



Dipartimento Integrato Interistituzionale  
DIPINT



Primo Workshop  
*Clinical Research and Innovation*

**Patient specific approaches based on new technologies to plan and to guide the surgical act in plastic surgery, gynecologic surgery and orthopedic surgery**

**Paolo D. Parchi** (1st Orthopedic Division Chief Prof Michele Lisanti)

**Plastic  
Surgery**

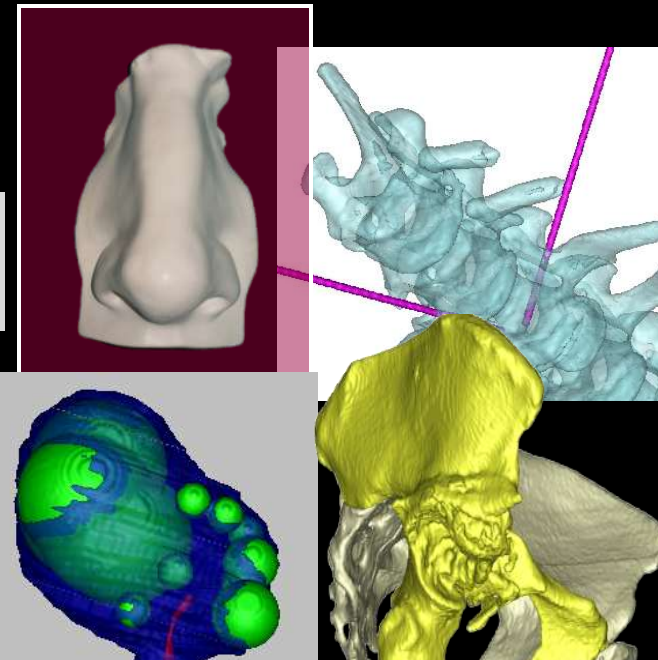
**Marcello Pantaloni**  
U.O.C. of Plastic Surgery

**Gynecologic  
Surgery**

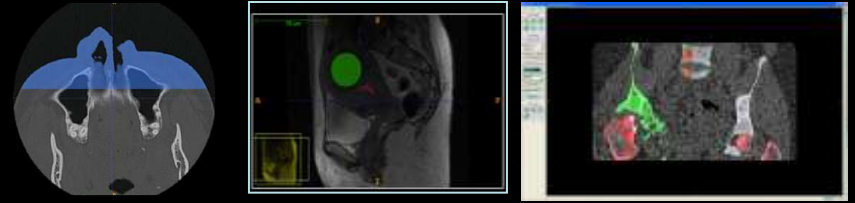
**Tommaso Simoncini**  
Ostetric and Gynecologic Division University of Pisa

**Orthopedic  
Surgery**

**Paolo D. Parchi**  
1st Orthopedic Division University of Pisa



Medical Data (Rx, CT, MRI ...)



Computer Aided Design

3D Virtual Model

Rapid Prototyping

3D Solid Model

Surgical Guides

Preoperative Virtual Planning

Computer Assisted Surgery

*Patient specific approaches based on new technologies to plan and to guide the surgical act*

Preoperative Physical Planning

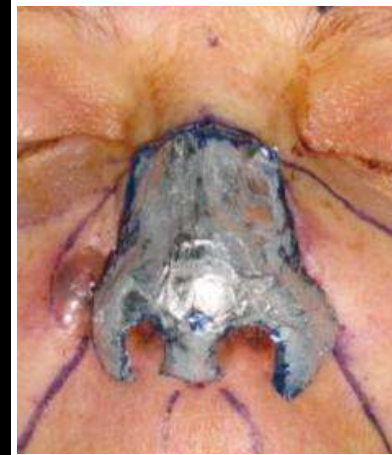
Design Custom Made Implants

Patient's Specific Instrumentation

- Nasal cast
- Carved nasal sculpture
- nasal model from 3D processing of CT images



