Articular Stability Control with computer navigation in hip surgery. CT-less new strategies.

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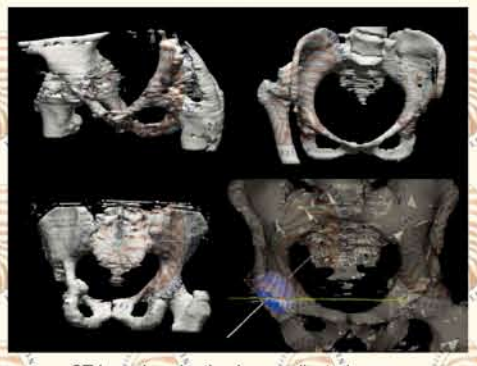
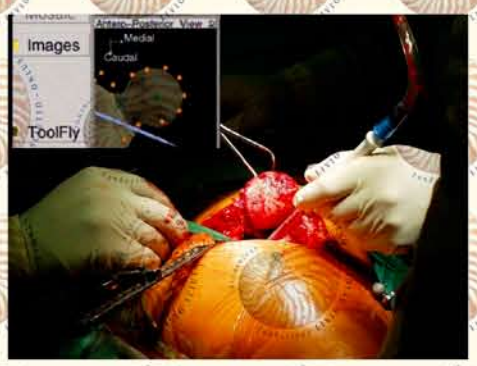


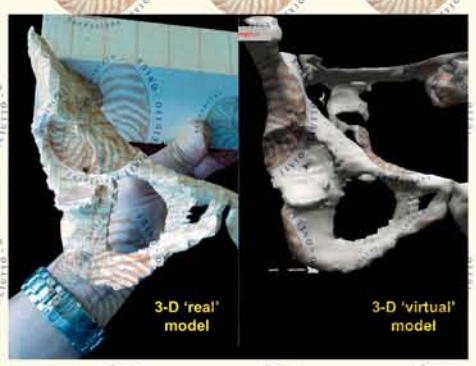
CT based navigation in complicated cases

CT-less navigation invert cost-benefit relation

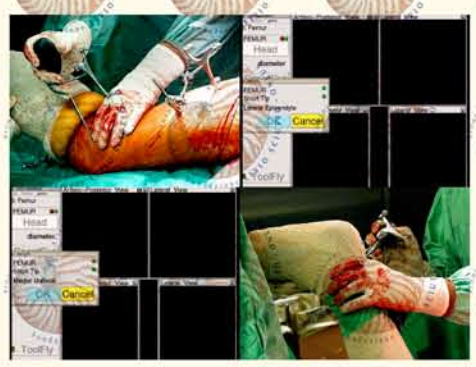
The CT-less navigation method permits a direct creation of the 3-D model, both pelvic...



...and femur, from actual T.H.R. surgery



These generated objects should be placed in a virtual space in which the coordinate system derives from the osseus reference point of the patient



The femural canal is orientated according to the femur condyles and the two tibial malleolus

Aims, Background:
The advantages brought about by computer assisted surgery are, from a theoretical viewpoint, undisputed.
The high benefits-cost of navigation based on CT scan for T.H.A. have affected, in our experience, the chance for this method to be used in ordinary, standard surgical activity.
However it has enriched our knowledge of biomechanics and 3D hip planning by representing a useful support-device in complicated cases of prosthetic surgery.

CT-less navigation obviously inverts the cost–benefits relation, not only in economical terms, as it is virtually cost-free, but above all by generating further information which benefits the surgeon in an easy, direct and efficient way.

Methods:
At our centre we have therefore started a clinical experiment using the method carried out by the company ORTHOSOFT and substantially based on similar principles to those already used in CT-less knee navigation.
This method enables us to gather landmarks for the orientation of femural and acetabular components and to juxtapose them by respecting or clearly modifying the centre of rotation with intra-operative re-planning. In addition this results in a chance to carefully check the limb's dysmetria matter.

Results:
Preliminar results are encouraging, the goals as planned have been acheved.
Software refining and standardisation of surgical manoeuvres will enable surgical time to be contained.

