Computer-Aided Surgery:

Robotics for digestive surgery and obstetrics

Soft tissues modeling for maxillo-facial surgery

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&
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Computer Assisted Medical Intervention Group
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TIMC Laboratory
Computer Aided Medical Intervention Group

- 15 years old
- About 35 persons
- More than 200 publications and 15 international patents
- 3 ongoing European project
- Creation of Praxim Company

Main goal: "to assist the clinician and the surgeon in the realization of diagnostic or therapeutic intervention, in the most accurate and minimally-invasive way"

PLAN

- Context : TIMC Lab
- Robotics for digestive surgery and obstetrics
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Robots in the OR: a classification

- *Passive* systems
  - give information to the surgeon
- *Active* systems
  - realize the intervention with human supervision
- *Interactive* systems: mechanical guides
  - Semi-active devices
  - Synergistic devices
- *Teleoperated* devices

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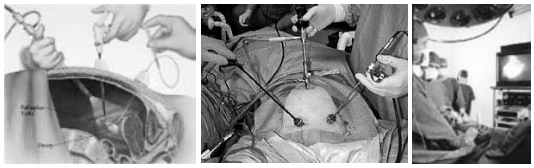
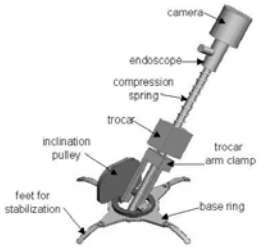
Laparoscopy



- Minimally invasive abdomenal surgery
- Surgical intervention through keyhole incisions
- Endoscope camera to observe interior on video display
- 3-6 incisions for instruments

Robot for laparoscopy:
a third hand assistant

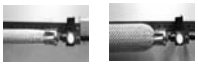


- System rests on patient abdomen
- Controls insertion depth and orientation of endoscope
- Lightweight, compact, simple to setup and use compared to current endoscope robots
- Uses standard endoscopes and trocars

Robot for laparoscopy:
a third hand assistant

Robot for tele-echography

- Objective: the remote control of an echographic probe by an expert
- Master workstation integrating haptic feedback
- Use of a light and compliant slave robot based on 2 parallel structures and pneumatic actuators (McKibben muscles)



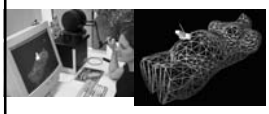
Pantograph textile shell

TIMC, LVR, FT R&D, Sinters, Praxim, CHU Tours, CHU Grenoble

Robot for tele-echography:
components

Master control

Slave robot



(ISDN network)

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Orthognatic surgery

Orthognathic surgery is directed to patients suffering from malformations of the lower part of the face

orthodontic

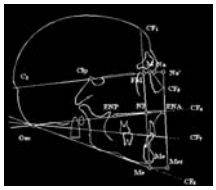
aesthetic

functionnal

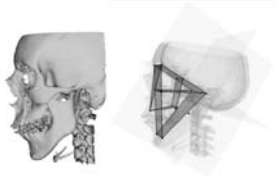
Orthognatic surgery

Bones cuttings and repositioning:

2D Cephalometry
from sagittal radiography



3D Cephalometry
from CT scanner



Bettega, Payan et al. (2000) *Journal of Computer Aided Surgery.*

Orthognatic surgery

Bones cuttings and repositioning:

Orthognatic surgery

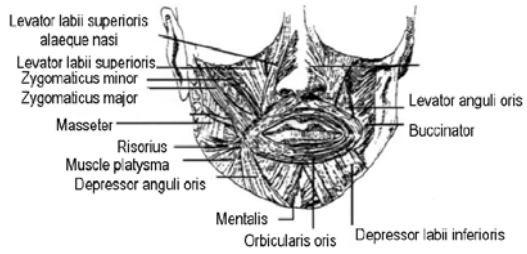
Bones cuttings and repositioning:

