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

Y. Chiesa[1]

1. Istituto Superiore di Osteopatia ISO, 120 Breda St, Milan , Italy.

Introduction: The concept of cranial Primary Respiratory Mechanism (MRP) is used by osteopathic practitioners to explain the perceptual characteristics arising from the clinical palpation approach of the human skull. The theoretical apparatus and the same MRP 's existence is always element of controversy among the scientific community.[1]

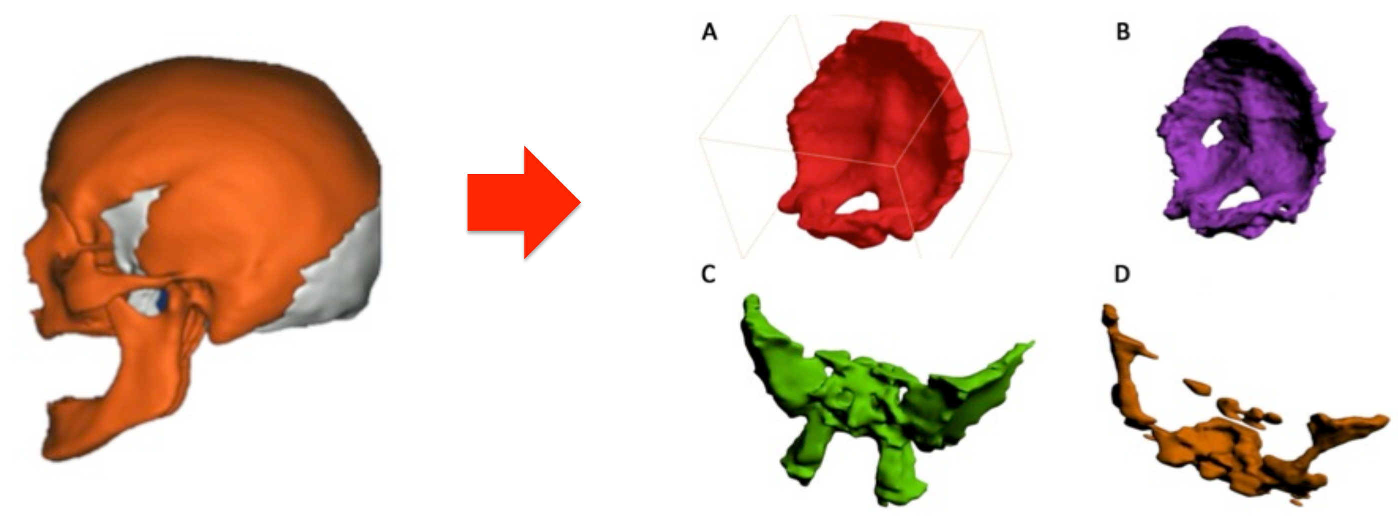

Figure 1. 3d-model: A) cortical occiput component; B) diploe occiput component; C) cortical sphenoid component; D) diploe sphenoid component

Computational Methods: I analyze, using Kelvin-Voight linear viscoelastic model, 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 and as isotropic, homogeneus materials.[3] Assess if the resulting displacement belongs to the perceptual ability of the human touch.[4]

