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ePoster #60: IODA-Shoulder: A Three-Dimensional Automated Software for Glenoid Bone Loss Quantification in Shoulder Instability

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DISCLOSURES

M. Maiotti, M.-O. Gauci and M. Cavaliere have participation into IODA S.r.l.

Objective of the study

1) To develop and validate a new semi-automated software, IODA-shoulder, for improved calculation of GBL using 3D imaging processing.

2) Compare the IODA output to the PICO area method to assess its reliability and accuracy.

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Materials and methods

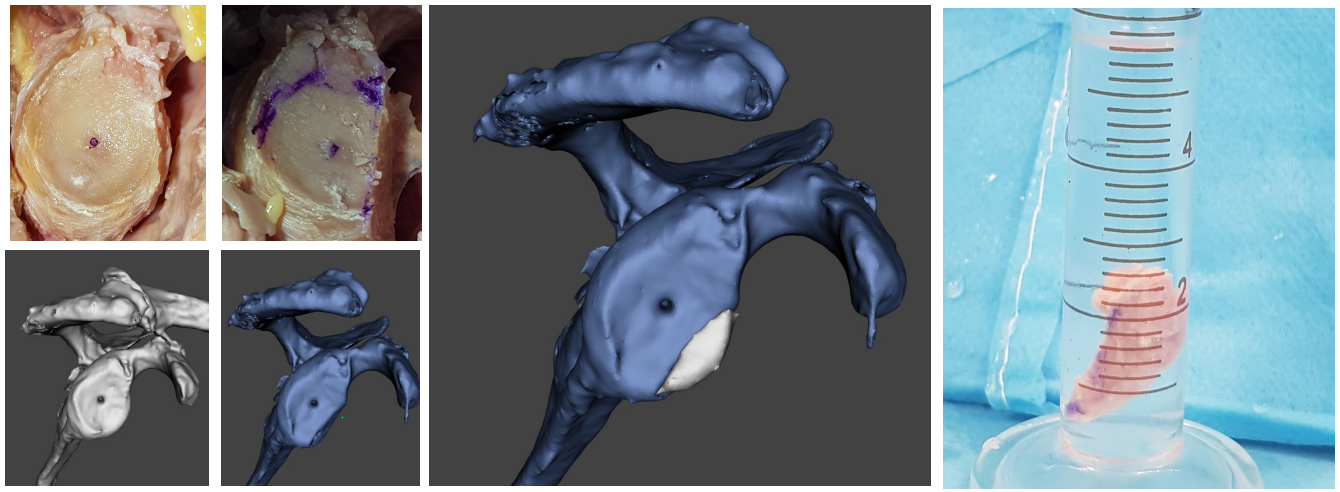
Preliminary *in vitro* study: The semi-automated IODA software was initially developed and validated using 7 fresh frozen specimens (aged 55 to 78 years) with handmade glenoid defects, utilizing the water displacement method.

Clinical study: the IODA software was applied to DICOM images of 20 patients with shoulder instability with bone defect.

Inclusion criteria were unilateral dislocation and a minimum of 2 dislocation episodes

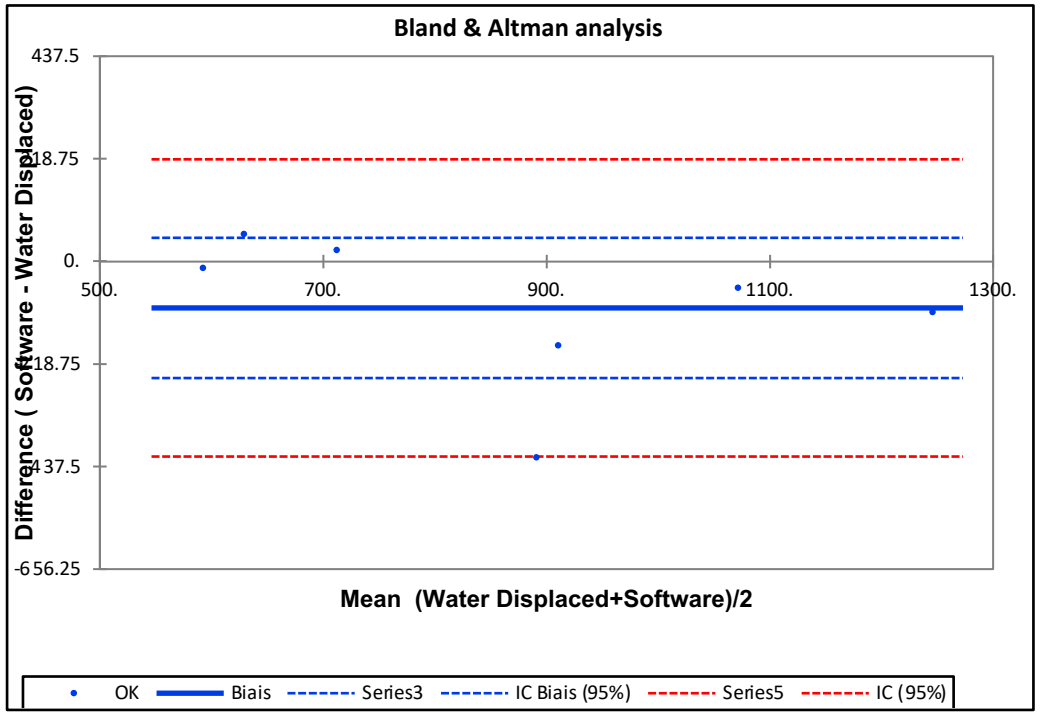
Exclusion criteria were previous glenoid bone reconstruction, failed shoulder stabilization, bilateral dislocation, and shoulder arthritis.

