
CLOVER
SPINE, ORTHO & BIOLOGICAL COMPANY

“Innovation distinguishes between a leader and a follower.”
Steve Jobs

MAIN SHOULDER PROBLEMS WE DECIDED TO SOLVE

Loss of cancellous bone tissue

Complex device's implantation and convertibility

Ineffective use of deltoid and poor external/internal rotation

VALUE PROPOSITION

Real, Quick and Effective implant convertibility to increase surgery efficiency and clinical efficacy

Real mini-invasiveness to significantly save vascularized bone tissue (up to 50%)

Global Lateral Offset to improve the tension of the remaining rotator cuff and make the deltoid vector force more medial, thus increasing joint reaction force and improving shoulder stability

State-of-the-art materials ensuring maximum biocompatibility, high bone conservation and no metal allergy

FACTORS WE HAVE DECIDED TO INCREASE

Global Lateral Offset/Onlay design

- Easier conversion [1]
- Metaphyseal bone preservation [1]
- Increased teres minor, infraspinatus and posterior deltoid lever arms [2]
- Improved deltoid wrapping angle [4], increased compressive forces [3] and enhanced stability [5]

[1] Kirsch JM, Khan M, Thornley P, GichuruM, FreehillMT, Neviaser A, Moravek J, Miller BS, Bedi A (2017) Platform shoulder

[2] Hamilton, M.A.; Roche, C.P.; Diep, P.; Flurin, P.-H.; Routman, H.D. Effect of Prosthesis Design on Muscle Length and Moment Arms in Reverse Total Shoulder Arthroplasty. Bull. Hosp. Jt. Dis. 2013, 71 (Suppl. S2), S31–S35.

[3] Langohr GD, Giles JW, Athwal GS, Johnson JA (2015) The effect of glenosphere diameter in reverse shoulder arthroplasty on muscle force, joint load, and range of motion. J Shoulder Elb Surg 24(6): 972–979. https://doi.org/10.1016/j.jse.2014.10.018

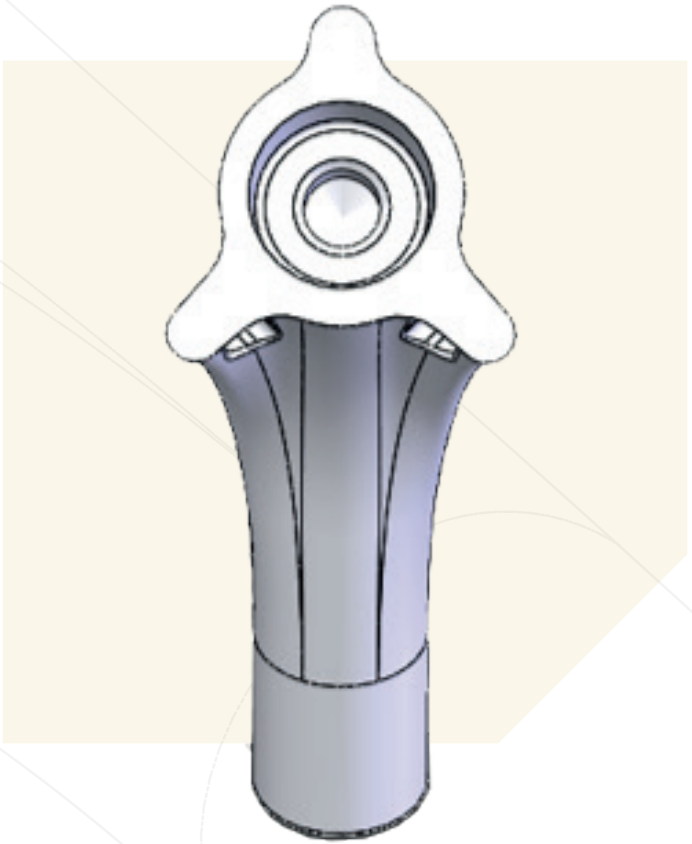
[4] Erickson, B.J.; Frank, R.M.; Harris, J.D.; Mall, N.; Romeo, A.A. The Influence of Humeral Head Inclination in Reverse Total Shoulder Arthroplasty: A Systematic Review. J. Shoulder Elb. Surg. 2015, 24, 988–993. [CrossRef]

