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Correlación entre los diámetros del círculo glenoideo interno y externo y su relevancia clínica.

Comparación de los círculos de Sugaya e Itoi en los defectos óseos glenoideos

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Shoulder and Elbow

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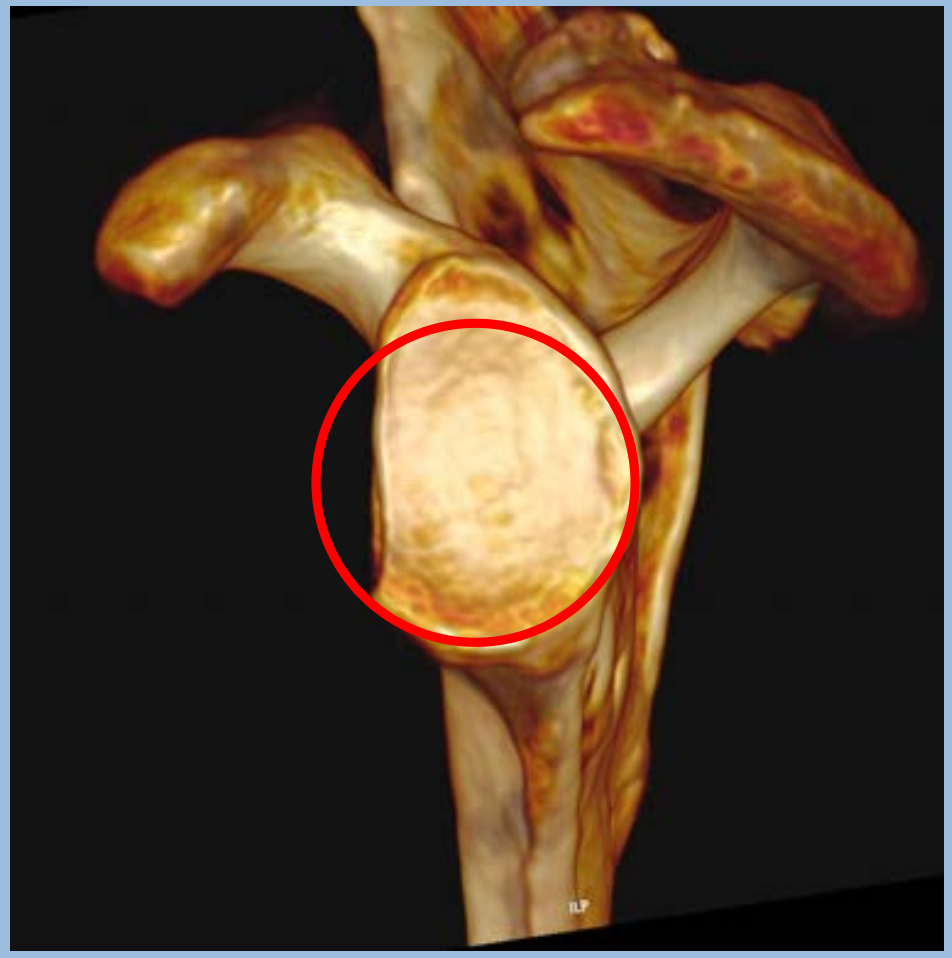
QUÉ ESTAMOS MIDIENDO EN DEFECTOS OSEOS GLENOIDEOS?



QUÉ ESTAMOS MIDIENDO EN DEFECTOS OSEOS GLENOIDEOS?