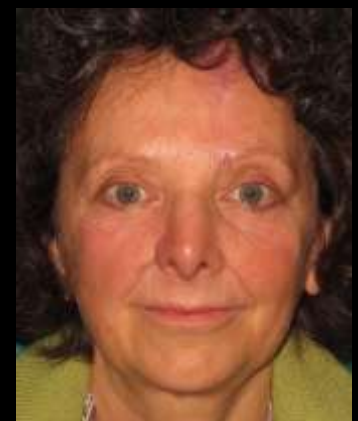
**Cast - Template**



**Nasal Footprint**



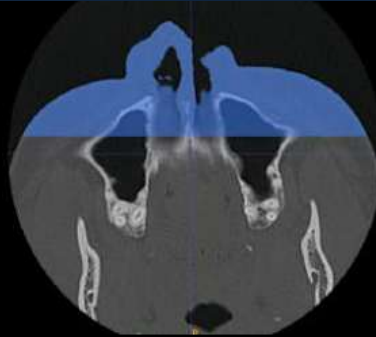
**Flaps Design**



- **Nasal cast**
- **Carved nasal sculpture**



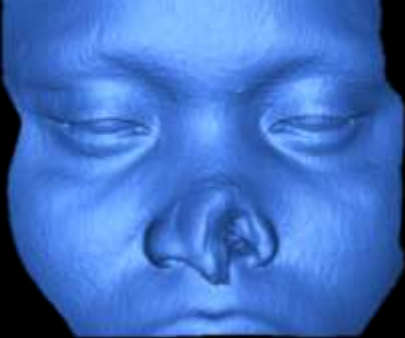
**CT Segmentation**

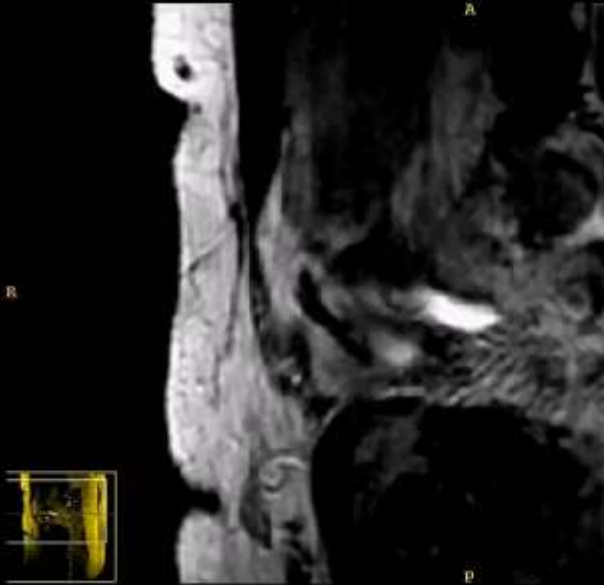


**3D Physical Model**

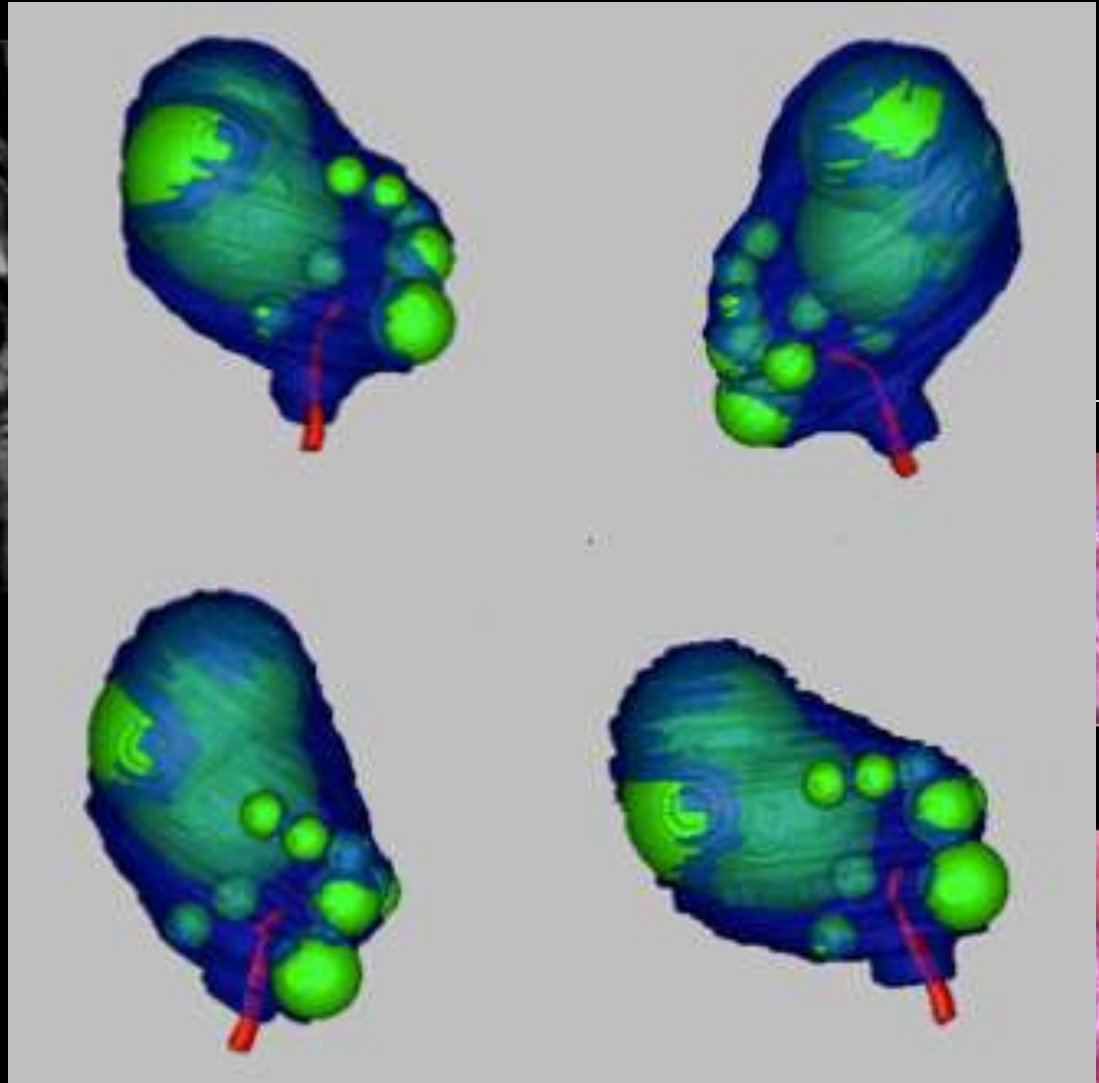


**3D Virtual Model**





**Corrispondence between  
preoperative Plannig and  
intraoperative Findings**



**EFFECTS ON SURGICAL PROCEDURE:**

**OPEN SURGERY  Mini-invasive Surgery**

	OPEN	MINI-INVASIVE
<i>Before using 3D Models</i>	6	12
<i>After using 3D Models</i>	2	16

