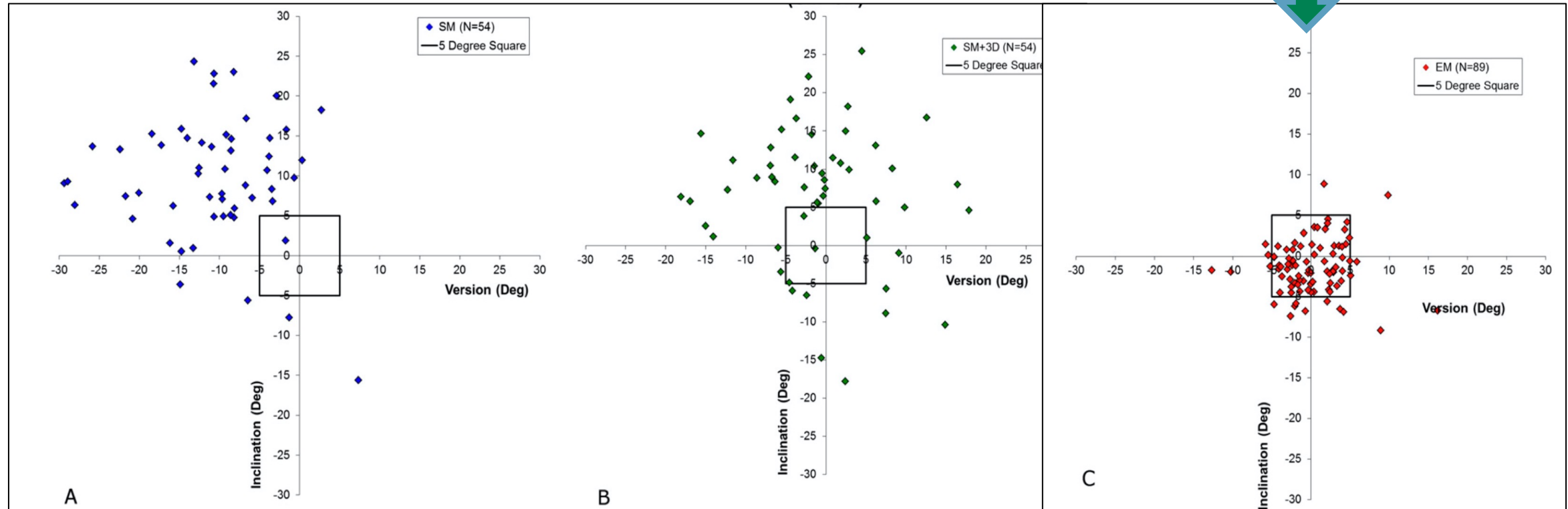
Conclusions: Use of 3-D preoperative planning and use of the patient-specific bone model and transfer device both improved the positioning accuracy of the pin used to guide placement of the glenoid component in total shoulder arthroplasty.

Clinical Relevance: Proper positioning of the glenoid component would be expected to improve the function and durability of the joint replacement.



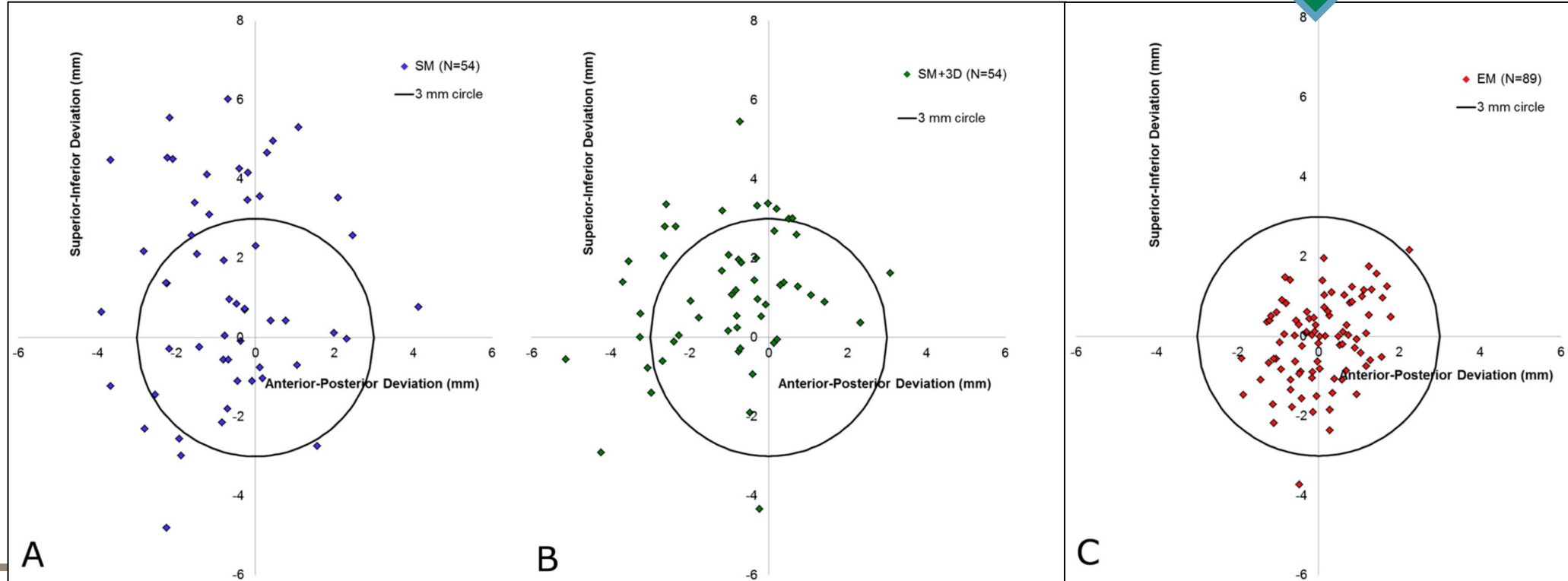
"The use of 'handheld' tools results in a deviation from the plan of over 10 degrees in inclination and rotation and 3mm in the positioning of the guide wire.»

