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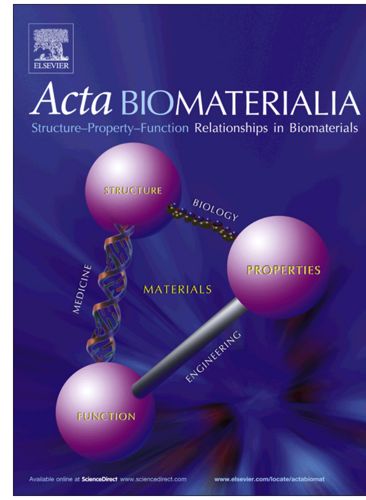

Full length article

Dentin horn angle and enamel thickness interactively control tooth resilience and bite force

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Dentin horn angle and enamel thickness interactively control tooth resilience and bite force

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Abstract

Fossil teeth are a primary source for inferring species development via evolutionary adaptation due to their linkage to feeding ecology and well perseverance. The main working tools in such studies are bite force analysis derived from jaw musculature and lever arms and morphogenetic based on enamel thickness and occlusal surface area. Despite progress made, quantitative correlation between predictions and behavior is still lacking. We studied histological sections in varieties of extracted premolar and molar human teeth. Sections corresponding to planes intersecting tips of primary cusps as well as more random planes were considered. The results revealed a unique, conclusive link between cuspal enamel thickness d_c and dentin horn angle φ, a developmental parameter which contribution to tooth functioning has been overlooked. Naturally led by design principles of corbel arches, we examined the bending stress at the horn apex due to axial cuspal loading. The results show that this d_c vs. φ relationship produces a constant force causing cusp fracture P_F, making the latter a viable measure of tooth resilience. A preliminary study on published sections of extinct hominin teeth showed that their d_c vs. φ behavior is consistent with modern humans albeit with varying P_F. Scaling BF with P_F enables direct estimate of bite force from measures of d_c and φ in fossil teeth, achievable nondestructively from micro-computed tomography scans.

Keywords: Enamel thickness; dentin horn angle; tooth resilience; bite force.