Orthognatic surgery

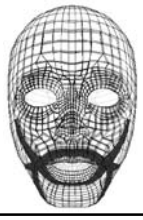
Next step: To take into account the face soft tissue deformations resulting from bone repositioning, in order to predict:

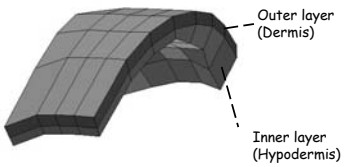
- the patient aesthetic aspect after surgery
- the functional consequences (facial mimics, mastication, speech production)

Face anatomy

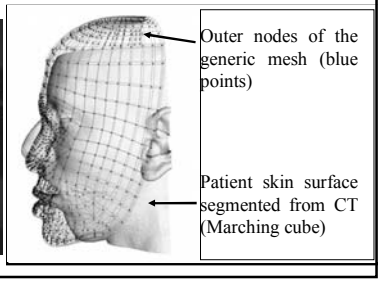


Generic Finite Element face model





Confromation of the generic model to patient morphology



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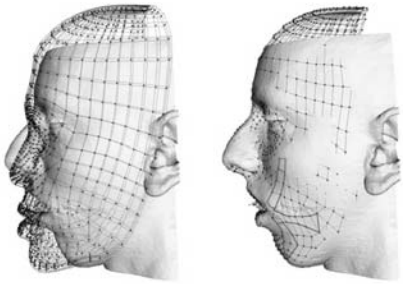

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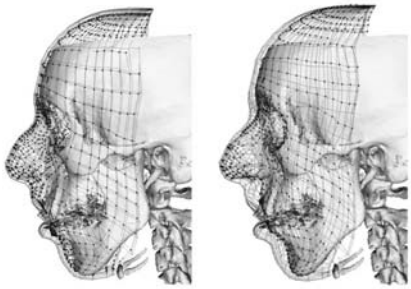
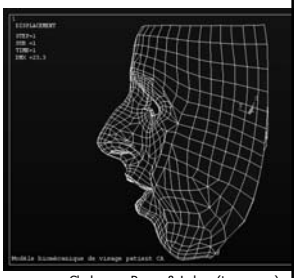


Finite Element Simulations of the bone repositioning consequences



Chabanas, Payan & Luboz (to appear)
Medical Image Analysis.

Finite Element Simulations of the bone repositioning consequences

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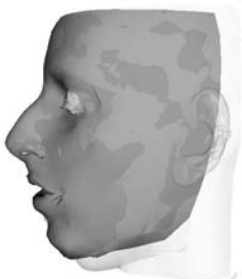
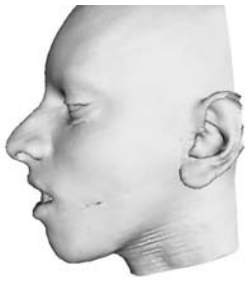


Simulations validations: comparisons with post-operative CT data



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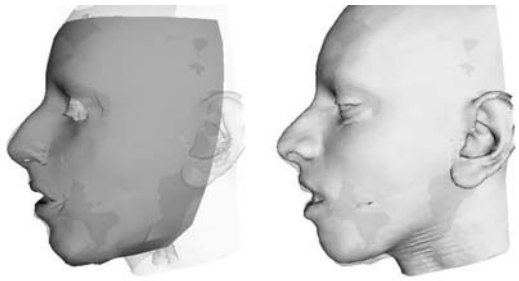

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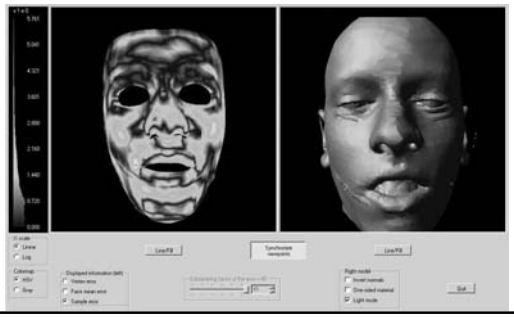

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