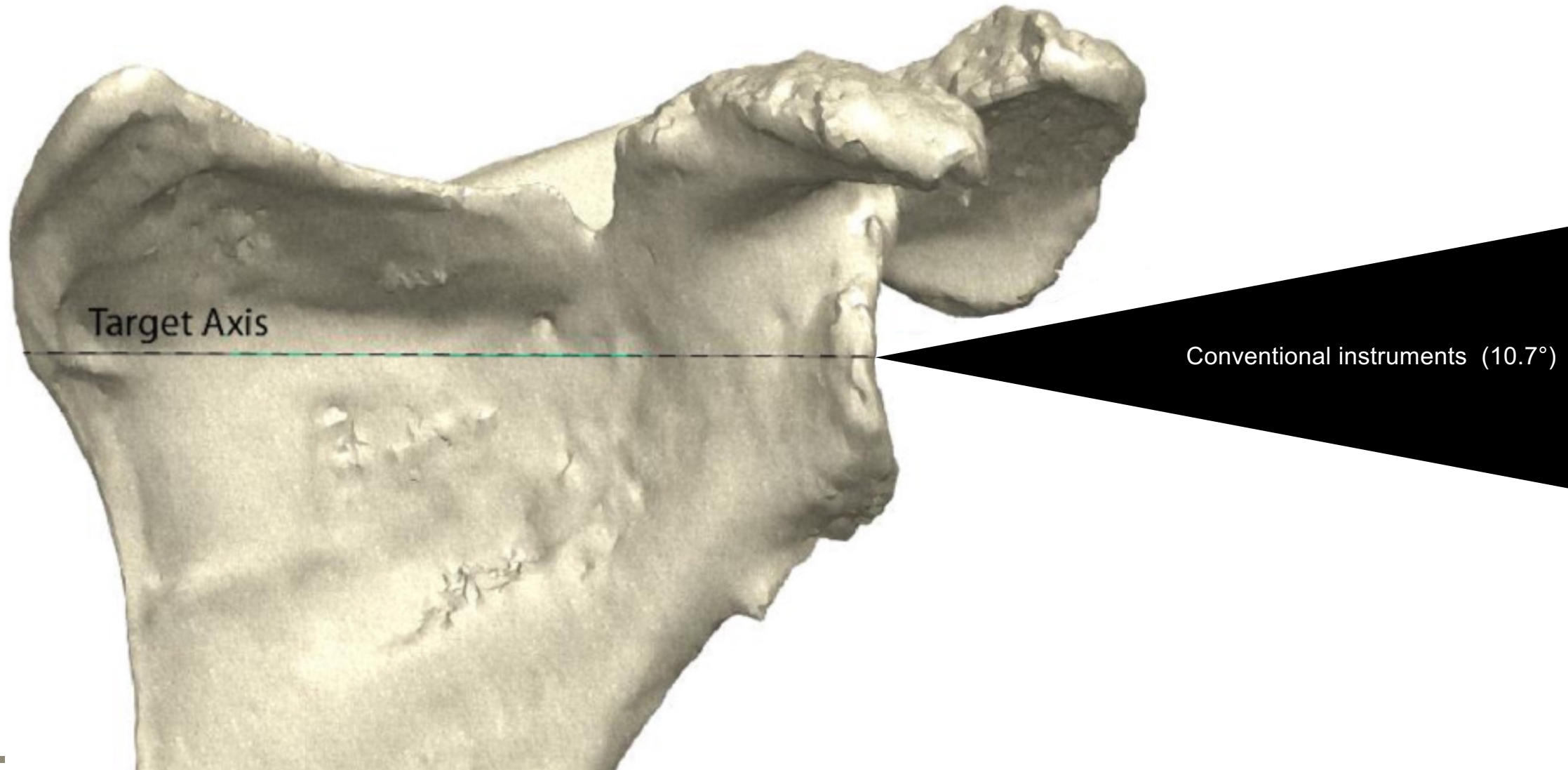
Three-Dimensional Preoperative Planning Software and a Novel Information Transfer Technology Improve Glenoid Component Positioning

