Non-metric variation of the Muisca dentition in the northern Andes of Colombia, South America

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Abstract

This article presents dental non-metric data observed in Muisca samples from the central-eastern Andes of Colombia. Permanent teeth of 146 individuals between 5 and 40 years of age belonging to five pre-Hispanic human cemeteries were observe. Fifteen dental traits were score following the ASUDAS method. A comparison between the values of the five samples shows that biological homogeneity did exist within these populations. At least 800 years of genetic continuity and biological interbreeding among populations of the same Muisca cultural tradition are express in similar frequencies of dental traits. All samples are Sinodonts.

Keywords: Northern Andes; Amerindians; Dental non-metric traits; ASUDAS

Introduction

Final Late Holocene Period (here in after FLHP) is a chronological category used by Northern Andes archaeologists to group ancient human societies that lived between the years 1.500 to 500 before present (here in after BP). FLHP can further be divide into two phases: 1. Initial Late phase (1.500 – 1.000 years BP) and 2. Final Late phase (1.000 – 500 years BP). FLHP is an important period for archaeological research in the northern region of South America since it constitutes a stage of intense

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cultural development, variability and continuity from its predecessors in the Initial Late Holocene Period (3.000 – 1.500 BP).

During the FLHP, a number of important cultural and biological features are preserve from Formative times by human societies in large areas of Colombia: North or Caribbean coasts, Western, Central and Eastern mountains and the valleys of Cauca and Magdalena (1). One of these societies lives in the Central and Eastern arms of Northern Andes and is name by archaeologist as Muisca society or Muisca culture.

The Muiscas are an indigenous group that inhabited the fertile plains of Zipaquirá, Nemocón, Ubaté, Chiquinquirá and Sogamoso in the Altiplano Cundiboyacense (Cundinamarca and Boyacá highlands) from 1.300 BP to the Spanish conquest in the sixteenth century. Muisca economy was based on agriculture optimized by leveraging the slopes and by cropping systems, irrigation and drainage canals. Production of blankets, pottery and crafts was frequent allowing Muiscas to use the surplus on trading salt, emeralds and tribute to the god Bochica and to the mother Bachue (2).

Biological origins of Muisca people are uncertain. The aim of this article is to describe dental non-metric characteristics in Muisca samples from the Central-Eastern Andes of Colombia. These data are then address in a discussion on the origins of Muisca people including a comparison with the Sinodont / Sundadont model.

Materials and methods

The material consists of data collected from 146 individuals belonging to five pre-Hispanic human cemeteries (Figure 1) excavated during the 1980´s and 1990´s (3, 4, 5, 6, 7, 8, 9, 10) from the Central-Eastern Andes of Colombia. The samples date between 1.300 and 500 BP (Table 1).

The cemetery of Marín was excavate between 1983 and 1984 by archaeologist A. M. Boada. The osteological data (sex, age and stature) and bone diseases was carried out by G. Correal (3, 4). In 1988 Boada published a detailed study of the pathologies in this population found degenerative joint disease, spondylolysis, tuberculosis, septic arthritis, otitis media (with effusion), criba orbitalia, Harris lines, enamel hypoplasia and severe attrition in the dentition (5). In 1995, Boada carried out a study of cranial deformation and its association to social differentiation in Muisca society. Nine crania exhibit tabular cranial deformation. Finally, she published an article detailing the burial pattern found in this population including previous bioanthropological data (6).

There are some previous references for the sample of Soacha (Figure 2). In 1990, two studies of oral disease in Muisca samples from Tunja was developed (7, 8). In 1994 C., Delgado published a detailed study of dental attrition in Soacha (9). In 2008, a study was conduct to identify paleopathological conditions of occupational activity from the analysis of vertebrae in the same sample (11).

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Candelaria cemetery was excavate between 1987 and 1989 as part of an archaeological project led by archaeologist C. Cifuentes. No bone analysis was previously conducted (10). Candelaria samples include 56 individuals from which 33 were select for this research. The sample from Las Delicias does not have previous documentation. Nemocón samples (Figure 3) contain only two skulls accessioned to the National Museum in Bogota in 1969. The sample is consider as a late one belonging to the last century before the conquest (G. Correal personal communication 2010).