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Knee Surgery, Sports Traumatology, Arthroscopy
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SHOULDER

Check for updates

Insufficient consensus regarding circle size and bone loss width using the ratio—"best fit circle"—method even with three-dimensional computed tomography

Lucca Lacheta[1,6] · Elmar Herbst[3] · Andreas Voss[1,8] · Sepp Braun[2] · Pia Jungmann[4] · Peter J. Millett[5,6] · Andreas Imhoff[1] · Frank Martetschläger[1,7]

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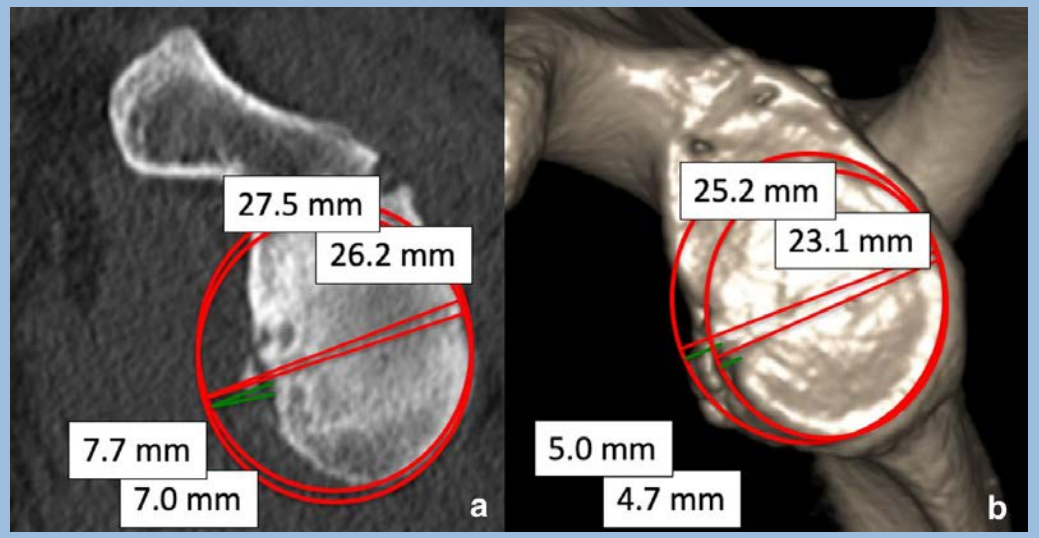

Conclusion The ratio method varies in all glenoid parameters and is not valid for consistently quantifying glenoid bone defects even in 3D computed tomography. This must be taken into consideration when determining proper surgical treatment. The degree of glenoid bone loss alone should not be used to decide for or against a bony procedure. Rather, it is more important to define a defect size as "critical" and to also take other patient-specific factors into consideration so that the best treatment option can be undertaken. Application of the "best fitting circle" is a source of error when using the ratio method; therefore, care should be taken when measuring the circle diameter.

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INESTABILIDAD ANTERIOR DE HOMBRO Y DEFECTO OSEO GLENOIDEO

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- Defectos óseos glenoideos son muy frecuentes – presentes hasta en el 90% *Edwards et al. 2003 Arthroscopy*
- Fallo en detección o infraestimación del defecto óseo → Recurrencia *Boileau et al. 2006 J Bone Joint Surg Am*
- No todos defectos son iguales
- "Critical bone loss" como guía para decisión quirúrgica:
  - Bankart artroscópico
  - Bloques óseos

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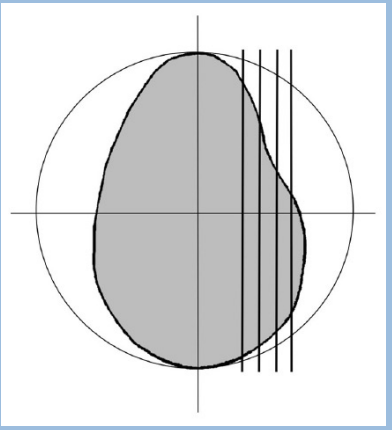
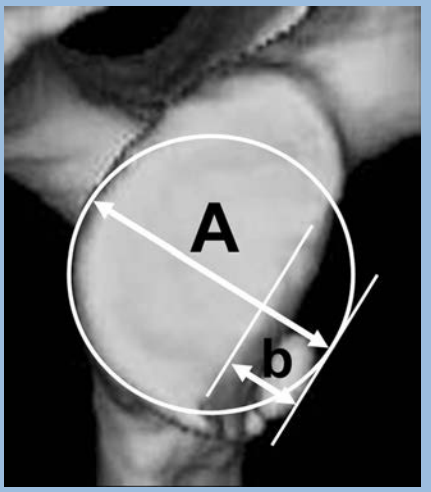
INESTABILIDAD ANTERIOR DE HOMBRO Y DEFECTO OSEO GLENOIDEO