[5] Routman HD, Flurin PH, Wright TW, Zuckerman JD, Hamilton MA, Roche CP (2015) Reverse shoulder arthroplasty prosthesis design classification system. Bull Hosp Jt Dis (2013) 73(Suppl 1): S5–S14

FACTORS WE HAVE DECIDED TO INCREASE

Minimally invasive design

Aim to preserve the highest possible volume of cancellous (vascularized) bone for a more effective osteointegration



FACTORS WE HAVE DECIDED/ELIMINATED

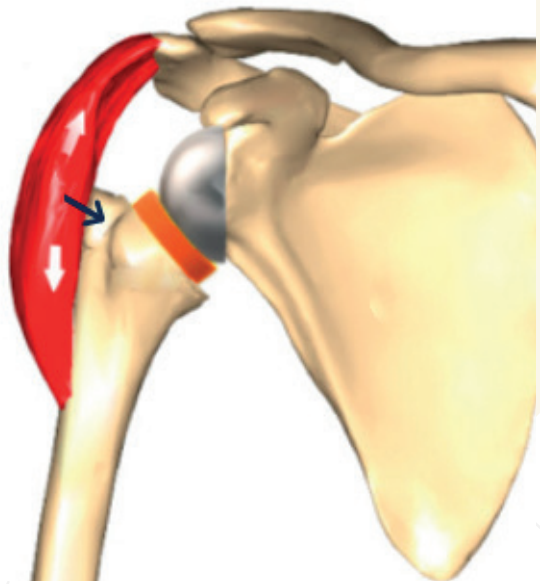
Medialization of instant center of rotation through Medialized glenoid, 155°NFA and inlay cups

Loss of contour of the shoulder [10]

Increase the risk of Scapular Notching [9]

Instability and weakness in external rotation [10]

Instability due to the loss of physiologic deltoid wrapping from 48° to 8° [11]



[9] Berhouet, J.; Garaud, P.; Favard, L. Evaluation of the Role of Glenosphere Design and Humeral Component Retroversion in Avoiding Scapular Notching during Reverse Shoulder Arthroplasty. J Shoulder Elb. Surg. 2014, 23, 151–158. [CrossRef] [PubMed]

[10] Boileau P, Watkinson DJ, Hatzidakis AM, Balg F (2005) Grammont reverse prosthesis: design, rationale, and biomechanics.J Shoulder Elb Surg 14(1 Suppl S):147S–161S. https://doi.org/10.1016/j.jse.2004.10.006

[11]Valenti P, Sauzieres P, Katz D, Kalouche I, Kilinc AS (2011) Doless medialized reverse shoulder prostheses increase motion and reduce notching? Clin Orthop Relat Res 469(9):2550–2557. https://doi.org/10.1007/s11999-011-1844-8

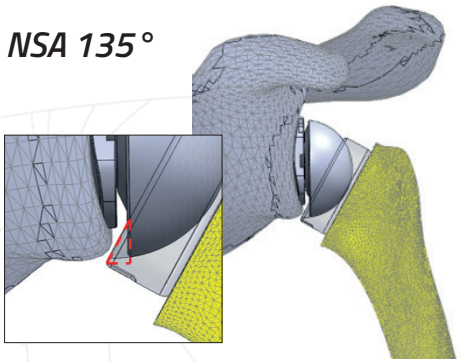
SOLUTION | FACTORS WE HAVE INCREASED

Humeral Lateralization through 135° Neck Shaft Angle (NFA) to reduce scapular notching

- Higher compressive joint reaction forces and increased stability [3]
- Increased ROM [8] and reduced risk of contact with the scapular pillar
- Deltoid lever arm increase, lower deltoid force and fatigue required for abduction [7]
- Tuberosities' positions restored. Better length/tension curve of the residual rotator cuff [3]