**= 22,2%**

**ISTERECTOMY vs MIOMECTOMY**

	ISTERECTOMY LPS	MIOMECTOMY LPS
<i>Before using 3D Models</i>	12	4
<i>After using 3D Models</i>	7	9

**= 31,2%**

**EFFECTS ON SURGICAL PROCEDURE:**

**SURGICAL TIME (miomectomy):**

**MIOMECTOMY**

**ULTRASOUND**

**47 ± 31 min**

**US + RMN + 3D Model**

**28 ± 11 min**

**INTRAOPERATIVE 3D Model CONSULTATION:**

**MIOMECTOMY 1-2 MIOMS**

**MIOMECTOMY > 2 MIOMS**

**1,25 TIMES**

**3,75 TIMES**

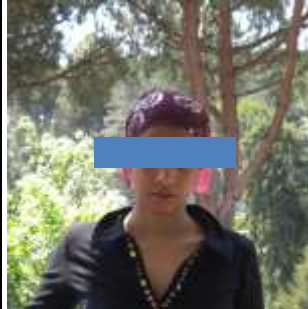
### Computer Tomography Prototyping and Virtual Procedure Simulation in Difficult Cases of Hip Replacement Surgery

Paolo Domenico Pardi, MD  
 Giuseppe De Santis, MSc  
 University of Pisa, Pisa, Italy

