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Temporal lobe surface anatomy and the bony relieves in the middle cranial fossa. The case of the El Sidrón (Spain) Neandertal sample

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The largely reabsorptive nature of growth dynamics at the cranial base (Duterloo and Enlow, 1970) leads to the partial imprinting of relieves of the cerebral surface on the cranial fossae. On this basis, a detailed analysis of the correspondence between brain external anatomy of the temporal lobe and the bony relieves on the middle cranial bases was performed in order to describe and compare new temporal bone remains found at the 49.000 years old El Sidrón neandertal site (Rosas et al., 2012). Three different methods were employed, based on the comparison of the soft (neuronal) and hard (bone) tissues from the same individuals. 1) We dissected two human heads and visual inspections were recorded. Once the dura mater was removed, both brain surface and middle cranial fossa were molded with resins. Positive molds were used to explore morphological correspondence. Superposition of brain and bone was also explored using optic surface scans, and computed tomography combined with magnetic resonance scans. In parallel, a large collection of dry skulls, virtual specimens, and reference books (Grimaud-Hervé, 1997; Holloway et al., 2004) were used for direct assessment of hard tissue variability. For the sake of clarity, the middle cranial fossa was divided into four regions: 1) anterior surface of the petrosal pyramid, 2) basal region around the oval foramen, 3) region of the temporal pole, and 4) temporal squama. A close correspondence among sulcus and gyri (sensu Ono et al., 1990) and bony relieves was detected, and a series of new anatomical details have been introduced in order to describe these correspondences. The inferior temporal sulcus and the inferior temporal gyrus are the cerebral structures that most strongly influence the underlying bone surface. The superior temporal sulcus, the middle temporal gyrus, and the fusiform gyrus also leave close matching on the endocranial surface. The El Sidrón internal temporal bone features were broadly compared. A wider and larger post-arcuate fossa (new nome) seems to be present in modern humans as compared with Neandertals. This area corresponds to the posterior limit of Brodmann area 20 and the anterior portion of Brodman area 37. However, other traits of the middle cranial fossa surface do not show evidence of dissimilarity between these two large-brained human groups. Regarding dural sinus pattern, a higher incidence of petrosquamous sinus is detected among Neandertal samples. Previous analyses have emphasized that modern humans present an apomorphic condition in its more anterior, lateral and superior position of the temporal lobe pole (Bastir et al., 2008; 2011), which fits with previously recognized overall endocraneal scaling differences (Bruner et al, 2003). Once fine anatomical correspondence of the temporal lobe circumvolution pattern on its bony base has been clarified, we put forward the hypothesis that the temporal pole is occupied by the middle and lower temporal gyri in Neandertals, while the pole is mostly defined by the superior temporal gyrus in modern humans. Further analyses need to test this proposition as well as the functional implications of these cortical cerebral reorganizations.

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