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LETTER TO THE EDITOR

Response to Todd and Graham's "Letter to the editor concerning external auditory bony growths in pre-Columbian inhabitants of Panama"

We thank Drs. Todd and Graham for their comments on our recent article regarding the presence of external auditory exostoses among the pre-Columbian inhabitants of Panama. The question raised regarding the distinction between external auditory canal exostoses and osteomata in our samples is an important aspect that we did not address in our original text. Nevertheless, we stand by our original assertion that the bony growths in the external auditory canals observed in the studied sample of pre-Columbian Panamanians follow the morphological characteristics of exostoses more closely than they do those of osteomata. Here we take the opportunity to provide an in-depth differential diagnosis of the bony growths affecting the eight individuals reported in our article.

Of the various morphological distinctions between osteomata and exostoses, the unilateral occurrence and pedunculated base shape of the osteoma are among the most useful for differential diagnoses (Koch, Hamilton, Hudgins, & Harnsberger, 2016, pp. 1021–1023). Exostoses, on the other hand, are broad-based and tend to be bilateral (Graham, 1979; Sheehy, 1958), although this tendency is variable. Exostoses have a noted association with environmental factors while the etiology of the osteoma is unclear due to its very rare incidence (Carbone & Nelson, 2012, p. 246). The distinct base shape of these two bony ear growths has led to different clinical approaches to their removal in modern times. In clinical settings, doctors prefer to simply snap osteomata off at their narrow base under local anesthesia, while broad-based exostoses necessitate that the excess bone be cut or burred off with the patient under general anesthesia (Kveton, 2001; Snow & Wackym, 2009, p. 198; Spielmann, Mckean, White, & Hussain, 2013). Osteomata also tend to be solitary occurrences along the sutural lines at the posterior and superior margins of the lateral border of the meatus (Barnes, Eveson, Reichart, & Sidransky, 2005, p. 337). We consider each of these characteristics among the eight ancient Panamanian cases in the following paragraph and Table 1 below.

Taking first the most important two characteristics (i.e., laterality and base shape), we can eliminate the possibility of osteoma in half of our samples due to the bilateral occurrence of the bony growths. In terms of base shape, the majority of the bony growths in our sample had a broad, oval-shaped base characterized by a long axis oriented mediolaterally within the ear canal. The only growth that attached to the canal wall via a thin, pedunculated stalk also accompanied another growth within the same ear canal with a broad base. This case, which pertained to Cerro Juan Diaz Burial 3.2 Bundle 11, may represent a simultaneous osteoma and exostosis, like those reported in the literature by Fenton et al. (1996, p. 624). All but two of our cases involved multiple bony growths per ear canal, and the remaining two had bilateral expression. Our cases also did tend to occur around sutural areas of the anterosuperior and posteroinferior ear canal, and although these tend to be the foci of osteoma occurrence, bony growth along the sutures is not prohibitive to osteomata; exostoses are circumferential, occurring at any point along the external auditory canal (Koch et al., 2016, p. 1023).

In sum, the cases of bony growths we report in the ear canals of ancient humans of Panama represent exostoses, not osteomata,

TABLE 1 Descriptive features of the bony growths in the ancient Panama assemblage per individual

Site	Individual	Base	Location in ear canal	Laterality	Number per ear (left)	Number per ear (right)
Cerro Mangote	Individual 1E	Broad	Superior, posterior, and anterior	Bilateral	3	4
Sitio Sierra (early)	Individual B-7	Broad	Superior and posterior	Unilateral	0	2
Cerro Juan Díaz (early)	Burial 3.2, Bundle 7, Cranium 1	Broad	Posterior	Bilateral	1	1
	Burial 3.2, Bundle 10	Broad	Superior, posterior, and anterior	Bilateral	3	6
	Burial 3.2, Bundle 11	Broad and pedunculated	Superior and posterior	Unknown	?	2
	Burial 3.16, Cranium 18	Broad	Posterior	Unilateral	2	0
Playa Venado	Trench A6, Skeleton 4	Broad	Superior and posterior	Unilateral	2	0
Panama Viejo	Plaza Mayor, Burial 1, Individual 9	Broad	Superior	Bilateral	1	1

based on the various distinguishing characteristics outlined in the clinical literature. Furthermore, the total prevalence of these bony growths among 8.1% of our studied sample of 86 individuals (those with both ear canals intact), of which the majority pertained to males, fits the higher prevalence and sex-specific nature of exostoses and discords with the rare, demographically unbiased occurrence of external auditory canal osteomata.

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