BEST OPTION

NSA 135°



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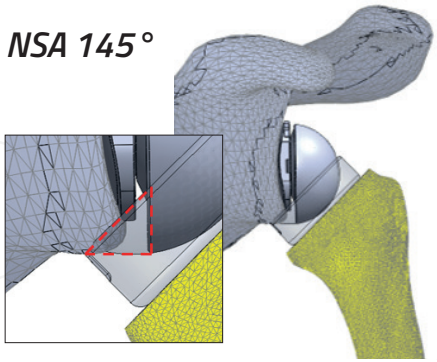
NSA 145°



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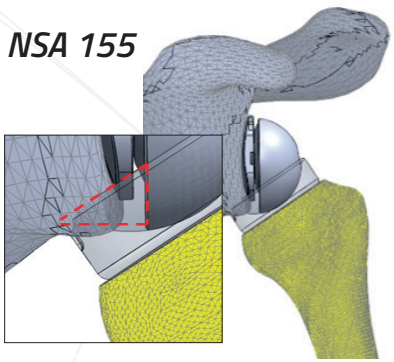
NSA 155



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[3]] Langohr, G.D.G.; Giles, J.W.; Athwal, G.S.; Johnson, J.A. The Effect of Glenosphere Diameter in Reverse Shoulder Arthroplasty on Muscle Force, Joint Load, and Range of Motion. J. Shoulder Elb. Surg. 2015, 24, 972–979. [CrossRef]

[6] Franceschetti, E.; de Sanctis, E.G.; Ranieri, R.; Palumbo, A.; Paciotti, M.; Franceschi, F. The Role of the Subscapularis Tendon in a Lateralized Reverse Total Shoulder Arthroplasty: Repair versus Nonrepair. Int. Orthop. 2019, 43, 2579–2586. [CrossRef]

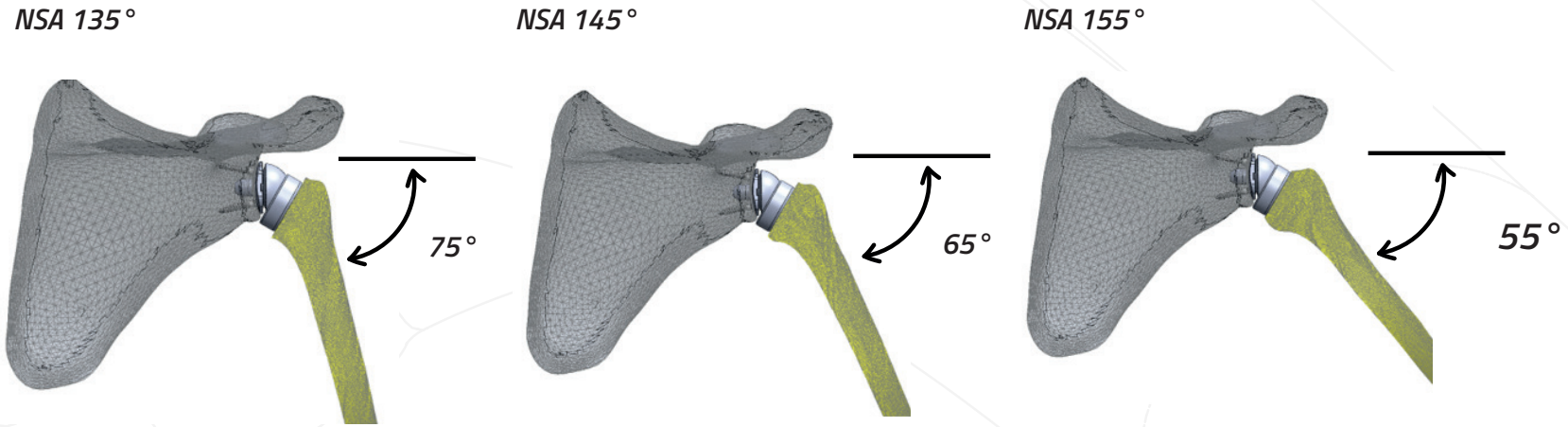
[7]Giles, J.W.; Langohr, G.D.G.; Johnson, J.A.; Athwal, G.S. Implant Design Variations in Reverse Total Shoulder Arthroplasty Influence the Required Deltoid Force and Resultant Joint Load. Clin. Orthop. Relat. Res. 2015, 473, 3615–3626. [CrossRef] [PubMed]

