3D-FEA of the Relationship Between the Occiput and Sphenoid in the Osteopathic Paradigm

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Abstract

INTRODUCTION: The concept of cranial Primary Respiratory Mechanism (MRP) is used by osteopathic practitioners to explain, in clinical, the perceptual characteristics arising from the palpation approach of the human skull. [1]

The theoretical apparatus and the same MRP 's existence is always element of controversy among the scientific community. [1]

OBJECTIVE: Analyze the mechanical effects of a pressure load, in the physiological intracranial pressure fluctuation range (phyICP) [2], applied on the endocranial surfaces of occiput and sphenoid, considered in natural synostosis. [3]. Assess if the resulting displacement belongs to the perceptual ability of the human touch.

MATERIALS AND METHOD: I got from an healthy adult male volunteers TC scan (0, 75 mm per slices) four 3D models (Mimics Innovation Suite) of occiput and sphenoid cortical and diploe components. (figure1 and figure 2)

On these models I performed a structural mechanics FE-analysis on the pressure condition of 5 mmHg and 15 mmHg.

RESULTS: The articular relationship between occiput and sphenoid in the physiological condition of synostosis, allows a measurable deformation of the same bones, plotted as displacement. (figure 3)

The arithmetic differences of the average on the displacements obtained from the two pressure loads are included in the human tactile discrimination range. [4]

CONCLUSION: This highlights, for the first time in the history of Osteopathy, the intrinsic capability of the bone of human skull base to adapt the periodic fluctuations of ICP, supporting the thesis of the physical existence of MRP and its palpation.

Reference

1. A. Ferguson, «A review of the physiology of cranial osteopathy.» journal of osteopathic medicine 6(2), 74-88, (2003).

2. M. Wagshul and al, «The pulsatile brain: A review of experimental and clinical studies of intracranial pulsatility.» Fluids Barriers CNS, 8:5, (2011).

3. D. Franklin and al, «Brief communication: Timing of spheno-occipital closure in modern Western Australians.» American Journal of physical anthropology, 153, 132-138, (2014).

4. L. Skedung et Al. «Feeling small: Exploring the Tactile Perception Limits.» Scientific reports 3(2617), (2013).

Figures used in the abstract

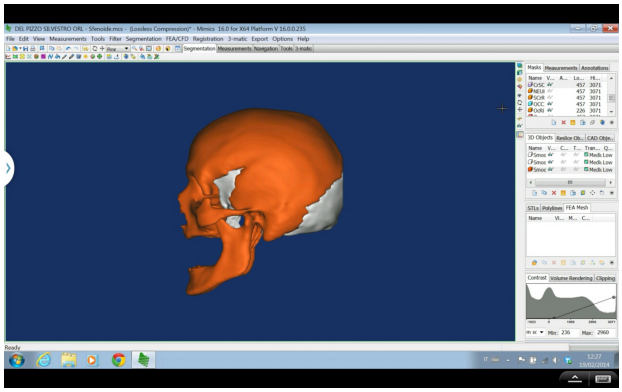

Figure 1: 3d-model of human skull.

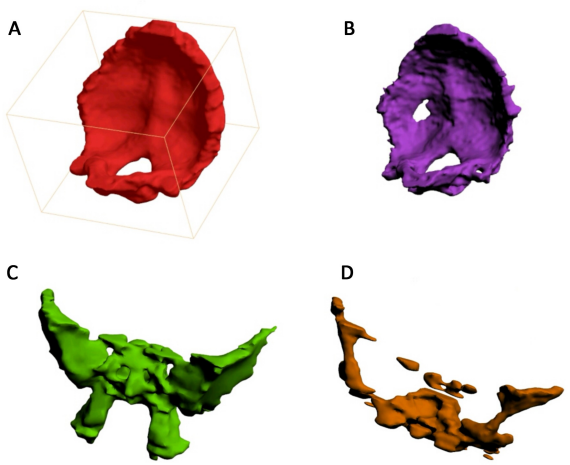

Figure 2: 3d-model: A) cortical occiput component; B) diploe occiput component; C) cortical sphenoid component; D) diploe sphenoid component.

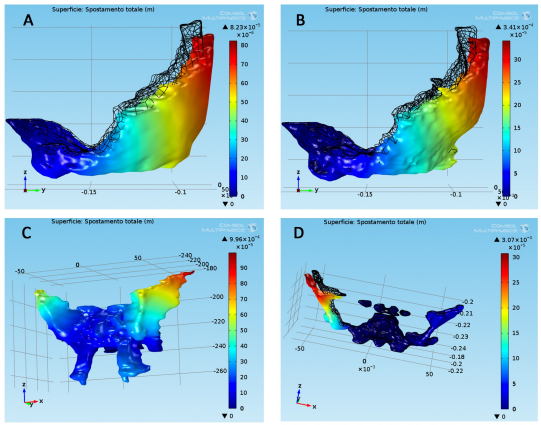

Figure 3: simulation result: A) cortical occiput component; B) diploe occiput component; C) cortical sphenoid component; D) diploe sphenoid component.