Brief Report: The Non-Metric Variation in the Dentition of the Earliest Americans (13.721 – 11.640 CYBP)

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Abstract

Dental non-metric data were described in a group of seven individuals of North and Central America. This report contributes to studies regarding the settlement of America by decribing the non-metric dental traits of the most ancient dentitions in the Americas. The sample consists of seven individuals from the Final Late Pleistocene (13.721-11.640 CYBP). Permanent dentitions from individuals between 5 and 35 years of age were scored for 13 dental traits based on the Arizona State University Dental Anthropology System (ASUDAS). These findings help us to have a comparable database with other groups and thus better understand the settlement process of human groups in the Americas and its relationship with migratory movements from Asia.

Keywords: non-metric variation; ASUDAS; America

Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

45

Introduction

Pleistocene individuals in America are very rare. Most skeletons with dentitions from the pre-ceramic culture correspond to the Early (11.500 – 7.000 BP) and the Middle Holocene (7.000 – 3.000 BP) periods (1). A recent study found that pre-ceramic peoples of America were Sinodonts (2). On the other hand, studies on Northern Andean samples of the Early Holocene period have found that these groups were not Sinodonts (3). This ambiguity in the American Sinodont pattern has led us to think that there are at least two different dental patterns in the initial settlement process of America (4).

The Sinodont / Sundadont theorethical model (hereafter SSTM) of Turner (5) is a benchmark of comparison for American pre-Hispanic samples with permanent teeth. However, most dental anthropology studies in America that support the SSTM have focused on communities that existed during the Initial Late and Final Late Holocene period (last 3.000 years before present). The relative lack of research on Middle Holocene (7.000 – 3.000 BP) and Early Holocene (10.000 – 7.000 BP) groups may be due a shortage of deposits (1, 3, 6). No dentitions of Final Late Pleistocene in Americas have been described as a population until now. Some related works of J. F. Powell for pre-ceramic Midle Holocene groups from North America can be mentioned (7, 8, 9, 10).

Dental non-metric traits have been used for identify biological relationships. The description of dental non-metric characteristics is important by the solution of ethnogenetic questions. On this way, there are two basic Asian populations, a southern (Sundadont) population and a northern (Sinodont) population (5, 11). Sinodont / Sundadont dichotomy is defined on the basis of eight key morphological traits distinguished in these two patterns: shoveling and double shoveling of maxillary incisors, enamel extension of maxillary first molars, root number of maxillary second premolars, peg / reduced / congenital absence of maxillary third molars, deflecting wrinkle and root number of mandibular first molars, and groove pattern of mandibular second molars. The Sinodont pattern exhibits these traits more intensively, whereas the Sundadont pattern exhibits simplification of these features (5, 11). A set of five additional traits has been recently proposed only for pre-Neolithic and early Neolithic Asian samples: shoveling in upper lateral incisors, interruption groove in upper central incisors, enamel extension and metaconule in upper first molars, metaconulid and Y pattern in lower first molars (4).

Therefore, data from the Final Late Pleistocene human dentitions (from 18.000 to 11.500 BP) have had very few impact on the reconstruction of the pre-Hispanic history in Americas. This research aimes to describe the variation in the dentition of the earliest communities in North and Central America through the observation and analysis of 13 dental non-metric traits.

Materials and Methods

Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

46

This research focuses on different pre-ceramic individuals who mainly lived in the Southwest of North America and the Yucatan Peninsula of Central America. Other areas of America are excluded by the absence of published data or access to the original materials from the same period (13.721-11.640 CYBP). Another problem is that many samples of such age present such a high degree of dental wear through that observations are impossible to obtain. Human remains used in this study were excavated between 1959 and 2013 by numerous archaeologists (12, 13, 14), and they are curated by multiple Institutions (Table 1). A total of seven individuals without severe occlusal wear between 5 and 35 years old were selected for this research (Figure 1). For an extensive bibliography on the individuals from Yucatan Peninsula in Mexico see (12), for Peñon Woman (15), for Silver Lake Woman (14), for Hoyo Negro female (16). Dental data for Naharon 1, El Pit 1, Muknal 1, El Templo and Peñon III are presented here for the first time.

The permanent teeth of five individuals (Naharon 1, El Pit 1, El Peñon III, Muknal 1 and El Templo) between 15 and 35 years of age were selected for direct trait observation and scored. Two other individuals (Hoyo Negro and Arch Lake) were recorded by previous researchers. When the expression of the trait was symmetrical, only one score represented the feature for the tooth in the individual. If an individual exhibits asymmetry of expression in a trait, the stronger expression was used to represent the feature for a tooth. If only one of an antimeric pair was present, the score for the trait of that tooth represented the individual. Thus, all frequencies and averages are based on counts per individual. The small number of individuals suitable for the morphology analysis is due to the fact that in some cases the skulls had no teeth by either antemortem or postmortem tooth loss. Some teeth could not be included due to severe occlusal wear that was often found in individuals of advanced biological age. Not all of the traits were observed in each individual. Table 1 refers to total sample, sample size, and presence.

