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IN VITRO METHODS TO TEST THE STABILITY OF ACETABULAR PROSTHESIS IN PRESENCE OF LARGE BONE DEFECTS

INTRODUCTION

Understanding the mechanical behaviour of the hip bone from the acetabular side under different loading conditions is extremely important because it can allow to overcome many clinical problems like the choice among different surgical approaches, different revision components and different bone reconstruction techniques. Despite the problems above, efforts to understand the mechanical behaviour of the acetabular cup can be found mostly *in silico* (FE analysis) and *in vivo* (gait analysis) and the few *in vitro* studies on the cup are not rigorous or miss detailed information. Moreover, no studies concerning *in vitro* test on hip bone with revision implants can be found in the literature.

AIMS OF THE FIRST YEAR

- Define a reference frame for hemipelvis and a standard procedure for the alignment and implant of acetabular cup
- Standardize and reproduce bone defects *in vitro*
- Select the motor task to evaluate the primary stability and define load and the loading protocol. Create the loading setup.
- Create a standard procedure for the application of the LVDTs.
- Make preliminary mechanical tests.

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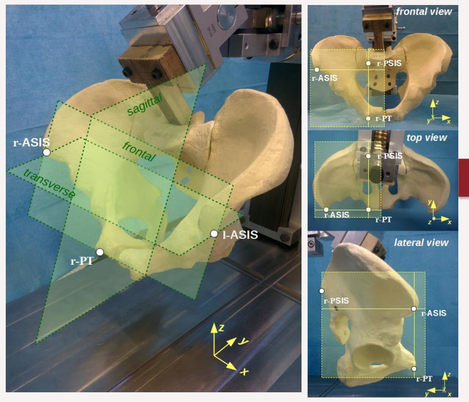
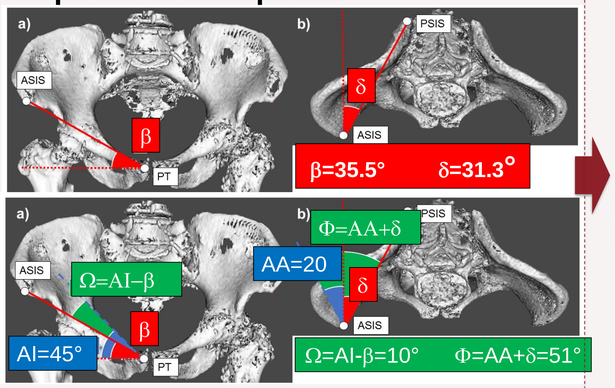
EXPERIMENTAL PROCEDURE AND RESULTS OF THE FIRST YEAR

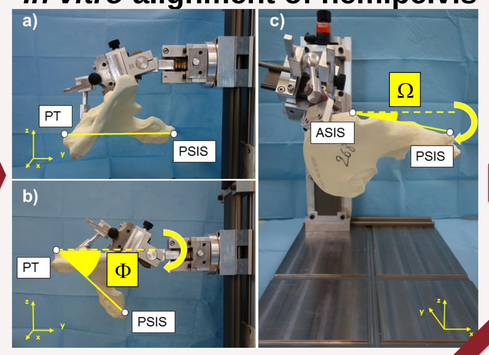
Reference frame: from pelvis to hemipelvis



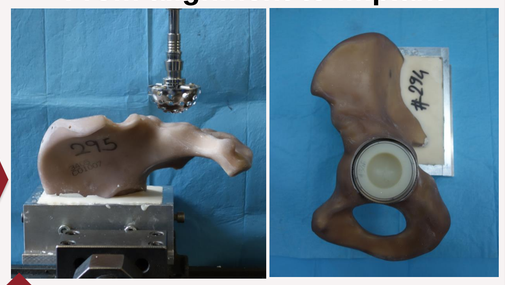


AA and AI define a standard acetabular plane (SAP)

In vitro alignment of hemipelvis

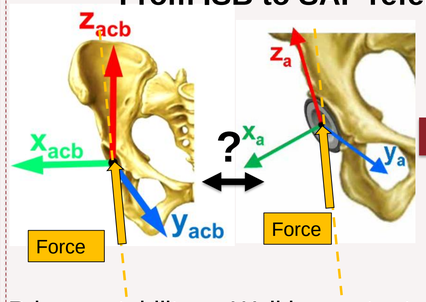


From alignment to implant

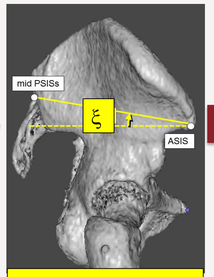


- Reamer perpendicular to SAP
- Diameter of reamer 1mm > diameter of acetabulum
- Depth= 10% radius of acetabulum
- Implant perpendicular to SAP

From ISB to SAP reference frame

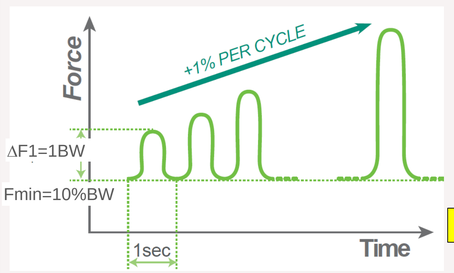


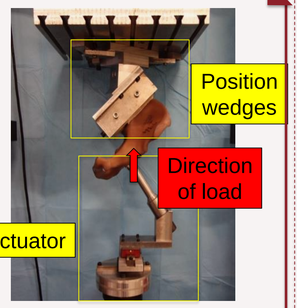
Primary stability → Walking motor task



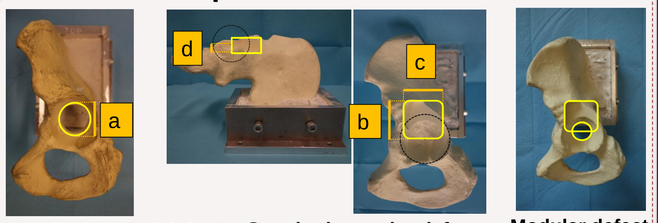
ξ: Intersubject variation = ±6°

Loading protocol and setup





In vitro reproduction of bone defects



Standard central defect
- Defect is drilled
- Normalized defect: a = 2 R· *f* (e.g. *f* = 50%)

Standard superior defect
- Defect is reamed
- Normalized defect: b = 20 + R , d=R/2 c = 2 R · *h* (e.g *h* = 70%)

Modular defect

CONCLUSIONS

A preliminary standard procedure to test the primary stability of acetabular cups was developed. This standardization will allow to compare different implant devices as well as different bone reconstructions.

NEXT STEPS

- Perform biomechanical tests on primary implants
- Measure the repeatability of the whole procedure
- Analyze the displacement through DIC
- Reproduce critical bone defects

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REFERENCES

Morosato F. Traina F., Cristofolini L. 2017 Standardization of hemipelvis alignment for *in vitro* biomechanical testing. *J Ortho Res*. Under review.

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IL PRESENTE MATERIALE È RISERVATO AL PERSONALE DELL'UNIVERSITÀ DI BOLOGNA E NON PUÒ ESSERE UTILIZZATO AI TERMINI DI LEGGE DA ALTRE PERSONE O PER FINI NON ISTITUZIONALI