The dental traits examined are list in Table 2. Selection of 15 dental traits was based on a previous´ bibliographical selection (between 1907 and 2010) that determined a group of common dental non-metric traits for continental comparisons using pre-Hispanic, post-Hispanic and contemporary human series (1). The Arizona State University Dental Anthropology System (here in after ASUDAS) was used to register the expression grade of all dental non-metric traits (12). Consequently, a dichotomous recording system was use to group grade expressions into either "presence" (1) or "absence" (0). Thus. "N" refers to the total number of individuals examined for each sample, "n" refers to the number of individuals in which each trait was observe and "k" refers to the number of individuals with the trait present.

Results

Las Delicias samples had low frequencies for the metaconule, groove pattern, 4-cusped lower molars and the protostylid. Frequencies between 33 – 66% are evident for double shoveling, the hypocone, Carabelli's trait, enamel extensions, cusp 6 and the deflecting wrinkle. Traits with high frequencies include shoveling, tuberculum dentale and 5-cusped mandibular molars. Other features were not present in this sample (Figure 4).

Soacha – Portoalegre samples had low frequencies for interruption grooves, the metaconule, lower premolar multiple lingual cusps, groove pattern, lower molars with 4, 6 and 7 cusps. Frequencies between 33 and 66% are present double shoveling, tuberculum dentale, the hypocone, Carabelli's trait, enamel extensions and cusp 6. Traits with high frequencies include the deflecting winkle, lower molars with 5 cusps and shoveling. Only the traits molars with 3 cusps and protostylid were not present in this sample (Figure 5).

Candelaria La Nueva had low frequencies as tuberculum dentale, interruption grooves, Carabelli´s trait, the metaconule, lower premolar multiple lingual cusps, groove pattern, lower molars with 3, 4 and 6 cusps, metaconulid and protostylid. Frequencies between 33% and 66% are presented as double shoveling, the hypocone, enamel extensions, lower molars with 5 cusps, entoconulid and the deflecting wrinkle. The only feature that has high frequencies was shoveling. The trait lower molar with 7 cusps did not occur in this sample (Figure 6).

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Marin and Nemocón samples were put together due to their spatial and chronological proximity. This sample had low frequencies in the traits the metaconule, groove pattern, lower molar with cusps 4 and 6. Frequencies between 33 and 66% are presented in the traits double shoveling, tuberculum dentale, Carabelli´s trait, enamel extension, entoconulid and deflecting wrinkle. High frequencies are presented in the traits shoveling, hypocone and lower molars with 5 cusps. Other features were not present in this sample (Figure 7).

Non-metric crown trait frequencies for the five samples are show in Table 3. In general, it is possible to observe that the percentage values are very similar among the samples examined. Small differences in the percentages of presence of some features are discuss below.

Discussion

Most archaeologists consider that the biological origin of these late Colombian societies is associated which the Herrera archaeological culture (pre-Muiscas) during the Initial Late Holocene Period (here in after ILHP) between 3.000-1.500 BP. A close biological relationship between samples belonging to the Initial Late (3.000 – 1.500 BP) and Final Late Holocene (1.500 – 500 BP) samples was demonstrated in a previous study that compared several cultures of western Colombia (1). In spite of the fact that this similarity is not recorded in samples of the Formative (ILHP), this relationship is presumed because of archaeological studies of this region of Colombia, which assume that there was a cultural continuity between societies during the last 2.000 years or so (13, 14).

Craniometric comparisons between samples from ILHP and FLHP periods in the same region of Colombia show that there was a common biological component between Muiscas and pre-Muiscas (Herrera culture) societies (15). Mitochondrial data extracted from the archaeological Guane sample from the same region of Colombia propose that the Muisca people would have been derive from two pre-Hispanic migration waves. This is suggest by an initial introduction of haplogroup B into the region followed by the introduction of haplogroup A because of a later expansion of Chibchan speaking populations out of Central America. This molecular information also supports the hypothesis that there was gene flow among the Andean groups and other areas in the Americas (16).

A comparison between the frequencies of the five samples (Table 3) shows that biological homogeneity did exist within these populations. Geographical and chronological closeness can explain the similarity in dental frequencies. Apparently, there is genetic continuity between the samples examined. A comparison between the earlier sample (Las Delicias) and the later samples (Soacha-Portoalegre, Candelaria-La Nueva, Marin+Nemocon) yields similar information. This result allows inferring that there must have been a closest the closest or a closer genetic relationship between human societies of the ILHP and FLHP in the Central-Eastern Andes of Colombia.

