Skull base robot-assisted indentation to identify force at break

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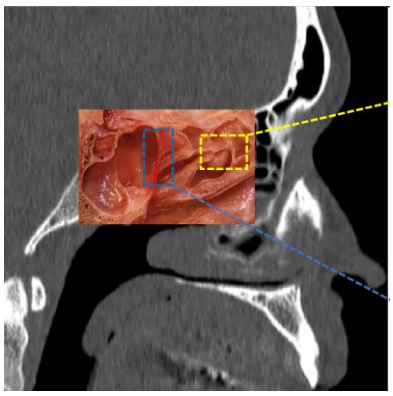


Context

The **mechanical characterization of skull base** bones is challenging[1] but mandatory for endoscopic surgeons who apply forces near the encephale, optic nerves and internal carotid arteries. This biomechanical knowledege is required to allow surgeon to train their **haptic feedback**[2]. The aim of our project is to improve biomechanical knowledge of the ethmoid, frontal and sphenoid bones making up the anterior and middle skull base, by analyzing **forces at break**. We propose a macroscopic approach on cadaveric heads.

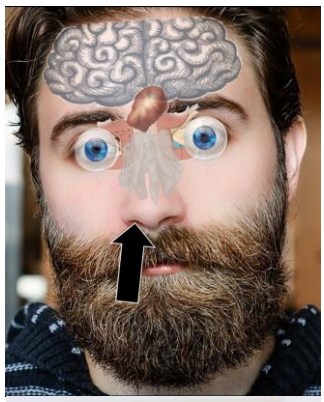
Research topic

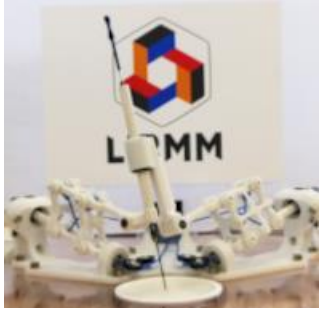
Two characterization methods on cadavers:

1. Standardized robotic-assisted indentation to reproduce a surgical complication (meningeal injury) and measure the forces at bone break
2. Real-time stresses measured during cadaveric head surgery to give the range of forces exerted during uncomplicated surgery.

Material and skills

- Robotic indentor
- Design of dedicated force sensors
- Finite Element Analysis





Perspectives

Haptic feedback for endoscopic skull base surgery simulation

Robot-assisted endoscopic surgery

Improving patient safety

Sensors to improve patient safety in the operating theater

Better understanding of traumatic mechanisms

References

1. Serantoni V, Faraj N, Subsol G, Rondet E, Ollier L, Captier G, et al. In-situ tensile test under microtomography to characterize mechanical behavior of ethmoid bone: a preliminary study. Computer Methods in Biomechanics and Biomedical Engineering. 2020 Oct 19;23(sup1):S279–81.
2. Favier V, Subsol G, Duraes M, Captier G, Gallet P. Haptic Fidelity: The Game Changer in Surgical Simulators for the Next Decade? Front Oncol. 2021;11:713343.