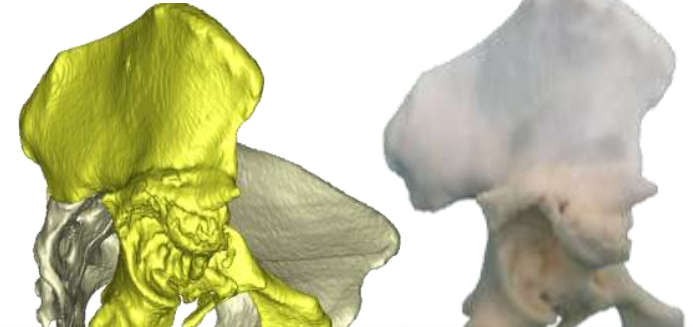
Yves Van Der Perren, MD  
 University of Pisa, Pisa, Italy

Enrico Ciampi  
 University of Pisa, Pisa, Italy

Giuseppe Di Stefano, MD  
 University of Pisa, Pisa, Italy



Female 23 years old  
 shotgun lesion at  
 the right hip



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ORIGINAL ARTICLE

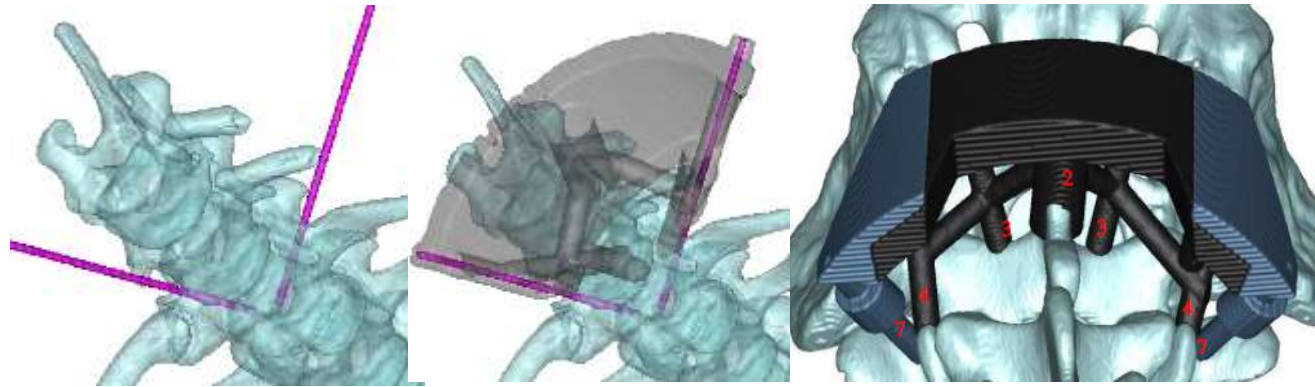
### An optimal design for patient-specific templates for pedicle spine screws placement

V. Ferraro<sup>1</sup>  
 P. Pardi<sup>1,2</sup>  
 S. Gandino<sup>1</sup>  
 M. Carbone<sup>1</sup>  
 A. Balugani<sup>1</sup>  
 M. Fimiani<sup>1</sup>  
 F. Mosca<sup>1</sup>  
 M. Lizzini<sup>1</sup>

**Abstract**

**Background:** Currently, pedicle screws are positioned using a freehand technique or under fluoroscopic guidance, with errors in the range 10–40%, depending on the skill of the surgeon.

**Methods:** After spine CT acquisition, each vertebra is segmented and the template plane screw positioning is a virtual environment. Then, the template is arranged around the chosen vertebrae. This design is based on surgical and mechanical considerations to create an optimal solution to guarantee template stability, simple positioning and minimized kinematical interferences. In vitro evaluation on synthetic spine models and on nine animal tests on porcine specimens were performed, with the insertion of 33 Kirschner wires.