[8]Oh, J.H.; Shin, S.-J.; McGarry, M.H.; Scott, J.H.; Heckmann, N.; Lee, T.Q. Biomechanical Effects of Humeral Neck-Shaft Angle and Subscapularis Integrity in Reverse Total Shoulder Arthroplasty. J. Shoulder Elb. Surg. 2014, 23, 1091–1098. [CrossRef]

SOLUTION | FACTORS WE HAVE INCREASED

High Mobility Cups and NSA 135° implemented for a further increased ROM

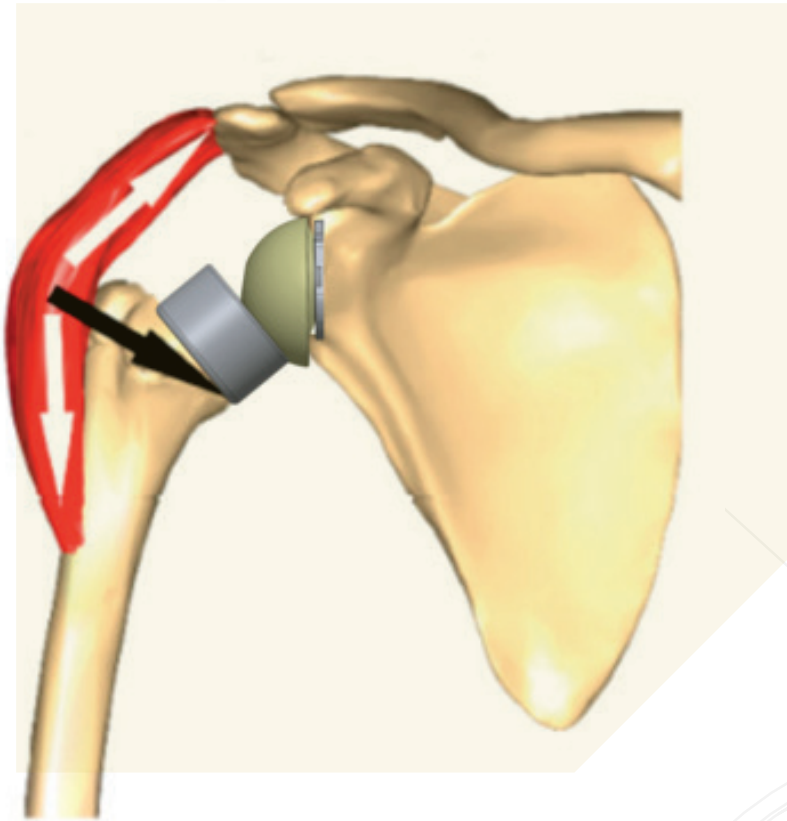
BEST OPTION



FACTORS WE HAVE ELIMINATED

Retentive cups

Not necessary. The 135° Neck Shaft Angle improves deltoid wrapping and thus compressive forces



