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Age, sex, and ancestry-related variation in cortical bone and dentine thickness in modern humans and relevance to evolutionary anthropology

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Cortical bone and dentine share an embryological origin, a development, and a genetic background, that are not shared with enamel [1]. Knowing how these tissues relate in individuals is of great importance to decipher the factors acting on their morphogenesis, and ultimately to understand the mechanisms responsible for the different patterns of tissue proportions shown by hominins. However, only a few studies have analyzed bone and tooth structures in combination [2], and no study has investigated a possible correlation between the volumes of cortical bone and dentine relative to endogenous and exogenous factors. The aims of our study are to examine age-, sex-, and ancestry-related variation in cortical bone and dentine volumes, and to preliminarily assess the possible covariation between these tissues in modern humans. The analytical sample includes 12 immature individuals and 17 adults from French medieval cemeteries, as well as 32 adults of African and European ancestries from South African contemporary osteological collections. Variables describing three-dimensional tissue proportions were assessed from microtomographic records of radii and permanent maxillary canines. Results suggest an age-related pattern in bone development and important sex differences in cortical bone and dentine thickness. The developmental pattern of dentine also seems to vary according to individual's ancestry. In addition, preliminary results have outlined a covariation trend between volumes of cortical bone and dentine that does not exist with enamel nor pulp. However, when splitting the sample by age, sex, and ancestry, no signal of covariation is found in the immature subsample, while the adults of South African and European ancestry show a covariation between cortical bone and either radicular or crown dentine, respectively. Thus, accessing the genetic-related morphological variation may be complexified by the impact of environmental factors, particularly mechanical ones, which play an important role in structuring the mechanosensitive tissues throughout life. To identify variations in degree of bone and dentine functional sensitivity, and thus disentangle genetic and environmental factors, we also documented the local variation of cortical bone and dentine distribution along the bone shaft and the dental remains by using morphometric maps [3,4]. More research on the cortical bone-dentine covariation would provide a better understanding of the impact of endogenous and exogenous factors on the development of the mineralized tissues. Ultimately, this may shed light on the pattern of joint tissue thickening observed in the palaeoanthropological record, and especially in the majority of Neandertal specimens [5].

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