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The archaeological hypothesis about a biological integration process occurring in ancient societies of this region (17) is support for dental data reported here. At least 800 year of genetic continuity and biological interbreeding among populations of the same Muisca cultural tradition are express in similar frequencies of dental traits.

An older origin from the ILHP is difficult to get with the dental information available for the Muisca people. Molecular data from living Chibcha speaking groups from Northern Colombia supports the hypothesis of an early geographic expansion of Chibcha-speakers from Central America into South America through the valley of Magdalena to the Cundiboyacense plateau at a time close to 7.000 BP (18).

In a recent study, the presence of the Uto-Aztecan premolar is report in the Soacha-Portoalegre sample indicating a distant genetic relationship with human groups that inhabited South America in preceramic times, at least in the past 7.000 years (19).

Anyway, a close relationship between Preceramic and Formative societies in this region of Colombia has not been yet demonstrate consistently. On the contrary the biological evidence suggests that Early Holocene (11.500 – 7.000 BP) and some Middle Holocene (7.000 – 3.000 BP) populations were very different from the Muiscas analyzed here (20). In a recent study it was demonstrated that craniometric data support the idea the first South Americans (in Colombia represented by Paleocolombian samples: Vista Hermosa, Checua, Chia, Sueva, Guavio, Tequendama and Aguazuque) had a cranial morphology very different from that prevailing today in the Americas and in East Asia (21).

From a strict dental morphological standpoint, we found that the average frequency of the observed traits in Muisca people are Sinodonic. Table 4 shows the proximity between such frequencies. The trend is determined by comparing the average percentage in Muisca series to the average rank of each one of the patterns (Sinodont and Sundadont). Thus, a discriminant function analysis shows a clear Sinodont pattern (Table 5).

Despite being this region of Colombia (Central Andes) the one with more biological data and anthropological and archaeological studies than any other part of the country, the problem of Muisca origins remains unconcluded. A gathering of biological data (molecular, craniometrical and dental) strongly suggests that Muisca people come from Central American area during the Middle Holocene Period (7.000 – 3.000 BP). Other more ancient samples of these region of Colombia (Early Holocene samples date between 11.500 – 7.000 BP) show different dental patterns similar to Sundadonts from Southeast Asia (1, 23).

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The dental data presented in this paper avail to enrich the biological database of earlier Colombian cultures and allow for macro-regional comparisons in the future and help to resolve the problem of Muisca origins.

Acknowledgments

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Phase	Culture	Sample	N	Chronology
Initial Late	Muisca	Las Delicias	12	1.000 – 900 BP
Final Late	Muisca	Soacha - Portoalegre	84	800 – 600 BP
Final Late	Muisca	Candelaria - La Nueva	33	700 – 600 BP
Final Late	Muisca	Marín	15	700 – 600 BP
Final Late	Muisca	Nemocon	2	400 – 300 BP
Sample size			146	

BP: before present

Table 1 Samples used in this research.

Tooth type	Trait	Dichotomy	Presence
UI1	Shovel shape	0-6	2-6
UI1	Double shovel	0-6	2-6
UI2	Tuberculum dentale	0-6	2-6
UI2	Interruption grooves	0-1	1
UM2	Hypocone	0-5	2-5
UM1	Metaconule	0-5	1-5
UM1	Carabelli	0-7	2-7
UM1	Enamel extension	0-3	1-3
LP2	Multiple lingual cusps	0-9	2-9
LM2	Groove pattern Y	X-Y-+	Y
LM2	Cusp number	3-7	4
LM1	Protostylid	0-7	2-7
LM1	Entoconulid	0-5	2-5
LM1	Metaconulid	0-5	2-5
LM1	Deflecting wrinkle	0-3	2-3

U = upper arcade (maxilla). L = lower arcade (mandible)

Table 2 Dental traits used in this research.