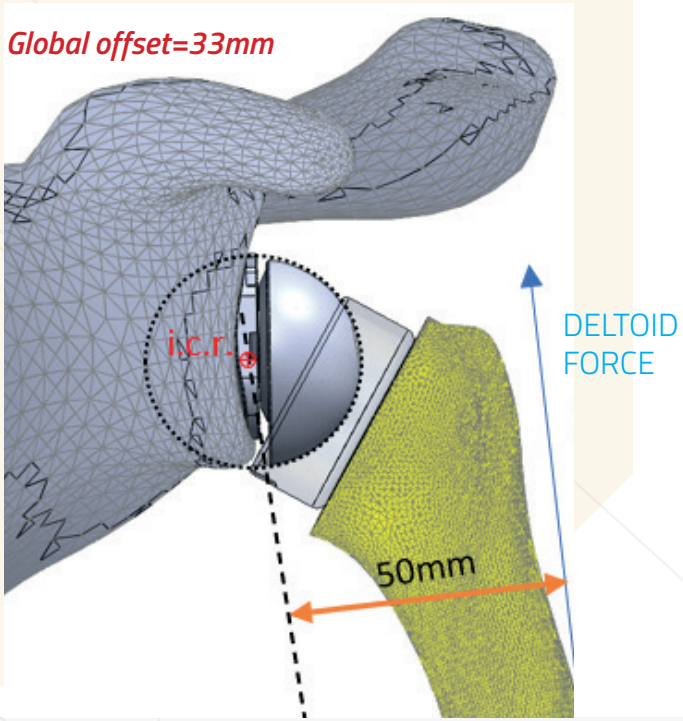
FACTORS WE HAVE INCREASED

Glenoid Lateralization at both glenoid and humeral side

Lower acromial stress [14, 15]

Lower deltoid force required in abduction [12, 13]

Lower shear forces on the glenoid components [16]



[12] Giles JW, Langohr GD, Johnson JA, Athwal GS (2015) Implant design variations in reverse total shoulder arthroplasty influence the required deltoid force and resultant joint load. Clin Orthop Relat Res 473(11):3615–3626. https://doi.org/10.1007/s11999-015-4526-0

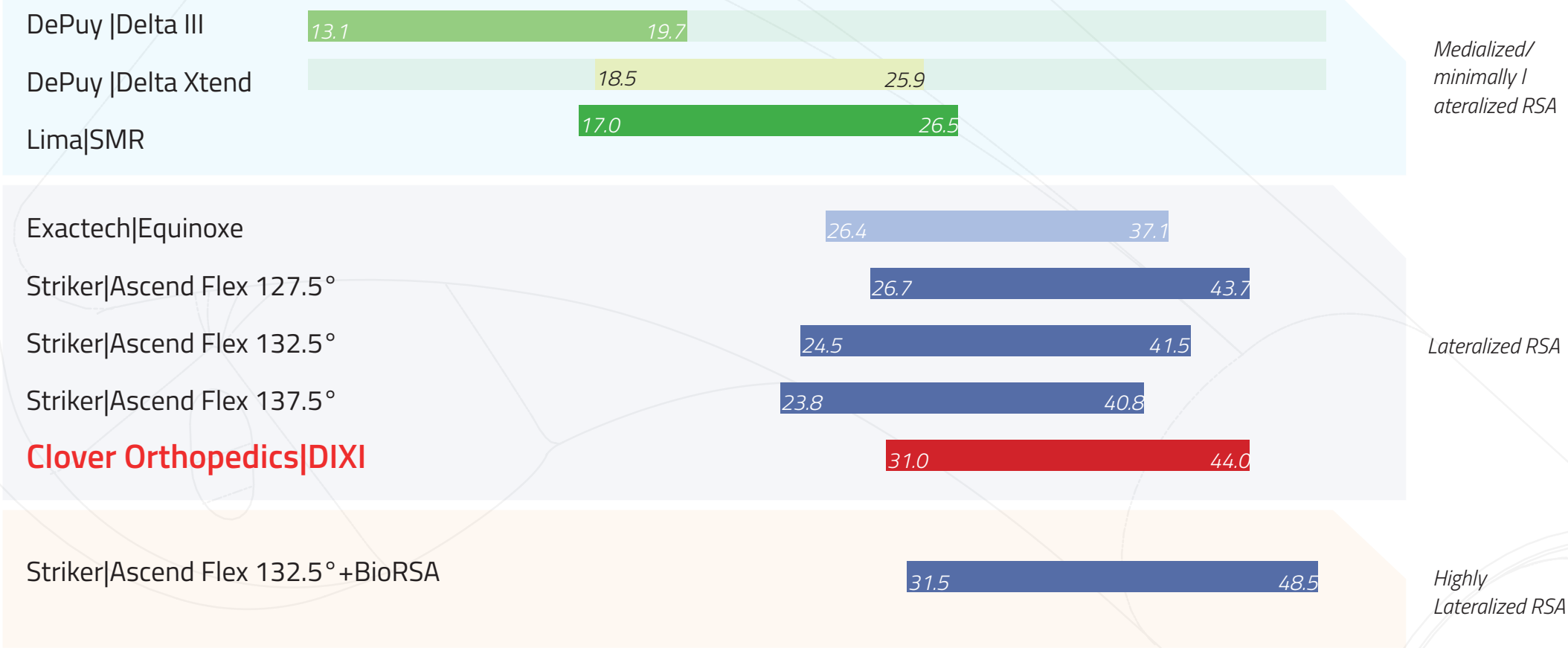
[13] Hamilton MA, Diep P, Roche C, Flurin PH, Wright TW, Zuckerman JD, Routman H (2015) Effect of reverse shoulder design philosophy onmuscle moment arms. J Orthop Res 33(4):605–613. https://doi.org/10.1002/jor.22803

