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Biological proximity and dental heritability from internal tooth structure analysis of early agriculturalists from the Neolithic necropolis of Gurgy (France)

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Studies on dental heritability focused on tooth crown size and external structure while studies of enamel thickness and dental tissue proportions permit discussion of taxonomy, phylogenetic relationships or dietary habits. Here we employ a microtomographic (microCT)-based record of teeth from Neolithic individuals of the necropolis of Gurgy (France) to assess biological proximity and heritability from internal tooth structure. Second upper permanent molars from 21 immature and adult individuals of both sexes were scanned using high-resolution microCT at the MRI platform (Univ. Montpellier II, France) on a Skyscan 1076 X-ray equipment. Acquisitions were performed with an isotropic voxel size ranging from 17.93 to 36.18 μm . Semi-automatic threshold-based segmentation was conducted using Avizo v.7 (VSG) and crowns were digitally isolated from roots. For each crown, 15 linear, surface, and volumetric 2D and 3D variables describing enamel thickness and dental tissue proportions were digitally measured or calculated. We performed centered principal component analysis and cluster analysis according to Ward's method. Results show biological proximity in enamel thickness and dental tissue proportions for individuals buried at Gurgy. Clusters correspond to individuals who mainly share same location in the necropolis, same burial structure and orientation in the burial. Also, sexual dimorphism affects crown dimensions and dental tissue proportions. Interindividual biological proximity shown in the Neolithic necropolis of Gurgy suggests that the characterization of internal tooth structure could be used to discuss biological proximity and dental heritability. As the human sexual chromosomes differently impact enamel and dentine growth, we expect sexually-linked variation in enamel thickness and dental tissue proportions between family members.

Keywords: enamel thickness; dental proportions; Neolithic; microtomography