$$\theta = E\varepsilon + \mu\frac{d\varepsilon}{dt}$$

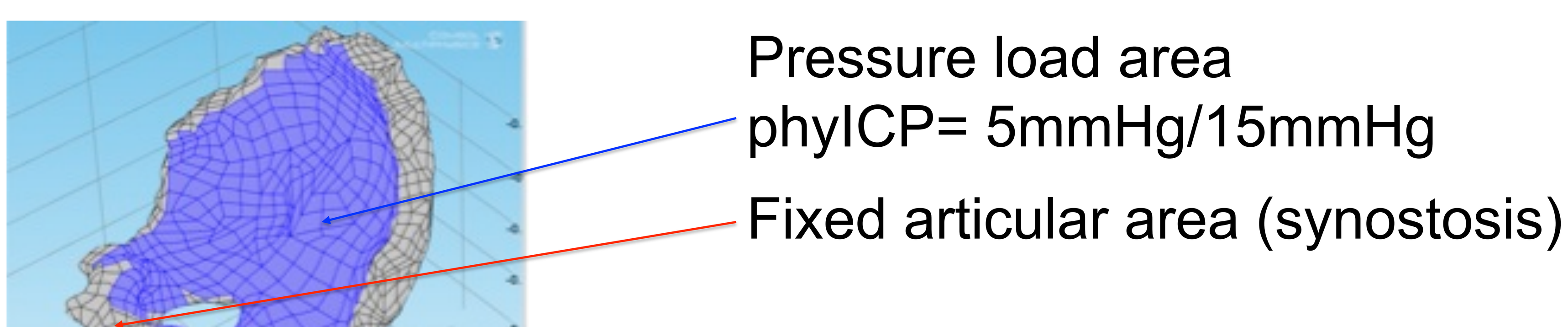

Figure 2. Occiput example

Results: The articular relationship between occiput and sphenoid allows a measurable deformation of the same bones, plotted as displacement. The arithmetic differences of the average on the displacements obtained from the two pressure loads are included in the human tactile discrimination range.

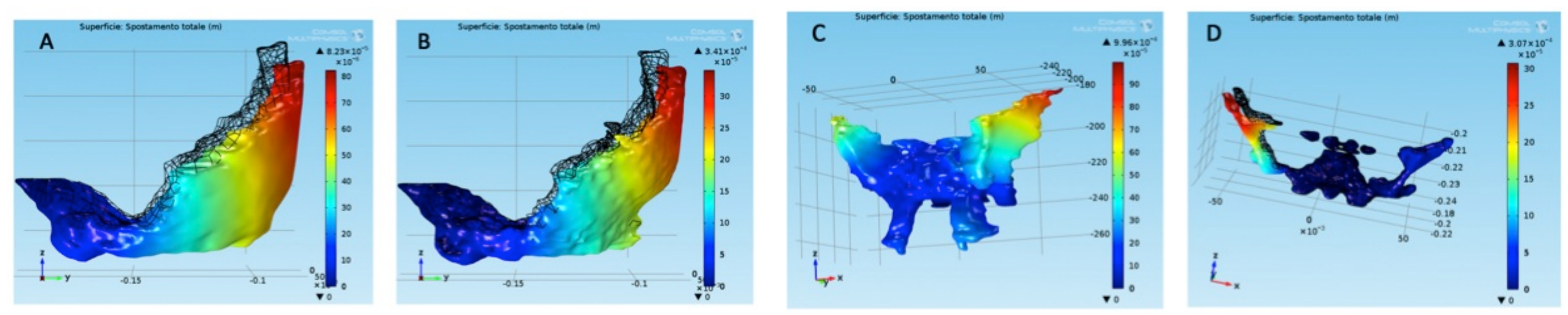

Figure 3. simulation result: A) cortical occiput component; B) diploe occiput component; C) cortical sphenoid component; D) diploe sphenoid component.