Three-dimensional computed tomography images of both shoulders were obtained for each patient, and GBL was determined using two methods: the PICO surface area method and the new IODA method. Intra- and inter-rater reliability of the two methods were assessed using the Intraclass Correlation Coefficient (ICC), Bland-Altman analysis, and Lin's concordance correlation coefficient (CCC).



Results – preliminary in vitro

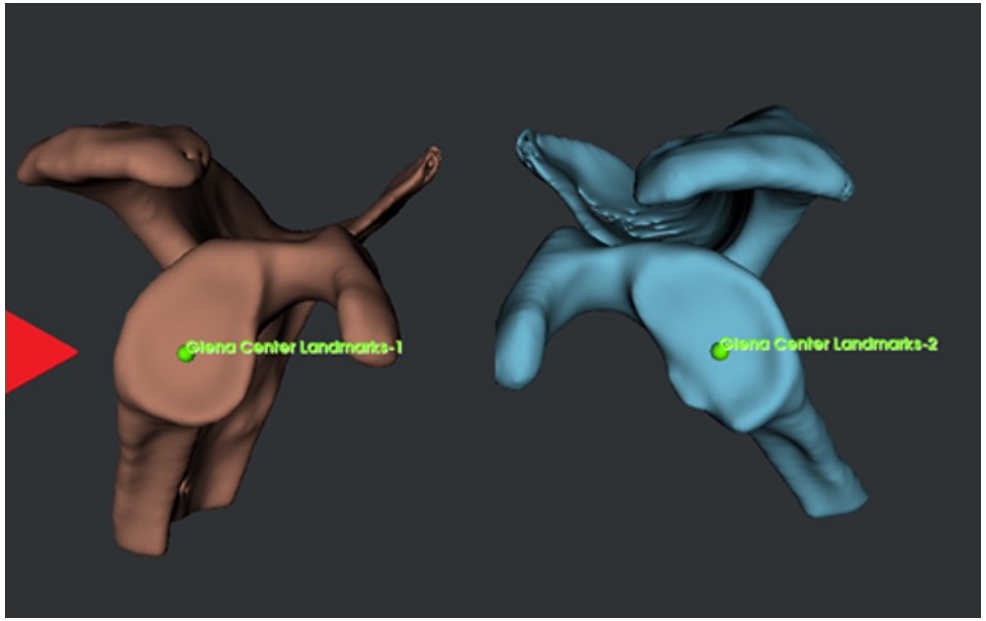
Water Displacement measure (mm3)	3D software prototype measure (mm3)
1100	1043
1000	821
1100	682
600	585
1300	1192
600	658
700	724