- Definición “critical bone loss” en evolución
  - Desde 27% → 13.5% *Burkhart et al Arthroscopy 2000*
    Saha et al AJSM 2015
- Falta de consenso: cada estudio utiliza métodos diferentes
  - Técnicas de medición
  - Técnicas de imagen: RM vs TC (2D vs 3D)
  - Resultados clínicos NO comparables



- Técnicas de medición están basadas normalmente en:
  - Circulo tangente polo superior e inferior glenoideos *Itoi et al. 2000 JBJS*
  - Circulo ajustado a márgenes inferiores glenoideo *Sugaya et al. 2003 JBJS*



Estudio en cadáver

- **Objetivo**
  - Determinar la relación proporcional de los círculos interno y externo, descritos por Sugaya e Itoi, para ayudar a mejorar la reproducibilidad en la medición de defectos óseos

Estudio en cadáver: metodología

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MATERIAL

- 95 escapulas disecadas: sin artrosis o deformidad ósea
- Mediciones físicas vertical y horizontal de la cavidad glenoidea
- Fotografía digital proyección *en face* de cavidad glenoidea
- Análisis de imágenes con Horos®:
  - Circulo externo (tubérculos supra- and infraglenoideos)
  - Circulo interno (ajustado a márgenes glenoideos inferiores)
- Mediciones
  - Diámetro círculos
  - Área círculos
- 2 observadores (shoulder fellowship trained observers)
  - 1 observador repite mediciones (intervalo 3 semanas)

Estudio en cadáver: metodología

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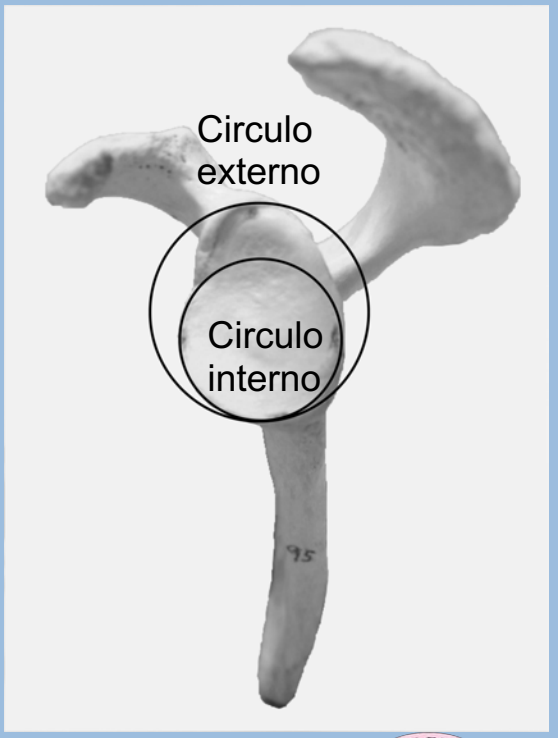
ANALISIS DE FIABILIDAD

- CCI (IC al 95%):
  - Diámetro de ambos círculos
  - Área de ambos círculos

  - Concordancia Inter-observador
  - Concordancia Intra-observador

CORRELACION DE LOS CIRCULOS

- Coeficiente de Pearson, **r**
- Coeficiente de determinación, **R^2**



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Estudio en cadáver: resultados