[14] Wong MT, Langohr GDG, Athwal GS, Johnson JA (2016) Implant positioning in reverse shoulder arthroplasty has an impact on acromial stresses. J Shoulder Elb Surg 25(11):1889–1895. https://doi.org/10.1016/j.jse.2016.04.011

[15] Hess F, Zettl R, Smolen D, Knoth C (2018) Anatomical reconstruction to treat acromion fractures following reverse shoulder arthroplasty. Int Orthop 42(4):875–881. https://doi.org/10.1007/s00264-017-3710-0

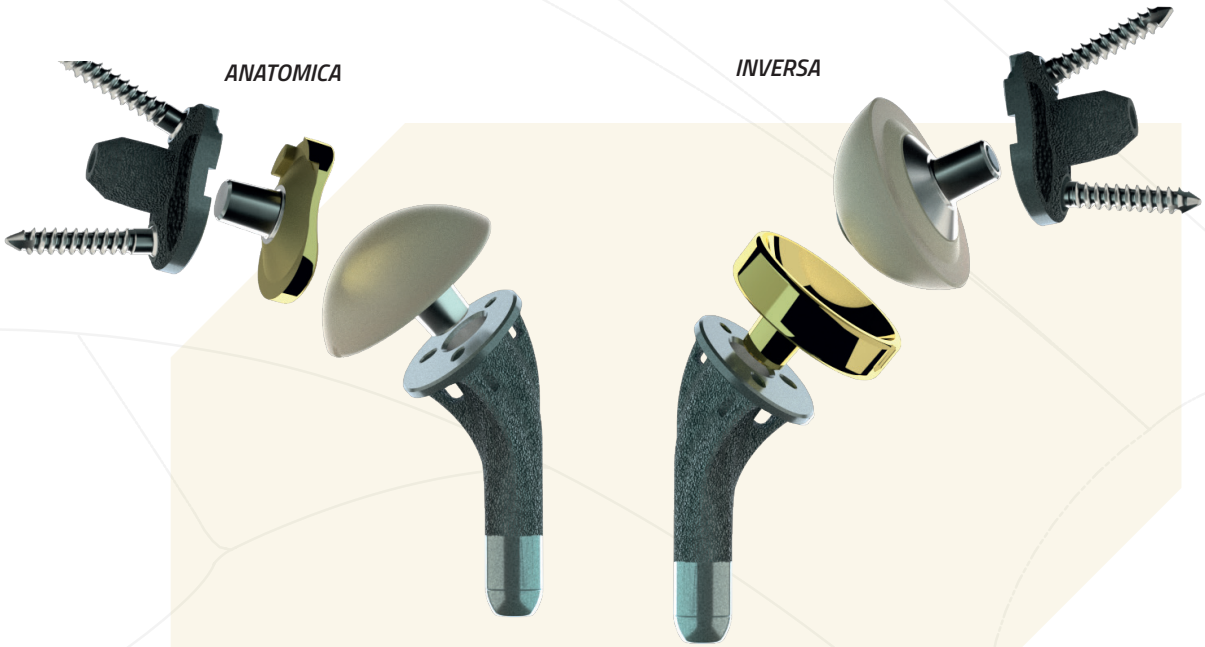
[16] Harman M, Frankle M, Vasey M, Banks S (2005) Initial glenoid component fixation in "reverse" total shoulder arthroplasty: a biomechanical evaluation. J Shoulder Elb Surg 14(1 Suppl S):162S–167S. https://doi.org/10.1016/j.jse.2004.09.030