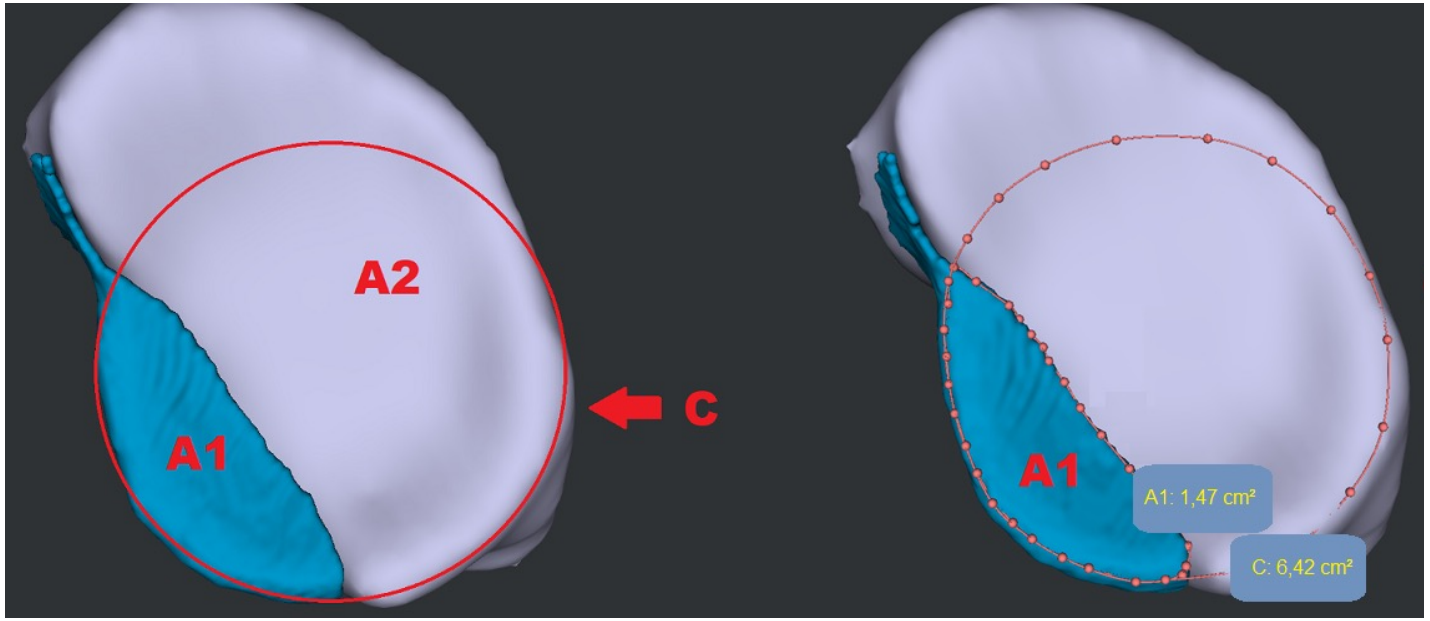


In the first phase of the study we did not find a statistically significant difference between the average volumes calculated with the 2 methods "Water displacement" and IODA, respectively 914±279 vs. 815±223 mm^3 (p = 0.155).

Results – clinical study

The IODA method demonstrated higher concordance rates among four observers compared to the PICO method, irrespective of defect size and location. The ICC agreement was significantly higher with the IODA method (0.97) compared to the PICO method (0.76). The CCC was poor with the PICO method (ranging from 0.65 to 0.81) and substantial with the IODA method (ranging from 0.96 to 0.98).

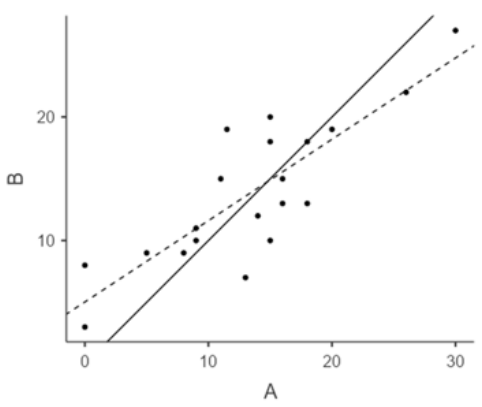


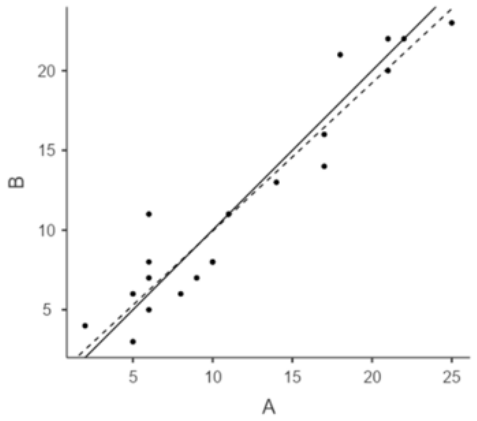


Lin’s concordance results

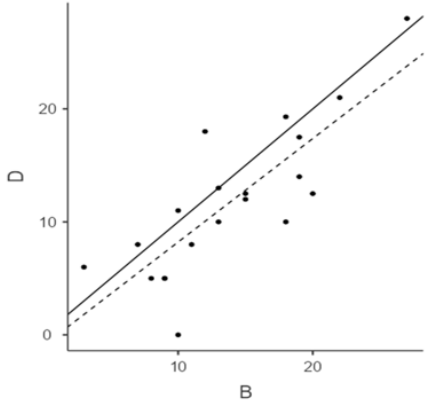
PICO **IODA** **PICO** **IODA**

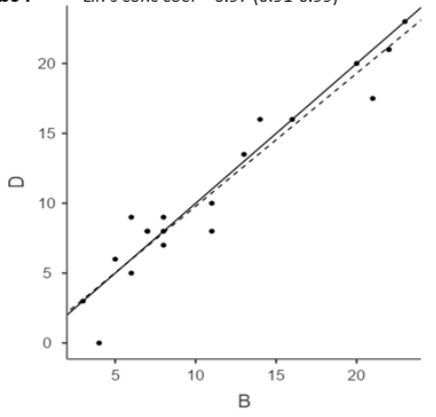
Lin’s conc coef = 0.81 (0.60-0.91) **Obs1 vs Obs2** Lin’s conc coef = 0.96 (0.89-0.98)