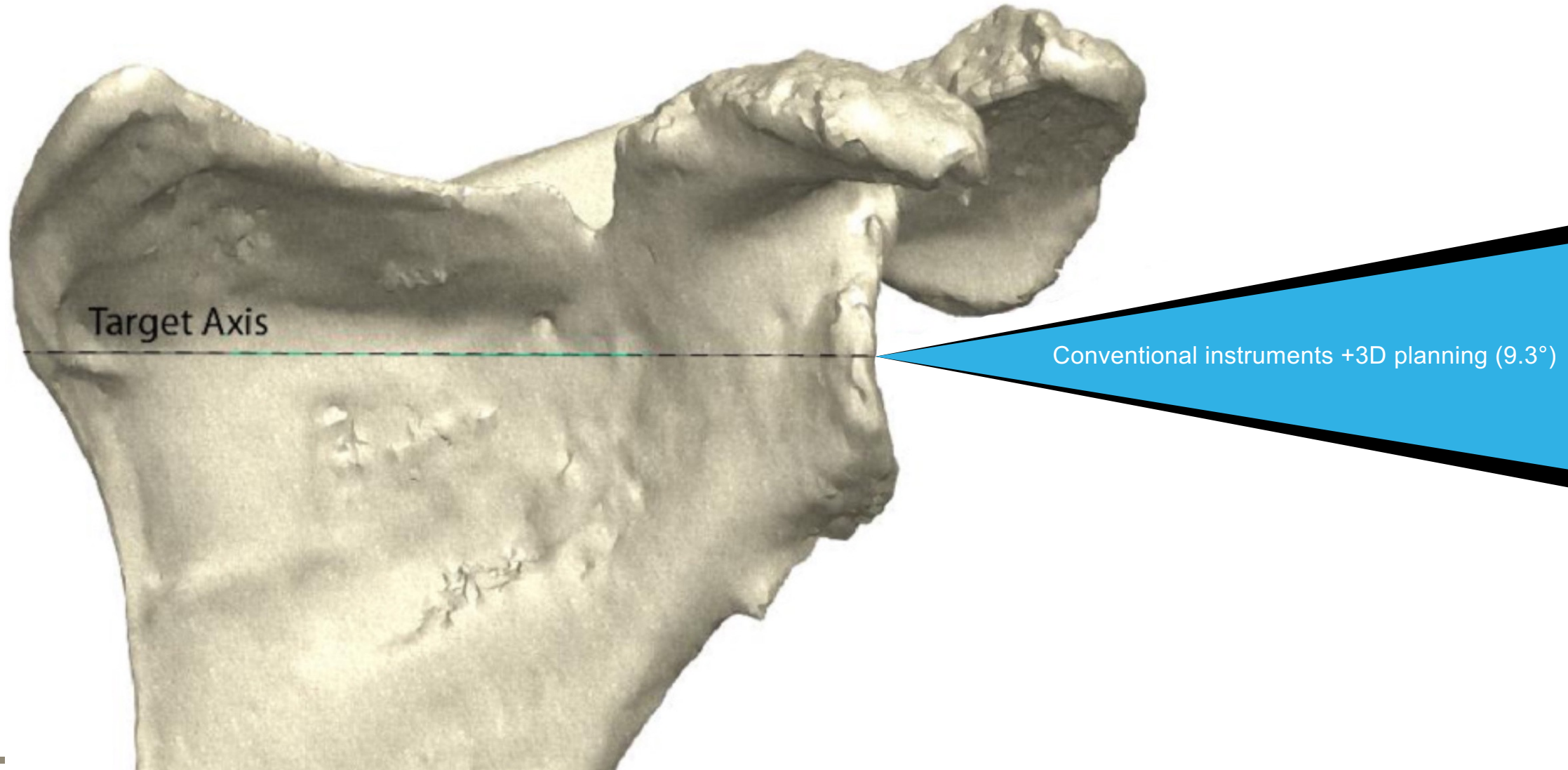


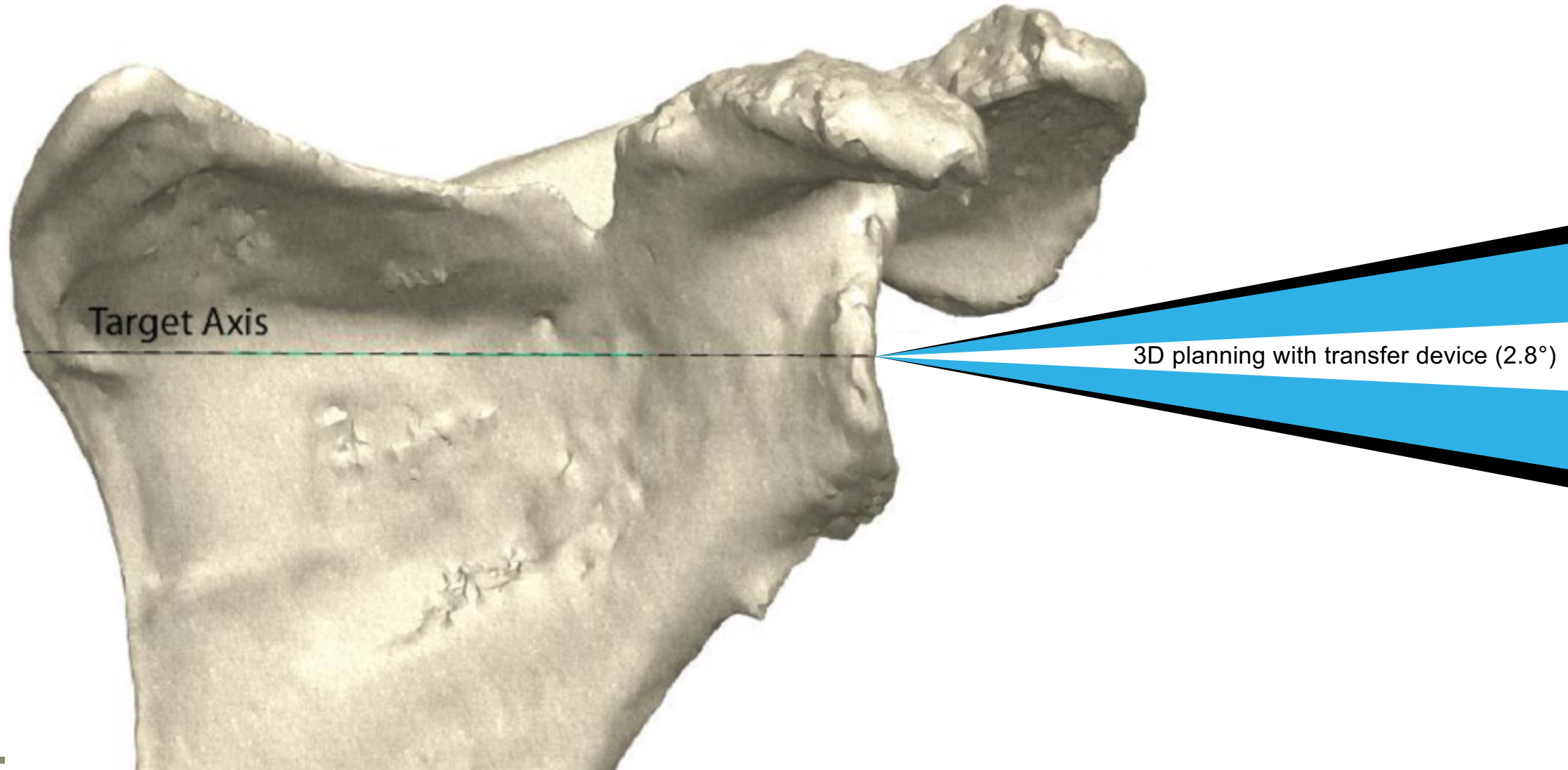
Three-Dimensional Preoperative Planning Software and a Novel Information Transfer Technology Improve Glenoid Component Positioning