CLOVER vs COMPETITORS



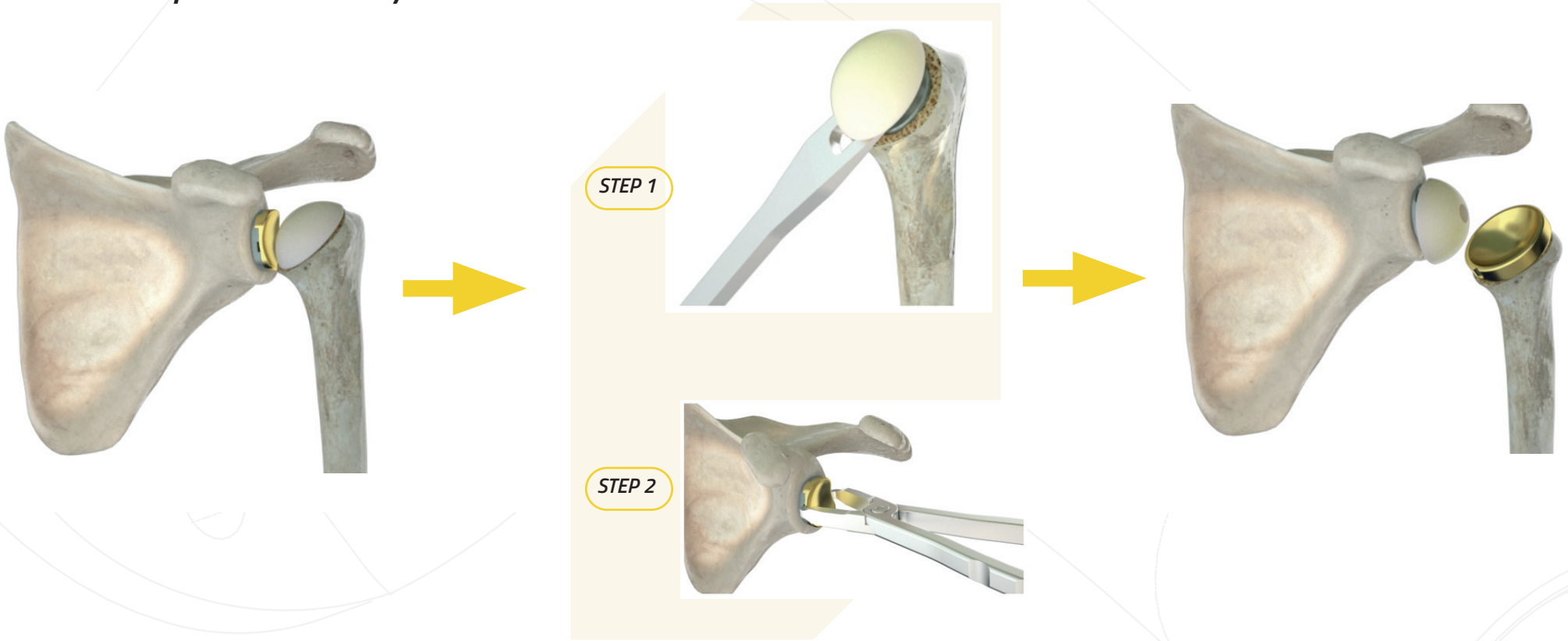
FACTORS WE HAVE DECIDE TO CREATE/INCREASE

