From wolf to dog

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Summary

Morphometric and morphological differences have been used extensively in the past to study domestication of the wolf and the origin of dogs. Certainly before genetic testing was performed, these methods were the only means to diverge both groups. But still now, when aDNA cannot be extracted, morphometry and morphology are still important study methods to discern between wolves and dogs.

Many of the historically claimed differences were based on studying rather low numbers of Specimens, and on comparisons with genetically isolated groups of dogs or breeds that had anatomical variants which diverge from the mean. This led to several claimed differences that needed rigorous re-evaluated, by investigating larger groups of specimens, both dogs and wolves, and more importantly, and if possible, Pleistocene wolves and the oldest archaeological dogs.

We re-evaluated all important morphological and morphometric criteria published in the literature. Most are related to oral, mandibular and skull differences, but also difference in stature was reported. From all criteria we re-tested very few proved to be valuable. And those that show a difference, can often only be used to a limited extend, as only the extremes of these criteria are non-overlapping between groups.

Pertaining criteria are:

-A general reduction in stature in dogs, and concurrent isometric size reduction of isometrically related body parts (such as mandible, etc.). Early dogs are about 1/3 smaller than wolves.

-The extremes of the orbital angle (angles above 55° are certainly modern dogs, above 50° archaeological dogs, angles under 35° are certainly wolves).

-A small mesio-distal diameter of maxillary P4 in archaeological dogs, dogs having P4 under 21.8 mm, fossil wolves over 22.5 mm.

-A small mesio-distal diameter of mandibular M1 in archaeological dogs: mesio-distal diameters under 22.5 mm are certainly dogs, these above 26.9 mm are certainly wolves.

-A broader snout index in dogs: mean snout width index in Holocene dogs is

0.366, in wolves 0.341 (significantly different, $p=0.04$), with modern wolves having a statistically narrower snout index than Pleistocene wolves ($p=0.02$).

-A higher skull ratio in Neolithic dogs versus modern wolves ($p<0.0001$) with minimal overlap between groups (0.34-0.36). Skulls with a ratio above 0.36 are certainly dogs, those with a ratio under 0.34 are certainly wolves.

The higher skull ratio, together with a larger orbital angle, and wider snout ratio, lead to stop formation in dogs, and a forward and lateral expansion of the orbital area.

Based on these accepted criteria there is no indication to assign large Pleistocene canids that are presumed to be putative, incipient, proto-dogs, to a different category then wolves.