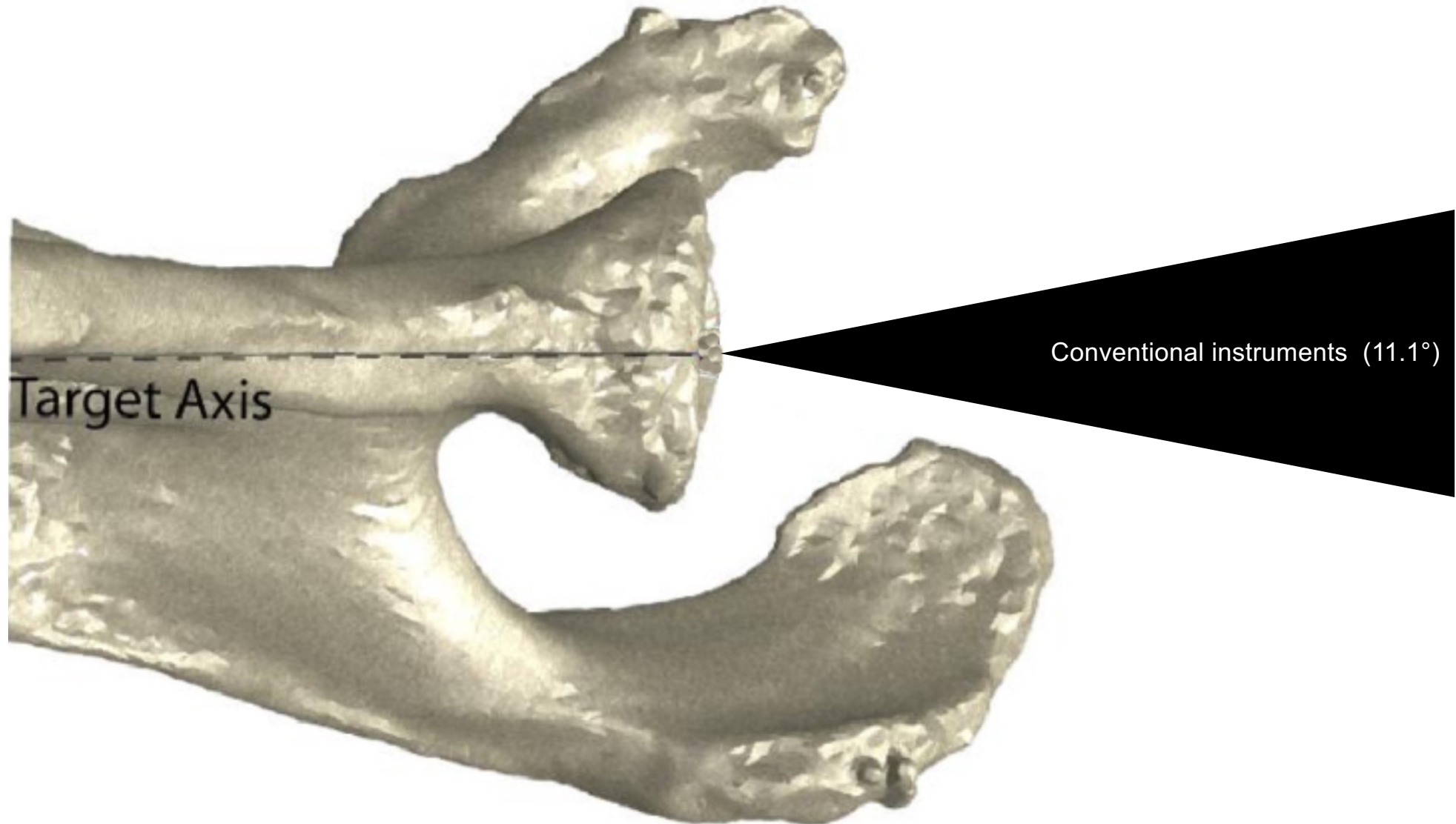
PSI

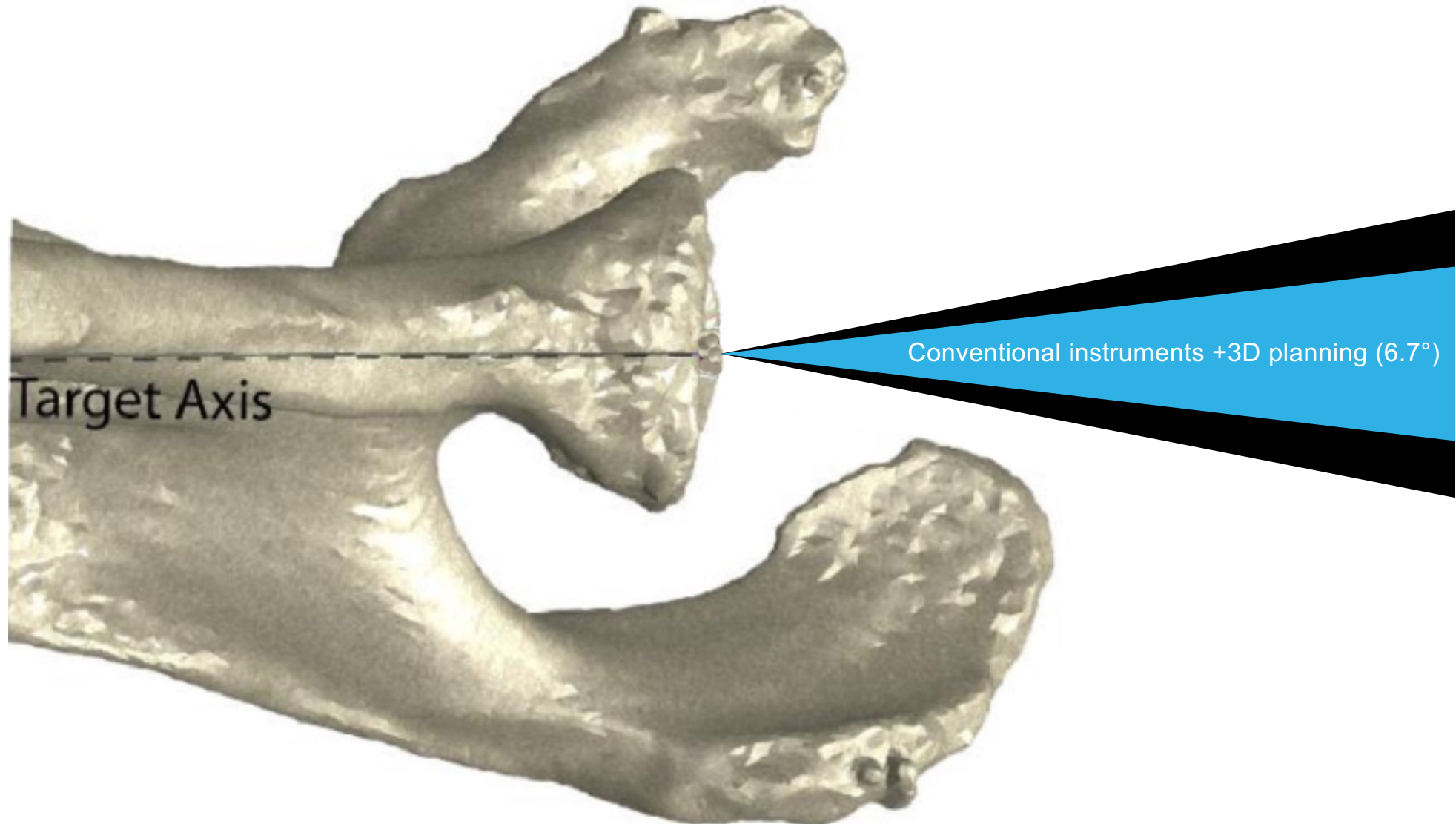


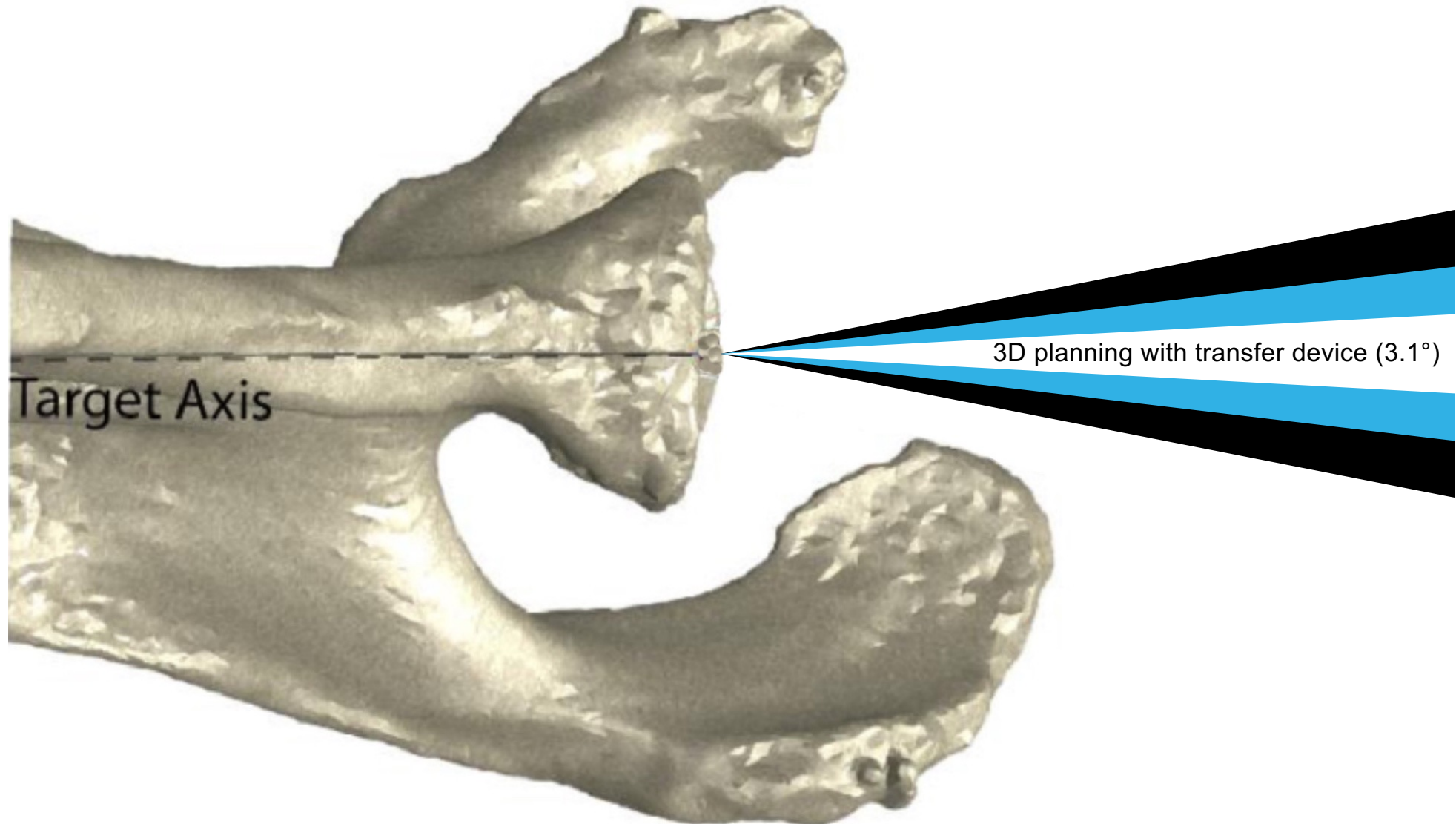








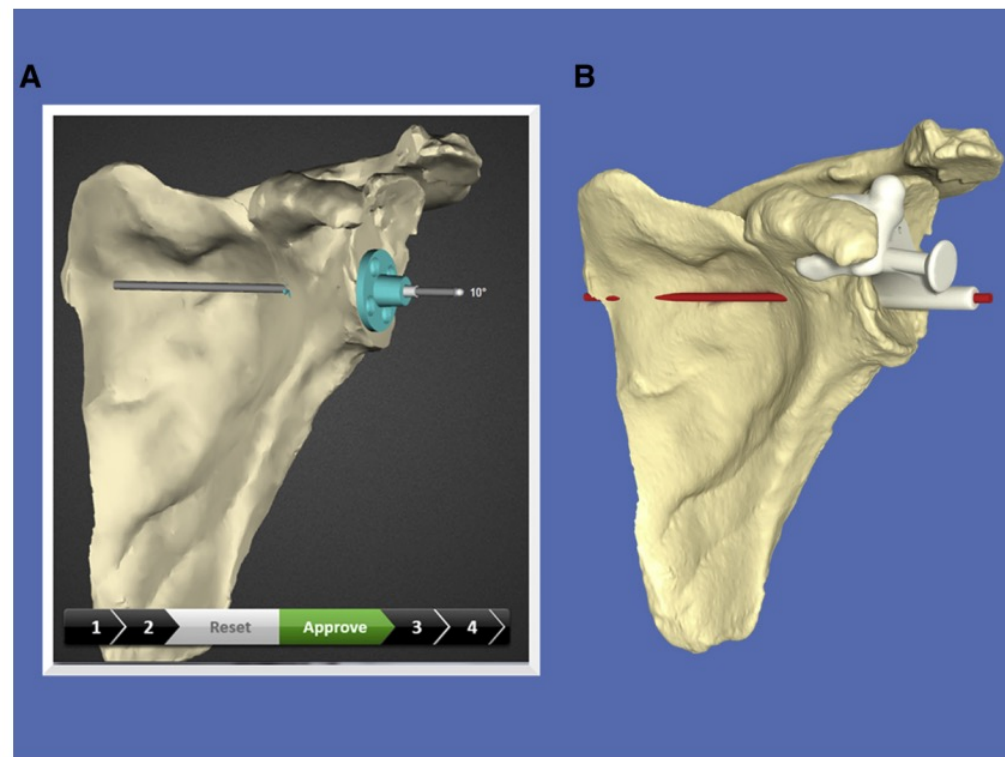




Accuracy of patient-specific guided glenoid baseplate positioning for reverse shoulder arthroplasty

Jonathan C. Levy, MD^{a,*}, Nathan G. Everding, MD^a, Mark A. Frankle, MD^b,
Louis J. Keppler, BS^c

- Cadaveric study (14 shoulders)
- Posizionamento e traiettoria del filo guida valutata con TAC 3D e confrontata con planning
- Accuratezza:
 - 2.6° version
 - 1.2° inferior tilt
 - 1.2mm starting point



Reverse Shoulder Arthroplasty With Patient-specific Glenoid Implant Positioning Guides

Srivatsa Subramanya, MS and Jonathan Herald, FRACS

SHOULDER/ELBOW | VOLUME 31, ISSUE 7, P1488-1498, JULY 2022

[Download Full Issue](#)

Patient-specific instrumentation improves the reproducibility of preoperative planning for the positioning of baseplate components with reverse total shoulder arthroplasty: a comparative clinical study in 39 patients

[Jae-Man Kwak, MD, PhD](#)¹ • [In-Ho Jeon, MD, PhD](#)¹ • [Hyojune Kim, MD](#) • [SeungHyun Choi, MS](#) •