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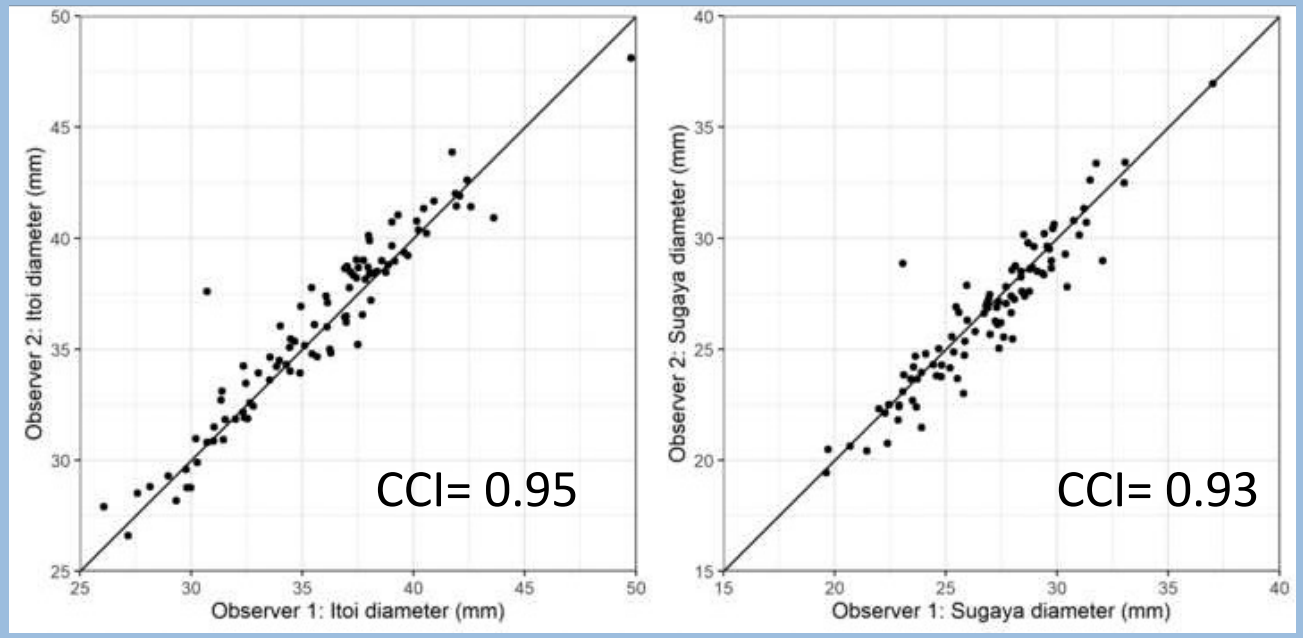
Resumen mediciones