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Trait	Las Delicias			Candelaria La Nueva			Soacha Portoalegre			Marín + Nemocón		
	n	*k*	*%*	*n*	*k*	*%*	*n*	*k*	*%*	*n*	*k*	*%*
SHOVELING UI1	7	6	0.86	20	17	0.85	26	24	0.92	11	10	0.91
D. SHOVELING UI1	7	4	0.57	20	8	0.40	26	10	0.38	11	5	0.45
T. DENTALE UI2	5	4	0.80	13	8	0.62	15	9	0.60	7	4	0.57
I. GROOVES UI2	5	0	0.00	13	1	0.08	15	1	0.07	7	0	0.00
HYPOCONE UM2	4	2	0.50	13	8	0.62	29	19	0.66	9	7	0.78
METACONULE UM1	8	1	0.13	21	5	0.24	43	4	0.09	11	2	0.18
CARABELLI UM1	8	3	0.38	21	8	0.38	43	15	0.35	11	5	0.45
E. EXTENSION UM1	8	4	0.50	21	10	0.48	43	19	0.44	11	7	0.64
L. CUSP NUM. LP2 (+1)	4	0	0.00	13	1	0.08	11	1	0.09	6	0	0.00
G. PATTERN LM2 (Y)	4	1	0.25	22	6	0.27	35	10	0.29	10	3	0.30
C. NUMBER LM2 (3)	4	0	0.00	22	0	0.00	35	0	0.00	10	0	0.00
C. NUMBER LM2 (4)	4	1	0.25	22	5	0.23	35	5	0.14	10	2	0.20
C. NUMBER LM2 (5)	4	3	0.75	22	15	0.68	35	25	0.71	10	7	0.70
C. NUMBER LM2 (6)	4	0	0.00	22	2	0.09	35	4	0.11	10	1	0.10
C. NUMBER LM2 (7)	4	0	0.00	22	0	0.00	35	1	0.03	10	0	0.00
PROTOSTYLID LM1	9	1	0.11	22	1	0.05	36	0	0.00	14	0	0.00
ENTOCONULID LM1	9	4	0.44	22	9	0.41	36	14	0.39	14	5	0.36
METACONULID LM1	9	0	0.00	22	1	0.05	36	3	0.08	14	0	0.00
D. WRINKLE LM1	9	5	0.56	22	11	0.50	36	24	0.67	14	8	0.57

Table 3 Frequencies of dental traits in five Muisca samples.

Trait	Sundadont		Muisca		Sinodont
	percentage range	*Trend*	*%*	*Trend*	*percentage range*
SHOVELING UI1	0.0 – 65.1		89	>	53.3 – 92.4
D. SHOVELING UI1	0.0 – 60.0		42	>	25.0 – 99.9
E. EXTENSION UM1	0.0 – 50.0		48	>	18.7 – 62.1
C. NUMBER LM2 (4)	5.6 – 63.6		18	>	3.5 – 27.4
C. NUMBER LM2 (5, 6 or 7)	36.4 – 94.4		81	>	72.6 – 96.5
D. WRINKLE LM1	0.0 – 68.4		59	>	0.0 – 87.5

Table 4 Comparison between the average values of the Muisca samples and Sinodont / Sundadont dental patterns. Sinodont / Sundadont data taken from Turner (22).

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A		
Classification	Predicted groups	
Actual group	n	1	2
Sundadont (1)	23	20	3
Sinodont (2)	18	0	18
Muiscas	4	0	4
TOTAL	45	20	25

B		
Population	Predicted group allocation	
	Sundadonts	Sinodonts
Las Delicias	-	X
Candelaria La Nueva	-	X
Soacha - Portoalegre	-	X
Marín + Nemocón	-	X
TOTAL	0	4