Preoperative Virtual Planning

Patient's Specific Instrumentation

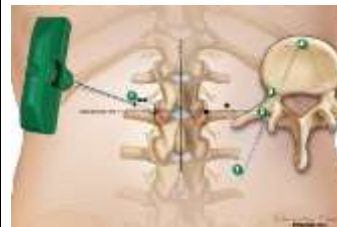
University of Pisa PATENT



93% error < 1 mm

7% error 1-2 mm



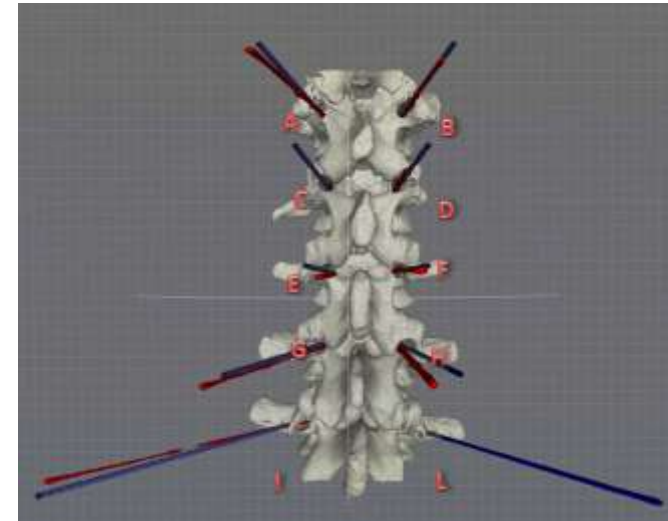
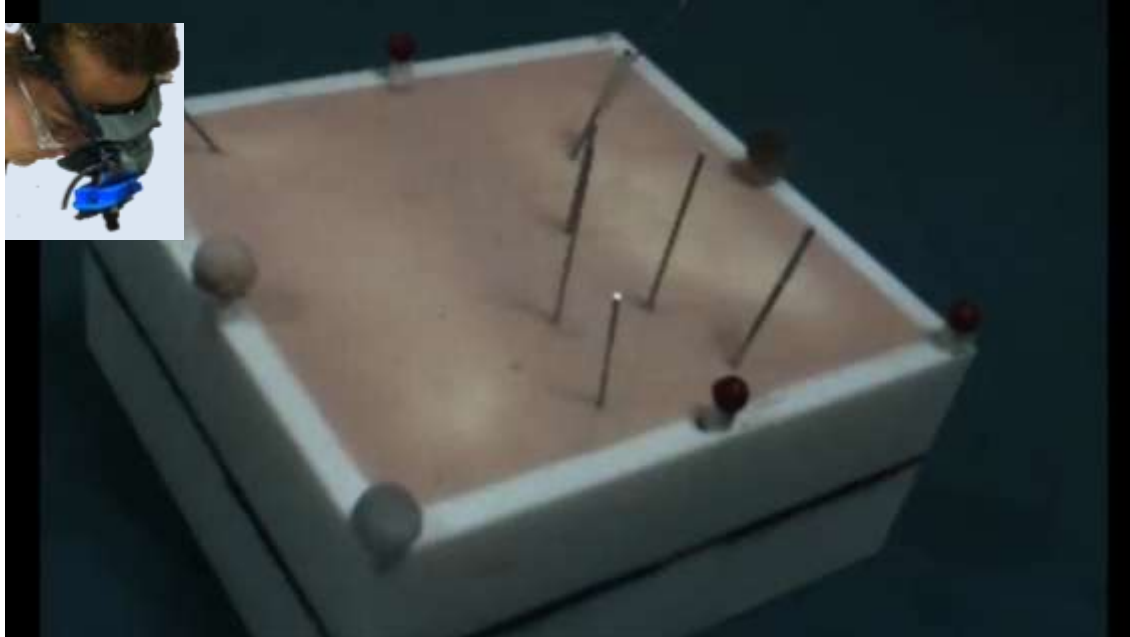