[HwaYong Lee, BS](#) • [Kyoung Hwan Koh, MD, PhD](#)   • [Show footnotes](#)

Published: January 15, 2022 • DOI: <https://doi.org/10.1016/j.jse.2021.12.012> • [Check for updates](#)

Navigazione

- Tecnologia che utilizza un tracking system ottico o la realtà aumentata per rendere più accurati alcuni step chirurgici (non solo il posizionamento del filo guida)
- Fornisce al chirurgo un feedback in real-time di ogni step chirurgico

NAVIGAZIONE>PSI

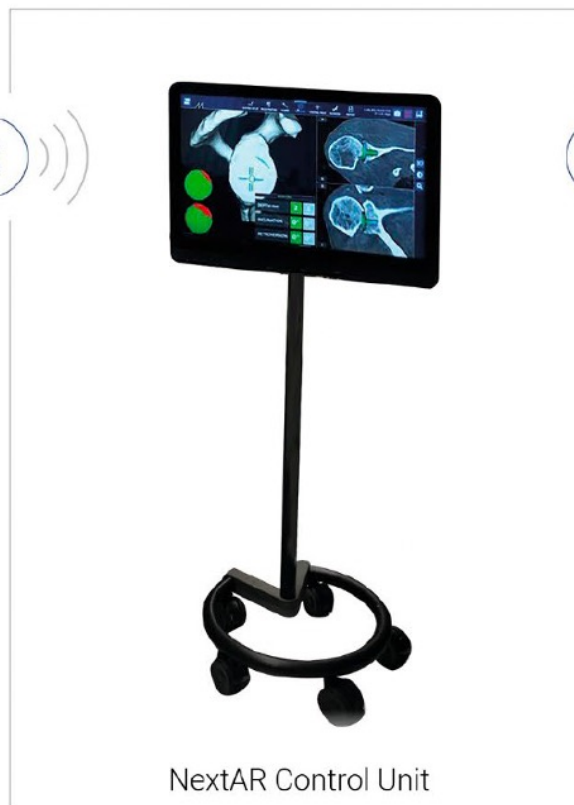


K-WIRE POSITIONING



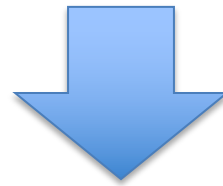
«real time» information of the instruments position


Navigazione con realtà aumentata



Cosa dice la letteratura?

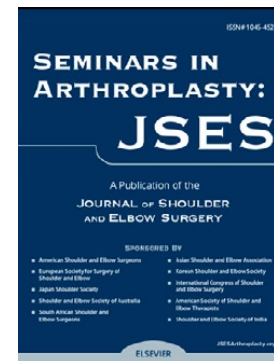
Non esiste letteratura riguardante l'utilizzo della navigazione nelle revisioni protesiche



dobbiamo estrapolare i risultati dagli studi più rilevanti relativi alla navigazione di casi primari (ricordandoci la presenza degli artefatti metallici) 

Accuracy and precision of placement of the glenoid baseplate in reverse total shoulder arthroplasty using a novel computer assisted navigation system combined with preoperative planning: A controlled cadaveric study

Richard B. Jones^{a,*}, Alexander T. Greene^b, Sandrine V. Polakovic^b, Matthew A. Hamilton^b, Nicole J. Mohajer^b, Ari R. Youderian^c, Ira M. Parsons^d, Paul D. Saadi^e, and Emilie V. Cheung^f



