



Original article

# Craniofacial shape from pre- to post-adolescence

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## Summary

**Aim:** Craniofacial growth demonstrates significant variation and is difficult to predict. The aim of the present investigation was twofold: (1) to assess the association (covariation) between craniofacial shape at pre- and post-adolescence and (2) to evaluate if pre-adolescent craniofacial shape is related (covaries) with growth magnitude and direction.

**Subjects and methods:** One hundred fifty subjects (86 males and 64 females) untreated orthodontically were selected from AAOF Craniofacial Growth Legacy Collection. Each subject had cephalograms taken before 9 (pre-adolescent stage) and after 15 years of age (post-adolescent). Fourteen curves comprising 123 points (10 fixed and 113 sliding semilandmarks) comprehensively covering the craniofacial skeleton were digitally traced on each cephalogram. Procrustes alignment, principal component analysis, 2-block partial least squares (2B-PLS) analysis, and regression analysis were done after sliding the semilandmarks to minimize bending energy.

**Results:** The first 16 principal components (PCs) were non-trivial and explained 85.2% of total shape variability in the sample. PC1 depicted mainly variability in the vertical direction, PC2 represented mostly variability in the saddle angle and in the antero-posterior position of the mandible, and PC3 depicted primarily variability of the mandibular shape (steep versus flat mandibular plane). The covariation between pre- and post-adolescent facial shape was statistically significant, both in the pooled sample (RV coefficient = 0.604) and in boys (RV = 0.639) and girls (RV = 0.629). The pre-adolescent shape was weakly associated with the magnitude of facial change—2-block PLS analysis demonstrated that blocks 1 and 2 were independent ( $P = 0.118$ , RV = 0.035).

**Conclusions:** The pre-adolescent shape of the craniofacial complex explained approximately 60% of the post-adolescent shape of the craniofacial complex; however, the relationship between pre-adolescent shape of the craniofacial complex and magnitude of its change was weak.