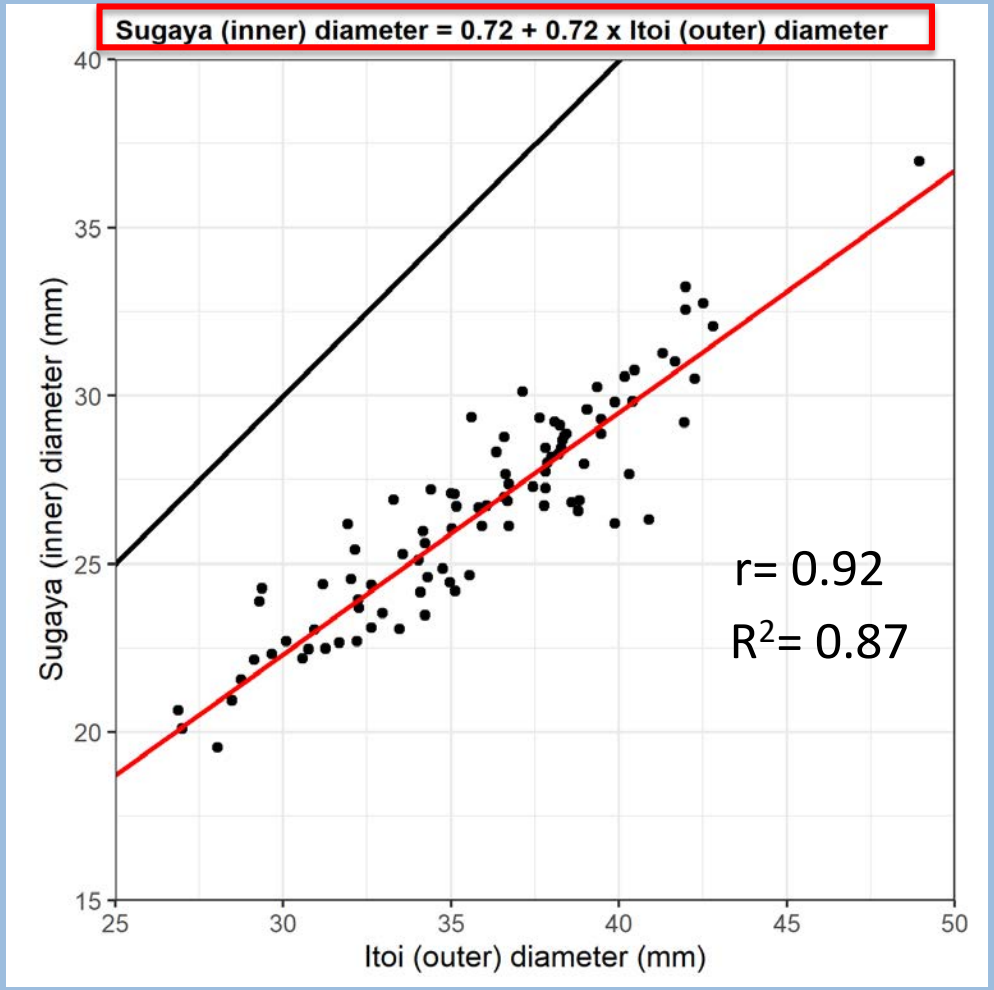
	Mean ± SD
Altura glenoides (mm)	35.1 ± 3.3
Ancho glenoides (mm)	25.6 ± 2.7
Diámetro circulo externo (mm)	35.7 ± 4.2
Diámetro circulo interno (mm)	26.8 ± 3.2
Diámetro circulo interno / Diámetro circulo externo RATIO	**0.74 ± 0.04**
Área circulo externo (mm²)	50,028 ± 11,633
Área circulo interno (mm²)	28,154 ± 6,733
Área circulo interno/ Área circulo externo RATIO	0.56 ± 0.05

CCI: inter-observador



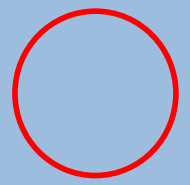
Concordancia entre observadores para diámetros de círculos externo (Itoi) e interno (Sugaya).

Estudio en cadáver: resultados

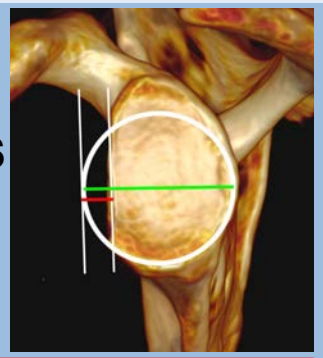


Ecuación de regresión para predecir el círculo interno a partir de círculo externo

Aplicación del método



MEDICIONES LINEALES



MEDICIONES AREA

METODO PICO

What Is the Most Reliable Method of Measuring Glenoid Bone Loss in Anterior Glenohumeral Instability?

A Cadaveric Study Comparing Different Measurement Techniques for Glenoid Bone Loss

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Investigation performed at MQ Health Translational Shoulder Research Program, Faculty of Medicine & Human Sciences, Macquarie University, Sydney, Australia

Background: Preoperative quantification of bone loss has a significant effect on surgical decision making and patient outcomes. Various measurement techniques for calculating glenoid bone loss have been proposed in the literature. To date, no studies have directly compared measurement techniques to determine which technique, if any, is the most reliable.

Purpose/Hypothesis: To identify the most consistent and accurate techniques for measuring glenoid bone loss in anterior glenohumeral instability. Our hypothesis was that linear measurement techniques would have lower consistency and accuracy than surface area and statistical shape model–based measurement techniques.