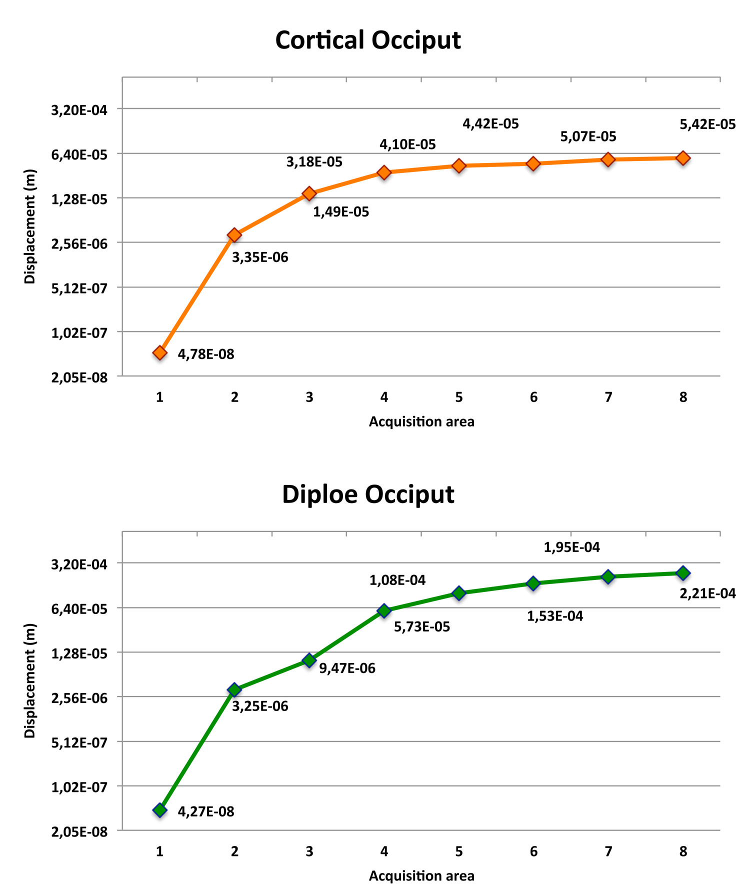

Figure 4. Δ[phyICP] displacement of occiput

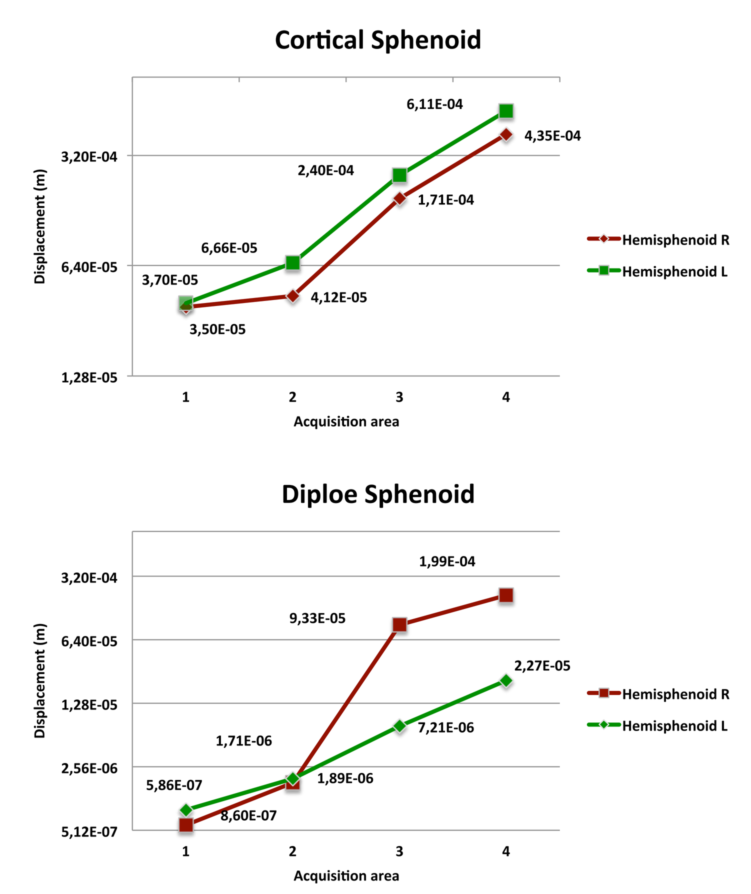

Figure 5. Δ[phyICP] displacement of sphenoid

Conclusions: 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.

References: 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).

Excerpt from the Proceedings of the 2014 COMSOL Conference in Cambridge