Preoperative Virtual Planning

Augmented Reality Setup

Computer Assisted Surgery

**In Vitro Test**



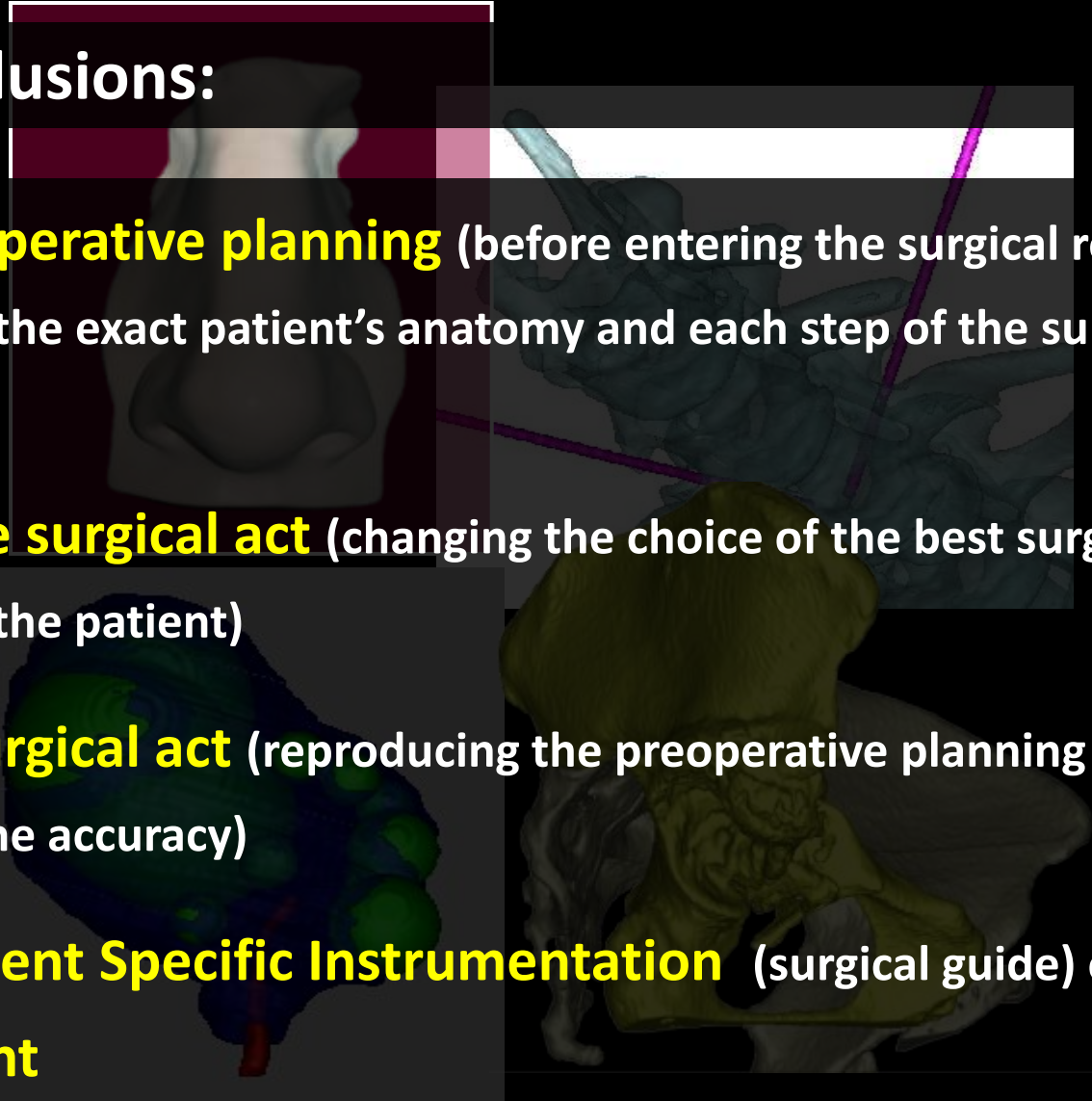
**CT scan Accuracy evaluation**

**Medium error of 1.48+/-0.81 mm**

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## General Conclusions:

- **Precise preoperative planning** (before entering the surgical room the surgeon kown the exact patient's anatomy and each step of the surgical procedure )
- **Optimize the surgical act** (changing the choice of the best surgical technique for the patient)
- **Guide the surgical act** (reproducing the preoperative planning and improving of the accuracy)
- **Use of a Patient Specific Instrumentation** (surgical guide) or **Custom made Implant**



Thanks for your attention

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ENDOCAS