Cranial shape changes with age in male and female adults of *Papio*

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**Introduction**

Ontogenetic changes to skull shape throughout adulthood in primates are rarely researched in comparison to those occurring earlier (Bramblett, 1969; Joganic and Heuze, 2019). In this study, we used geometric morphometric methods (GM) to investigate the effect of age on cranial shape after reaching adulthood, which is important for a better comparison of fossil specimens of differing ages, age estimation in forensic anthropology, and understanding of the aging process.

**Methods**

- Forty-five landmarks digitized using a Microscribe-3DX on 347 wild-collected baboon crania (Table 1; Fig. 1; Frost et al., 2003).
- Upper third molar wear used as a proxy for ontogenetic age, based on the approach of Delson (1973) using a scale from 0 to 16 (Fig. 2), then added 1 to the wear stage and transformed them by the natural logarithm.
- Generalized Procrustes analysis to superimpose the landmark configurations and standardize them for geometric size, position, and orientation.
- Adjusted for size and sex through multivariate regression analysis, then regressed the adjusted coordinates against wear stage, in order to test for a significant age effect; all statistical analyses were performed in MoPhad (Klingenberg, 2011).

**Results**

Cranial shape was highly correlated with molar wear, even after we accounted for sex and size differences. The effect is subtle, however, with allometry accounting for approximately 42% of total variance, and sex an additional 4%, whereas molar wear accounted for 4.5%.

There was no interaction between molar wear and sex; males and females appear to age similarly (Fig. 3). Coefficients from the regression of molar wear on cranial shape were used to visualize the shape (Fig. 4). The orbitals and supraorbital torus appear to recede equally, while the pre-maxilla and maxilla become anterior-posteriorly longer and shifted.

Age, as measured by molar wear, has a clear but subtle effect on skull shape during the adult stage of life. Understanding these changes can facilitate more informed comparison of rare fossil crania.

Further investigation will be required to determine the causes of these age-related shape changes.

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**References**