
ANALYSIS OF CRANIOFACIAL SKELETAL AND SOFT TISSUE ANATOMY OF THE EYE IN RELATION TO REDUCED VISUAL ACUITY IN HUMANS

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Despite nearly 100 years of research, the etiology of juvenile-onset myopia is still unknown. However, given that millions of years of brain expansion and reduced facial prognathism have brought the frontal lobes to rest directly above the eyes, while the face has become situated directly beneath them, it is likely that these adjacent craniofacial characteristics are associated with functional constraints of the visual system. As a result, this study examined to what extent the myopic eye is associated with circumscribing hard and soft tissues of the skull.

This was carried out using magnetic resonance images and associated de-identified clinical data for 112 subjects. Linear and volumetric measurements of the eye, orbit, and craniofacial anatomy were obtained using AMIRA, and linear regression analysis and ANOVA were used to test for relationships between variables, and differences among vision groups.

Results showed that increased eye ($F = 2.93, p = 0.05$), orbital ($F = 7.28, p = 0.00$), and to a lesser extent ocular fat volumes ($F = 2.26, p = 0.109$), were associated with reduced visual acuity across the study sample. A larger eye relative to orbital volume was also associated with diminished vision ($F = 2.55, p = 0.083$) though at slightly above $\alpha = 0.05$. However, this relationship became statistically significant ($F = 3.13, p = 0.048$) when ocular fat was also considered (eye/fat+orbit). Outside of these eye, ocular fat, and orbital relationships, no other skeletal trait of the face or cranium were found to be associated with visual acuity.