High Modularity for a High Adaptability to patients' anatomies



FACTORS WE HAVE DECIDE TO CREATE/INCREASE

2-steps convertibility



FACTORS WE HAVE CREATED

TiNbN-coated components

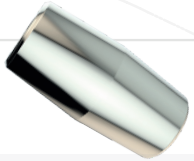
Included TiNbN-coated cups, heads and anatomical shell to reduce wear and make them anallergic

CONVERTIBILE | ANATOMICA-INVERSA

Metafisi
- **Convertibili**:
  - Anatomic/Reverse

Steli
- **Short:** 07-09-11-13-15-17-19mm
- **Medium:** 07-09-11-13-15-17-19mm
- **Long:** 07-09-11-13-15-17-19mm
- **XL:** 07-09-11-13-15-17-19mm
- **Rivestimento in Ti-Pore**

* Non Ti-Pore per cementazione

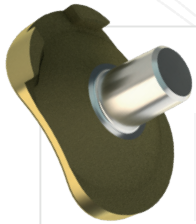


Adattatori Conici
- **MM**: +0mm/+2mm/+4mm

Teste
- 36-39-41-44-46-48-52mm
- Altezza: da 13 a 19mm
- Eccentricità: da 2 a 5mm
- Rivestimento in TiNbN

Glena Vit E-Poli
- Misure: S - M - L - XL
- 3 raggi di curvatura posteriori per misura
- Glena-Testa mismatch diametrale da 4mm a 8mm
- * disponibili su richiesta anche con chiglia (no peg)

Teste Vit E-Poli
- 39-41-44-46-48-52mm
- Altezza: da 14 a 19mm
- Eccentricità: da 2 a 5mm



Inserto
- Misure: S - M - L - XL
- Rivestimento TiNbN

Metalback
- Misure: S - M - L - XL
- Lunghezza Peg: 13-20-25mm

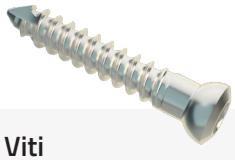
Coppe Omerali
Diametro: 38-42mm
Eccentricità: 2.5 - 4.5mm
Rivestimento in TiNbN

Standard
- Altezze: -2mm/0mm /+3mm/+6mm/+9mm

High Mobility
- Altezze: 0mm /+3mm/+6mm/+9mm

Adattatori Conici
- **MF**: +11mm

Glenosfera Vit E-Poli
- Diametro: 38-42mm
- Lateralizzazione: 0/+2mm/+4mm
- Con o senza eccentricità (3mm)



Viti
- **Vite Spongiosa** da 20mm a 45mm
- **Vite Corticale** da 20mm a 45mm

CONVERTIBILE | REVISIONE

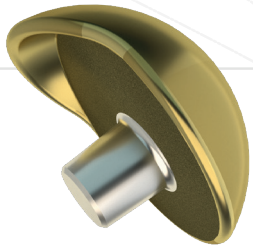
Metafisi

- **Convertibili**:
  - Anatomic/Reverse

Steli

- **Short:** 07-09-11-13-15-17-19mm
- **Medium:** 07-09-11-13-15-17-19mm
- **Long:** 07-09-11-13-15-17-19mm
- **XL:** 07-09-11-13-15-17-19mm
- **Rivestimento in Ti-Pore**

* Non Ti-Pore per cementazione



Teste CTA

- 36-41-46-52mm
- Altezza: 13-15-17-19mm
- Rivestimento in TiNbN

Glena Vit E-Poli

- Misure: S - M - L - XL
- 3 raggi di curvatura posteriori per misura
- Glena-Testa mismatch diametrale da 4mm a 8mm
- * disponibili su richiesta anche con chiglia (no peg)

CONCLUSION

DIXI is a modern shoulder prosthesis with practical and compelling features

Future outlook: Product Development Pipeline: Titanium alloy-based cups --> Stemless --> planning/intra OP navigation system based on an innovative stereoscopic technology

“The future belongs to those who believe in the beauty of their dreams.”

Eleanor Roosevelt

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