The dental traits examined are listed in Table 2. The selection of 13 dental traits is based on the ASUDAS method (17, 18). These methods were used to score the expression or grade of all dental non-metric traits. Breakpoints suggested in Scott and Turner (18) were used to determinate the "presence" of each trait (Table 2). A dichotomous recording system was also used for all traits in order to group trait expressions as either "present" (1) or "absent" (0).

Results

All data frequencies are in Table 3.

Discussion

Important non-metric traits as shoveling UI1, double shoveling UI2, interruption groove UI1, enamel extensión UM1, root number UP1, deflecting wrinkle LM1, three-rooted LM1, four-cusped LM2 and

Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

47

Y pattern in LM2 was recording in this sample. This information allows us to have a reference on some teeth morphological features of the earliest americans, and to make biological comparisons with other groups from the same period in Asia and the Americas.

In a general way, Final Late Pleistocene dentition in North and Central America is characterized by low frequencies of Y pattern in lower first molars (33,3%), moderate frequencies of shoveling UI1 (50,0 %), interruption groove in upper first incisors (50%), metaconule in upper first molars (40%) and 4-cusped lower second molars (40%). All other traits were absent or not observable. The trait shoveling UI1 in El Templo sample are expressed in grade 3 (ASUDAS system) without cingulum.

The group of individuals gathered in this research has a traits frequency that could be considered to be incomplete or unreliable due to: 1. the small number of samples available so far, and 2. lack of certain types of teeth for origin diagnostic as upper incisors. However, constitutes a benchmark for comparisons between American and Asian samples from late Plestocene and early Holocene.

Dental data reported here, can be aligned with other linguistic, archaeological, and genetic data to contribute to the understanding of the processes of human settlement in the past of North and Central America.

Acknowledgments

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Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

48

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Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

49

Figure 1. Location of the samples described in this research.

Skeleton	Country	Chronology*	Method	Location	N	Reference
Naharon 1	México	13.721	C14	IIA - UNAM	1	González et al. 2012
El Pit 1	México	13.346	C14	IIA - UNAM	1	González et al. 2012
Hoyo Negro [A]	México	12.926	C14	INAH	1	Chatters et al. 2014
El Peñon III [B]	México	12.770	C14	INAH	1	Chatters et al. 2014
Muknal 1	México	12.248	C14	IIA - UNAM	1	González et al. 2012
Arch Lake [C]	USA	11.640	C14	UENM	1	Owsley et al. 2010
El Templo	México	11.500**	-	IIA - UNAM	1	González et al. 2012
				Sample	*7*	

*Years before present. ** Presumably dating (C14 dating in process). Dating method: C14 = Radiocarbon method, Locations: IIA-UNAM = Instituto de Investigaciones Antropológicas, Universidad Nacional Autónoma de México, INAH = Instituto Nacional de Antropología e Historia - México, UENM = University Eastern New Mexico. A = Data taken from Chatters et al. 2014, B = Data taken over an anatomical replica at IIA-UNAM, C = Data taken from Owsley et al. 2010.

Table 1. Samples observed in this research.

Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

50

Trait	Dichotomy	Presence	Reference model
Shoveling UI1	0-6	3-6	Turner 1990
Shoveling UI2	0-6	3-6	Turner 1990
Double shoveling UI1	0-6	2-6	Turner 1990
Interruption groove UI1	0-4	1-4	Turner 1990
Enamel extension UM1	0-3	2-3	Turner 1990
Metaconule UM1	0-5	1-5	Turner 1990
Peg, Reduction, Absence UM3	0-1	1	Turner 1990
Premolar root number UP1	1-3	2-3	Turner 1990
Deflecting wrinkle LM1	0-3	3	Turner 1990
Metaconulid LM1	0-4	1-4	Turner 1990
Groove pattern LM2 (Y)	Y,X,+	Y	Turner 1990
4C Cusped LM2	4-(5,6,7)	4	Turner 1990
3-Rooted LM1	1-3	3	Turner 1990

Table 2. Dental non-metric traits observed in this research.

Trait	Naharón 1	El Pit 1	Peñón III	Muknal 1	Arch Lake	El Templo	Hoyo Negro	Freq.	%
ShovelUI1	0	-	-	-	0	1	1	2 / 4	50,0
ShovelUI2	-	-	0	-	-	-	-	0 / 2	0,0
DShovelUI1	0	-	0	-	0	0	0	0 / 5	0.0
IGroovUI1	0	-	1	-	-	-	-	1 / 2	50,0
EEUM1	0	0	-	-	-	-	-	0 / 2	0,0
MelUM1	0	1	0	-	0	0	1	2 / 6	33,3
PRAUM3	-	-	0	-	-	-	0	0 / 2	0,0
RootUP1	0	0	-	0	-	-	-	0 / 3	0,0
DWLM1	0	-	-	-	-	0	0	0 / 3	0,0
MeldLM1	0	-	0	-	0	0	-	0 / 4	0,0
3RootLM1	0	-	-	0	-	-	-	0 / 2	0,0
4CuspLM2	1	-	0	-	-	-	-	1 / 2	50,0
YPattLM2	0	-	0	-	0	-	1	1 / 4	25,0

Freq. = Trait frequency, - = not observable.

Table 3. Data obtained in the recording.

Bull Int Assoc Paleodont. Volume 9, Number 2, 2015

www.paleodontology.com

51