Navigation

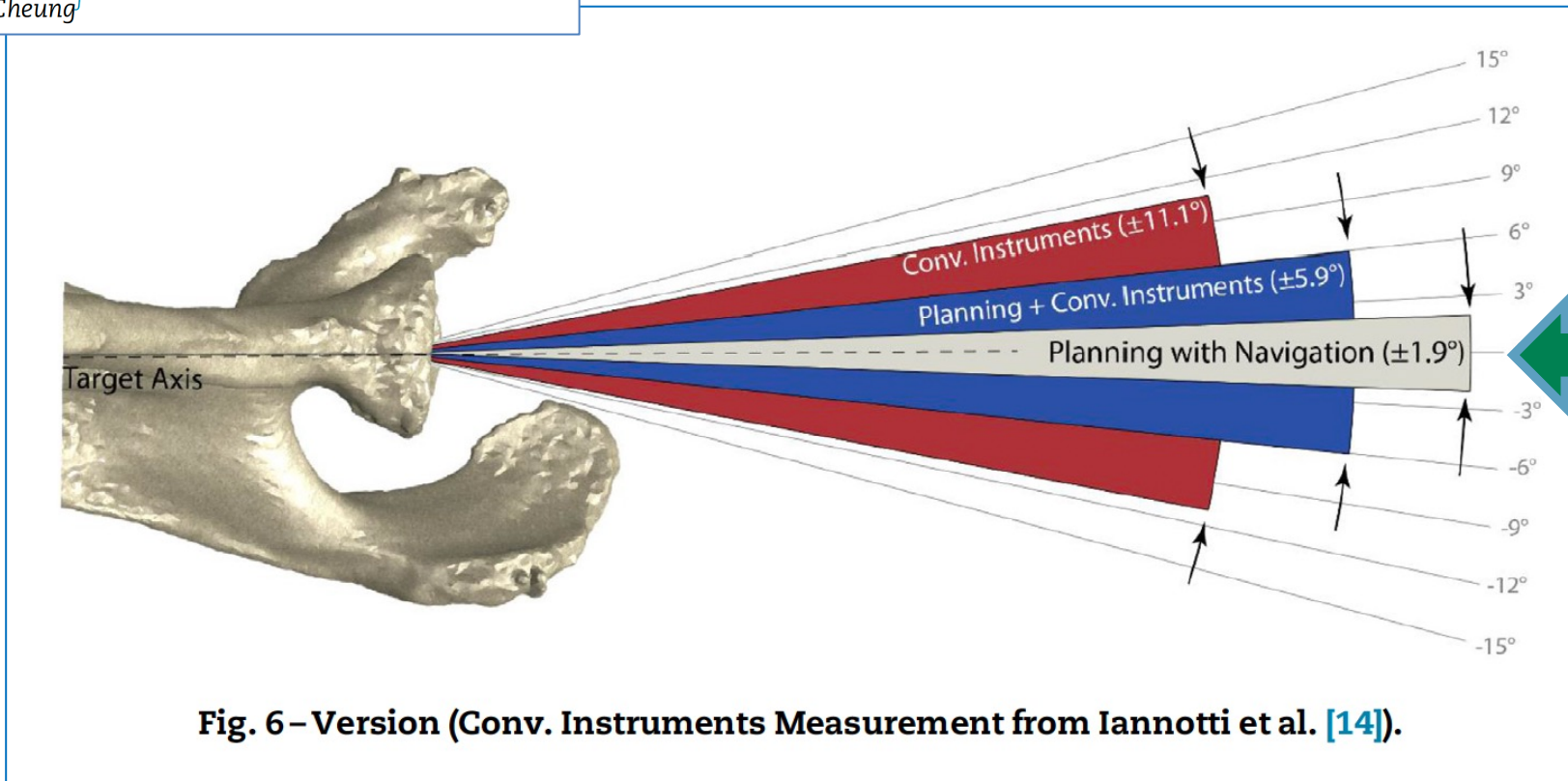


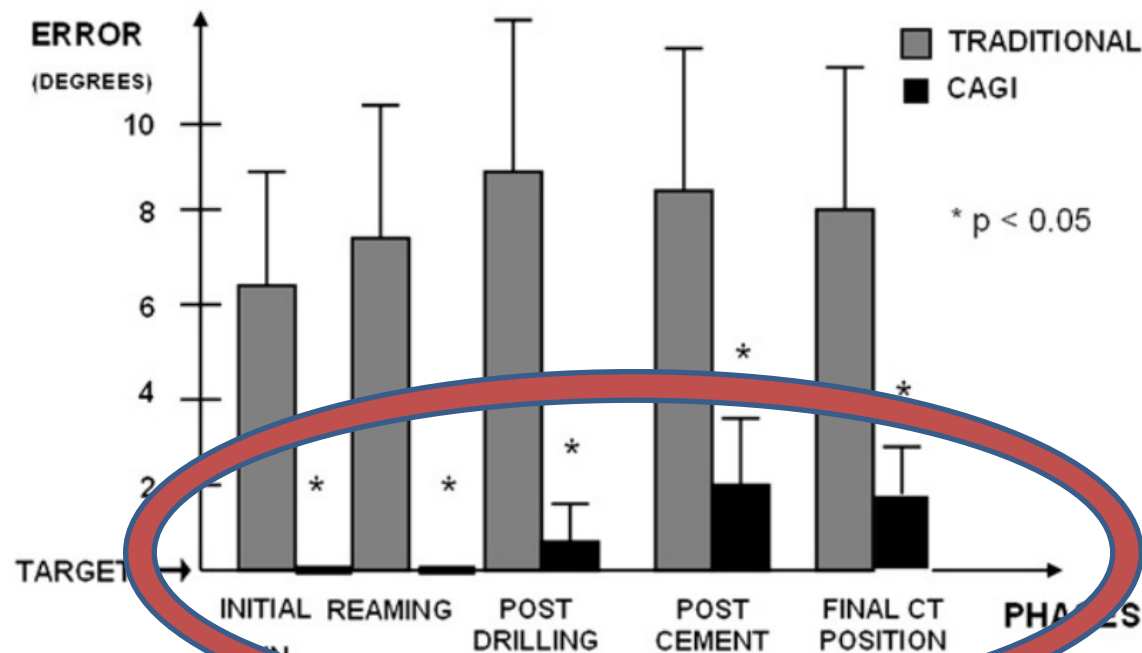
Fig. 6 – Version (Conv. Instruments Measurement from Iannotti et al. [14]).

Improved accuracy of computer assisted glenoid implantation in total shoulder arthroplasty: An in-vitro randomized controlled trial

Duong Nguyen, MD, FRCSC^{b,*}, Louis M. Ferreira, BSc, BEng^{a,c}, James R. Brownhill, PhD^a, Graham JW King, MD, MSc, FRCSC^b, Darren S. Drosdowech, MD, FRCSC^b, Kenneth J. Faber, MD, MHPE, FRCSC^b, James A. Johnson, PhD^{a,b,c}

JOURNAL OF
SHOULDER AND
ELBOW
SURGERY

www.elsevier.com/locate/ymse



ONLINE ARTICLE | VOLUME 30, ISSUE 10, E629-E635, OCTOBER 2021

Download Full Issue

The in vivo impact of computer navigation on screw number and length in reverse total shoulder arthroplasty

Keegan M. Hones, MS • Joseph J. King, MD ✉ • Bradley S. Schoch, MD • Aimee M. Struk, MEd, ATC • Kevin W. Farmer, MD • Thomas W. Wright, MD

Published: February 26, 2021 • DOI: <https://doi.org/10.1016/j.jse.2021.01.017> •  Check for updates

Methods

One hundred consecutive RSAs were selected from the computer navigation implantation date; then, 100 consecutive sex-matched RSAs were chosen prior to navigation implantation in reverse chronologic order.

Conclusion

- navigation in RSA leads to longer and fewer glenoid baseplate screws being implanted
- navigation appears to assist with better screw placement, which may have similar clinical benefits of better glenoid fixation
- using fewer screws can save glenoid bone stock, avoid added glenoid stress risers, and decrease operative time.

Navigazione nella revisione protesica

- Vantaggi...potenziali:
 - Maggiore accuratezza
 - Miglior posizionamento viti
 - Feedback in tempo reale
- Limiti:
 - Tempi chirurgici (10-15min)
 - Costi
 - Legati al planning (artefatti metallici, bon loss post-rimozione,...)