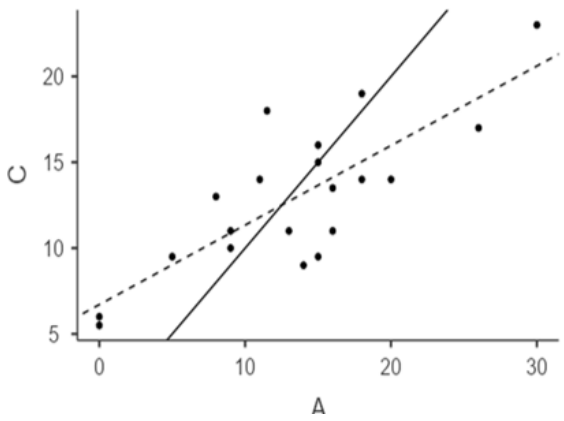


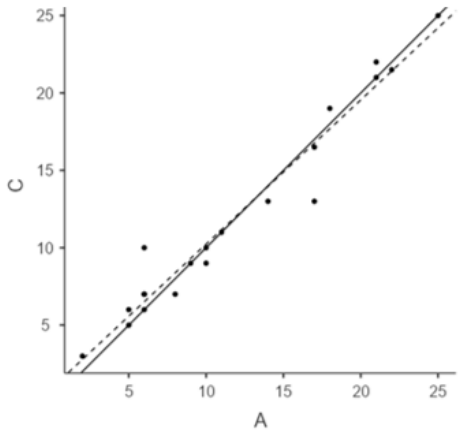
Lin’s conc coef = 0.76 (0.52-0.89) **Obs2 vs Obs4** Lin’s conc coef = 0.97 (0.91-0.99)



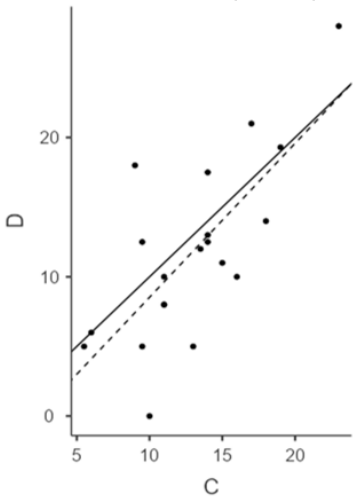


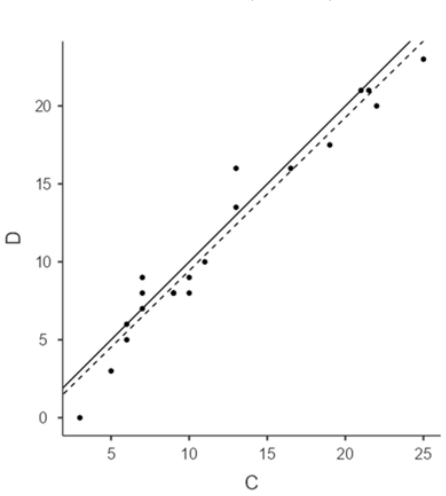
Lin’s conc coef = 0.69 (0.46-0.83) **Obs1 vs Obs3** Lin’s conc coef = 0.98 (0.94-0.90)





Lin’s conc coef 0.65 (0.38-0.82) **Obs3 vs Obs4** Lin’s conc coef = 0.97 (0.91-0.99)





Discussion

IODA software provides a more accurate estimation of Glenoid Bone Loss (GBL) compared to the PICO method, both in ex vivo and clinical settings.

The IODA method exhibited minimal deviation from perfect concordance, indicating greater agreement among observers. Additionally, the time required for the PICO method was considerably reduced.

These results support the hypothesis that the IODA software reduces dependency on user skill and expertise, leading to improved measurement accuracy and reduced timing.

Conclusion

The study demonstrates the effectiveness of the IODA software, providing a reliable and reproducible method for GBL estimation.

Although there are limitations to this preliminary study, it serves as a foundation for future clinical investigations and highlights the potential of the automated 3D-based IODA software for accurate GBL estimation with excellent inter-observer reliability.

Future perspectives: development of a full-automated IODA software, for estimation of GBL, Hill-Sachs location and size and glenoid track