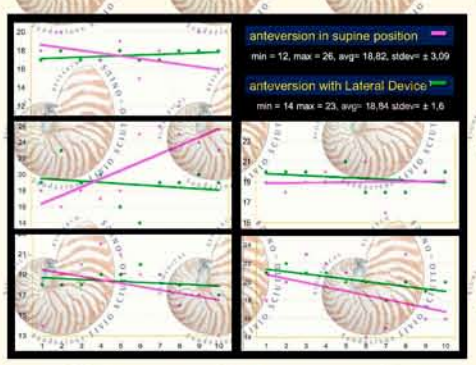
Conclusion:
Looking towards the future, CT-less navigation could constitute an effective device to further elevate the qualitative standards of prosthetic hip surgery.

The pelvic bone is again orientated by a surreal supportive plain that slightly touches both the anterior superior iliac spline and the pubic tubercle.

The problem in finding anatomic references in the lateral position was resolved by using a 3-point lateral device.

Anterior Pelvic Plane Supine vs. Lateral Device™ in a cadaveric study

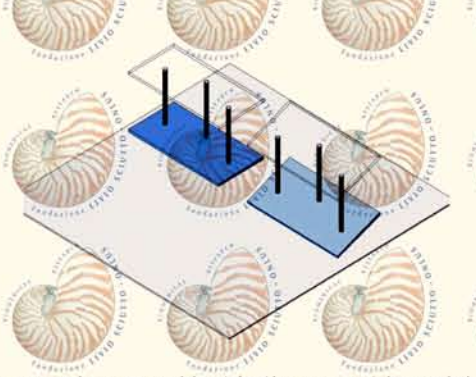
- Cup strongly fixed in each acetabulum with 4 screws
- Perfect supine position
- Cadavers in lateral position fixed with the Lateral Device™
- References digitized for both crests and pubic tubercule
- Armin= 5 rounds in supine and 5 rounds in lateral for each cadaver
- SPD= 5 rounds in supine and 5 rounds in lateral for each cadaver
- Twice bony digitations in supine & twice in lateral

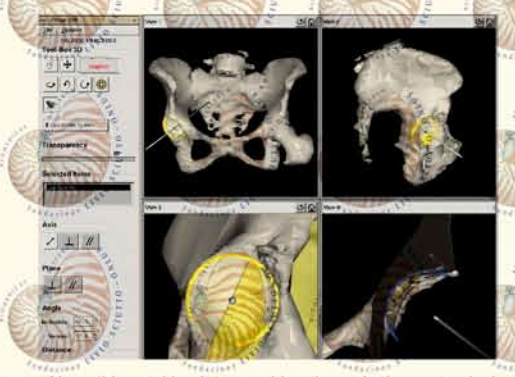


Preliminary Results

- Graphs show variation between bony references and points digitized for supine & lateral
- Better reproducibility with the Lateral Device™ than the supine digitization
- Should we need a more or less same concept for the supine position?

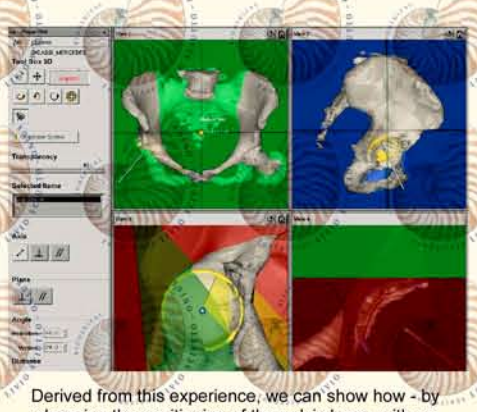
As demonstrated on the corpse, the 3-point lateral device system is reliable and repeatable in comparison to a direct reference pointing in the supine position



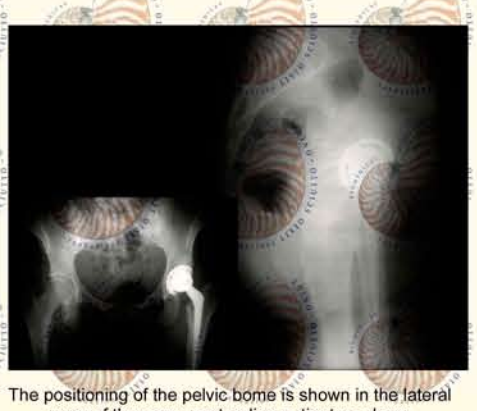


In the above three examples, an imperfect axes positioning of the pelvic bone does not affect the procedure as evident in the geometric model