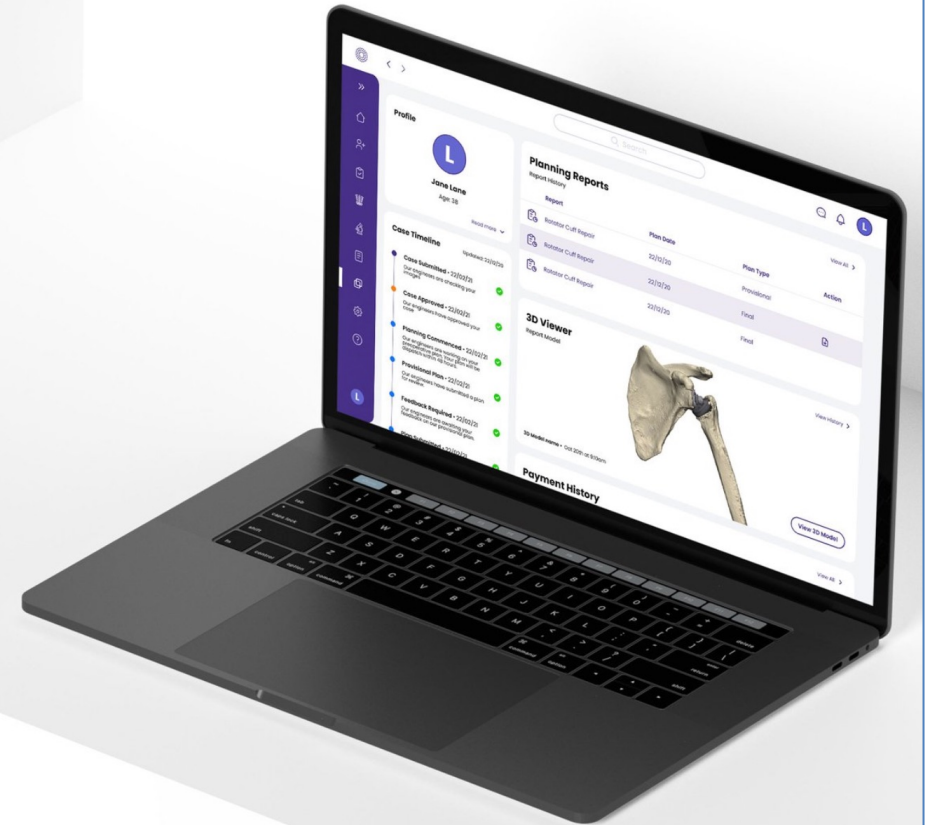
Futuro? Intelligenza artificiale



Dr. Ashish Gupta

REFLECT Complex by  akunah

REFLECT Complex by Akunah possesses the capacity to execute CT scan segmentation, encompassing metal artefact reduction for advanced 3D modelling, and personalised shoulder replacement and complex surgery preoperative planning.

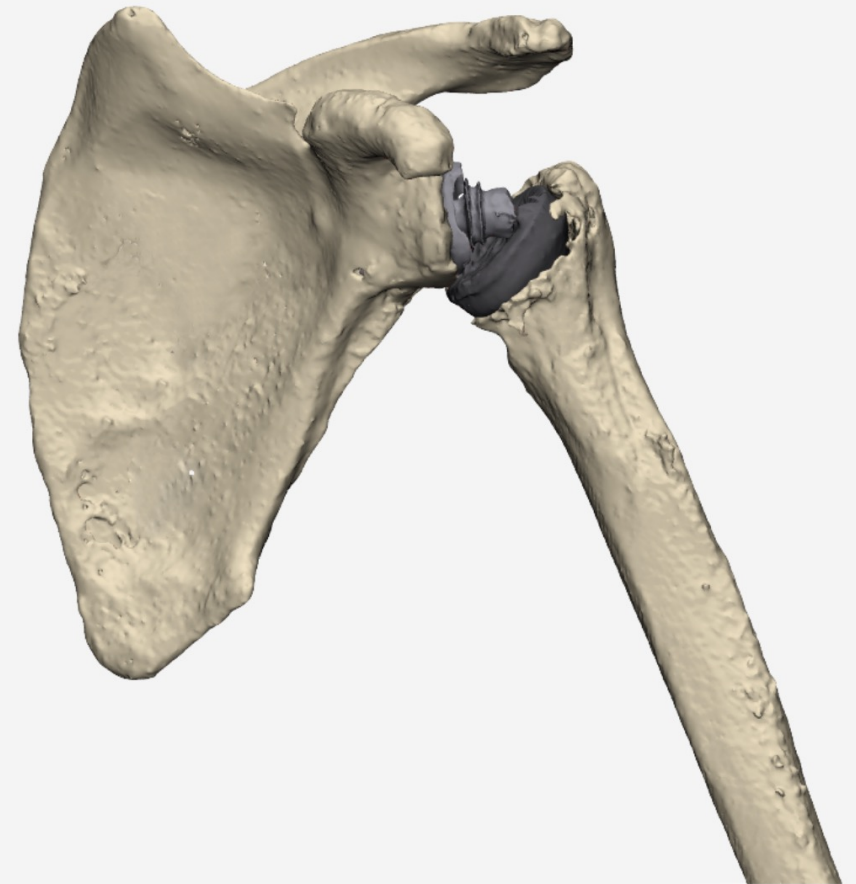




- Plan cases independently
- Primary Shoulder Replacement Planning
- Revision and Complex Planning
- Semi-automated 3D Reconstruction
- Premorbid Visualisation using AI
- Scapula and Humerus Planning
- Agnostic Implant Selection
- Plan Sports and Instability
- Integrated Data



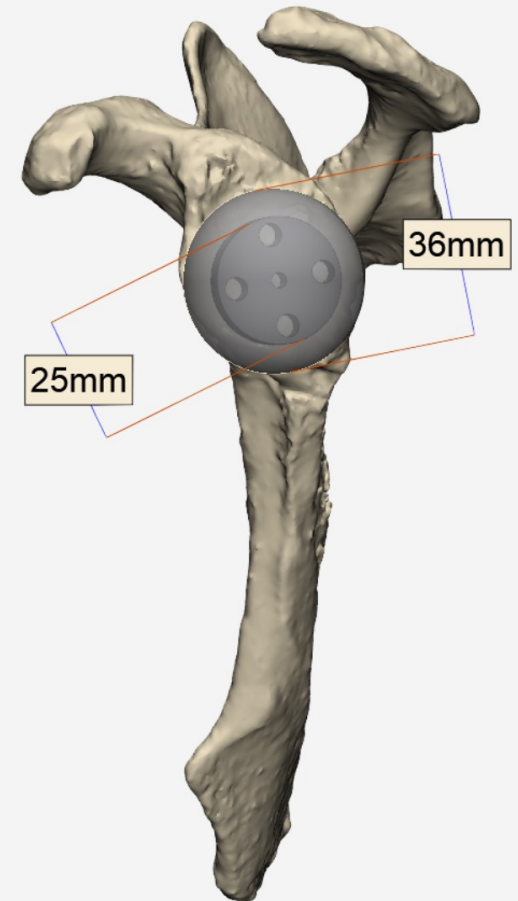
From CT DICOM with significant metal artefacts...



... to advanced 3D reconstruction



Subtraction of existing implants



Implant positioning

Conclusioni

- Aumento utilizzo della protesi di spalla → aumento delle revisioni → aumento delle «sfide»
- Planning 3D aiuta il chirurgo a comprendere meglio la patologia e pianificare con successo l'intervento chirurgico
- PSI e navigazione consentono la traslazione del planning in sala operatoria con grande accuratezza nei casi primari e potenzialmente anche nella chirurgia di revisione

Conclusioni

- Il limite attuale nelle revisioni protesiche risiede nella presenza degli artefatti metallici che rendono difficile definire l'anatomia ossea **precedente** e **successiva** della rimozione protesica
- Il caso ideale è il 2° stage di una revisione (assenza di componenti protesiche)
- Intelligenza artificiale ed i nuovi software risolveranno (alcuni stanno già risolvendo) il problema degli artefatti metallici e sono in grado di ricostruire la glena nativa

Grazie

andrea.lisai@gmail.com