Study Design: Controlled laboratory study.

Methods: In 6 fresh-frozen human shoulders, 3 incremental bone defects were sequentially created resulting in a total of 18 glenoid bone defect samples. Analysis was conducted using 2D and 3D computed tomography (CT) en face images. A total of 6 observers (3 experienced and 3 with less experience) measured the bone defect of all samples with Horos imaging software using 5 common methods. The methods included 2 linear techniques (Shaha, Griffith), 2 surface techniques (Barchilon, PICO), and 1 statistical shape model formula (Giles). Intraclass correlation (ICC) using a consistency model was used to determine consistency between observers for each of the measurement methods. Paired *t* tests were used to calculate the accuracy of each measurement technique relative to physical measurement.

Results: For the more experienced observers, all methods indicated good consistency (ICC $>$ 0.75; range, 0.75-0.88), except the Shaha method, which indicated moderate consistency (0.65 $<$ ICC $<$ 0.75; range, 0.65-0.74). Estimated consistency among the experienced observers was better for 2D than 3D images, although the differences were not significant (intervals contained 0). For less experienced observers, the Giles method in 2D had the highest estimated consistency (ICC, 0.88; 95% CI, 0.76-0.95), although Giles, Barchilon, Griffith, and PICO methods were not statistically different. Among less experienced observers, the 2D images using Barchilon and Giles methods had significantly higher consistency than the 3D images. Regarding accuracy, most of the methods statistically overestimated the actual physical measurements by a small amount (mean within 5%). The smallest bias was observed for the 2D Barchilon measurements, and the largest differences were observed for Giles and Griffith methods for both observer types.

Conclusion: Glenoid bone loss calculation presents variability depending on the measurement technique, with different consistencies and accuracies. We recommend use of the Barchilon method by surgeons who frequently measure glenoid bone loss, because this method presents the best combined consistency and accuracy. However, for surgeons who measure glenoid bone loss occasionally, the most consistent method is the Giles method, although an adjustment for the overestimation bias may be required.

The American Journal of Sports Medicine

Take Home Messages

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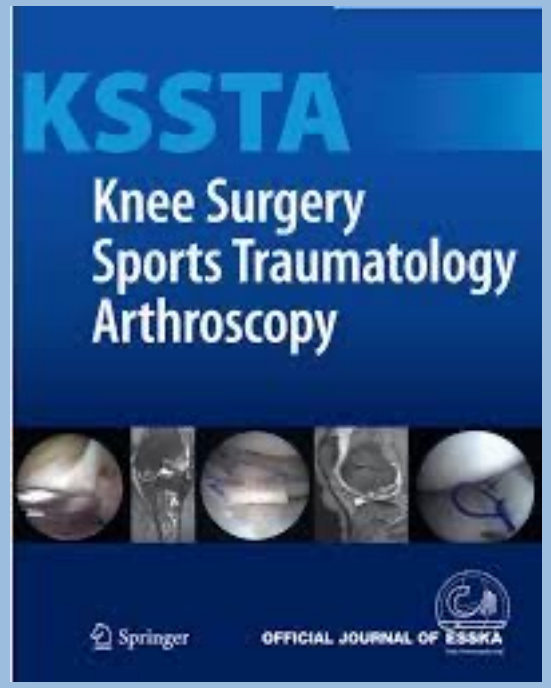
- Existen múltiples métodos de medición de defecto óseo basados en el circulo inferior glenoideo
- Sin embargo, la aplicación de este circulo es una fuente de error
- Alta correlación estadística entre los círculos interno y externo glenoideos (círculos de Sugaya e Itoi) con un ratio **0.74**
- Diámetro del circulo interno se puede predecir a partir del circulo externo
  - **D. círculo interno= 0.72 + 0.72 x D. círculo externo**
- Recomendamos el uso de esta técnica para mejorar la reproducibilidad y estandarización de las técnicas de medición de defectos óseos

Aceptado para publicación



¡MUCHAS GRACIAS!

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