An assessment of the neurovascular structures in the mandibular canal and their effect on diet in primates

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INTRODUCTION: Previous studies have concluded that the mental foramen is not an accurate proxy for touch sensitivity in relation to diet in extant species, but did not assess the underlying neurological structures of the mental nerve and surrounding structures [1]. Various authors have attempted to describe the typical course of the mandibular canal (Figure 1) and the variation seen in humans, however no study fully describes the diameter of the canal and the structures it contains (i.e. the mandibular nerve) at any location within the mandibular canal or at the opening of the mental foramen [2-5]. Many studies have shown that some nerves in the body, such as the infraorbital and optic nerve, occupy the majority of the space in the foramina through which they pass [6-8], while others have shown that other nerves, such as the hypoglossal nerve, do not occupy the majority of the foramina through which it passes [9]. The importance of understanding the size of the nerve, and not just the canal space it occupies, is noted in Cull et al. [10] due to the overwhelming evidence that total number of axons can be estimated from small cross-sectional areas of nerves, thus giving further information on the sensitivity and use of facial structures. This study aims to examine variation in mandibular canal shape and size in primates and to examine whether canal size is related to dietary preference and/or is patterned phylogenetically.

METHODS AND MATERIALS:

Results: 40 extant primate species (n= 72 males)
- Only males were used to eliminate sexual dimorphism
- microCT scans from Morphosource.org
- Five cross-sectional area measurements (Figures 3): mental foramen, % length from MeF to MaF, midpoint of canal, % length from MeF to MaF, and mandibular foramen
- Canals were measured in relation to diet

DISCUSSION AND CONCLUSION: This research indicates that the cross-sectional canal area varies along its length and differs among groups of extant primates (Figs. 4, 5). Paired t-tests (Table 5) indicate that there is no significant difference in the left and right sides of the mandibular canal in the individuals in this study, indicating no pattern of mandibular asymmetry. These results alone show that the mental foramen is variable in shape across groups and individuals, and is not accurately represented by the cross-sectional area of the mandibular canal and the mental foramen (Table 1). However, because no significant values were found when diet is compared to the foramina or canals (Tables 3 and 4), the data suggest that the cross-sectional area of the bony surfaces cannot be used as a proxy for dietary preferences. This could be in part because we used qualitative categories to assign diet, which is often biased or inconsistent for some species. Future research will include females to establish sexual differences in mandibular canal morphology and molar tooth morphology rather than qualitative dietary categories to further examine the evolutionary implications of the variation in the mandibular canal.

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