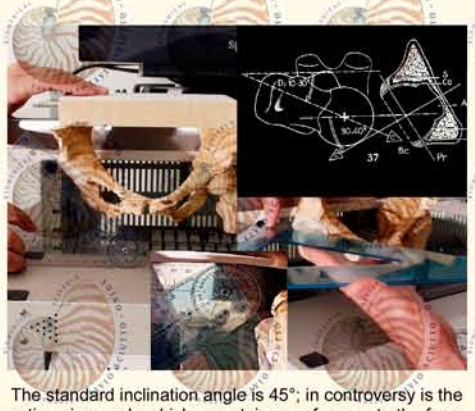
Neverthless taking into consideration only the anatomical references some limits are met. Exactly the same as the problem we had with the previous CT-based technique.



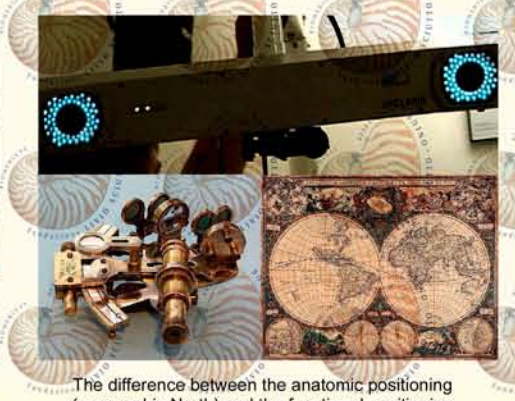
Derived from this experience, we can show how - by changing the positioning of the pelvic bone, with an already inserted cup, we have a considerable variation of the inclination and antiversion of the "navigated" cup



The positioning of the pelvic bome is shown in the lateral x-ray of the same upstanding patient as above

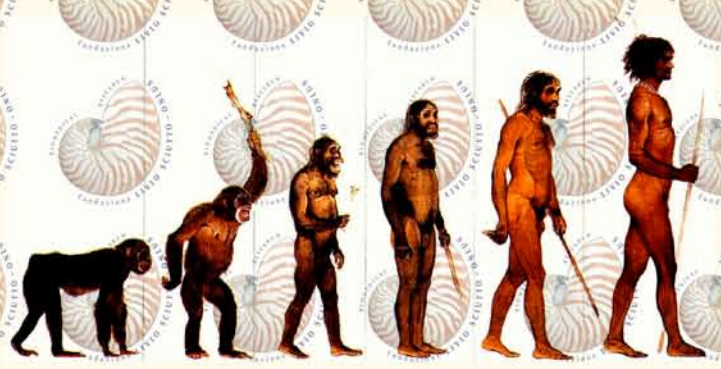


The standard inclination angle is 45°; in controversy is the antiversion angle which we retain as reference to the functional position according to the standard physiology should be between 30°- 40° as projected in the horizontal plain

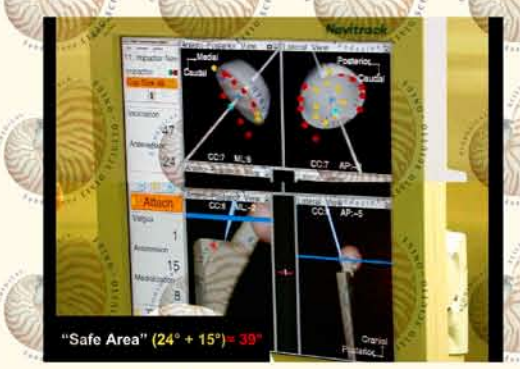


The difference between the anatomic positioning (geographic North) and the functional positioning (magnetic North) is evident

An example of the direct measurments in a tilting pelvic bone



In other words the tiltting of the pelvic bone variates from person to person and should be kept in mind when giving a correct antiversion to the impants



The GOAL has been achieved!