Table 5 Discriminant analysis of five dental morphological traits between Muisca samples and Asian populations. A - Discriminant analysis using Turner's published dental frequencies for Sinodont and Sundadont populations: Percentage of correct discrimination among populations (n = 45). Maximum classification achieved l00 percent with 5 discriminant dental traits. B - Classification of the Muisca samples using the function derived from Turner's data.
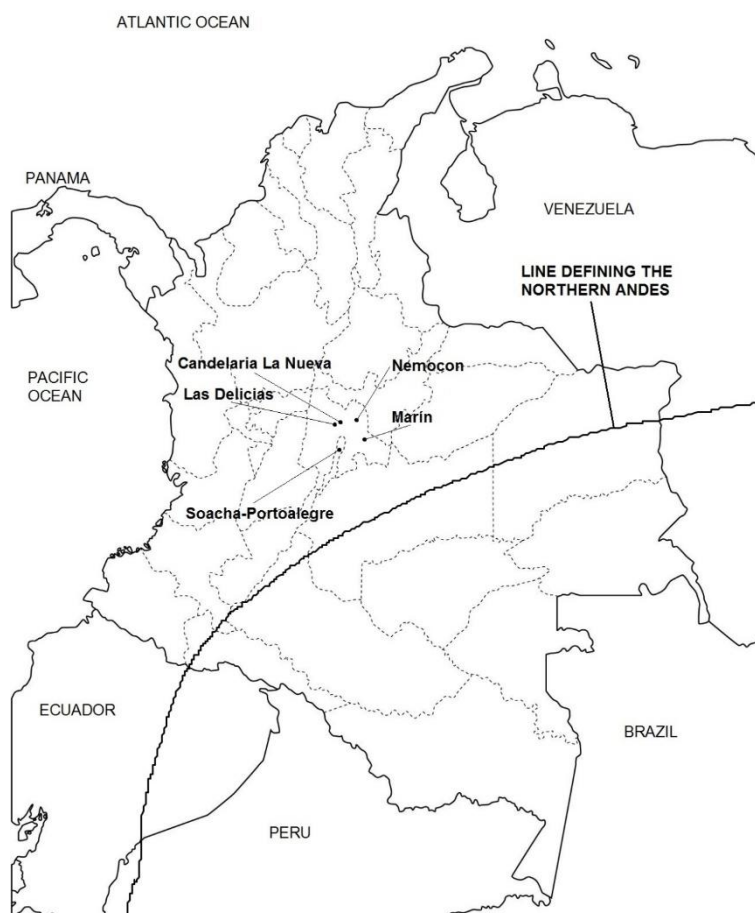

Figure 1 Location of the samples in this study.

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Figure 2 A male individual from Soacha.

Figure 3 A female individual from Nemocon.

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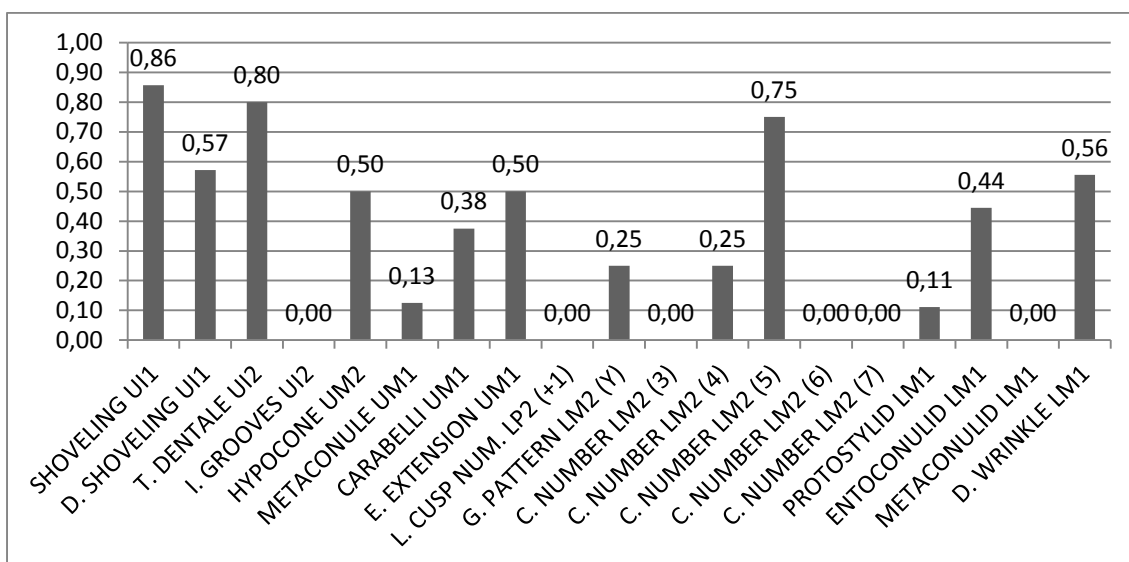
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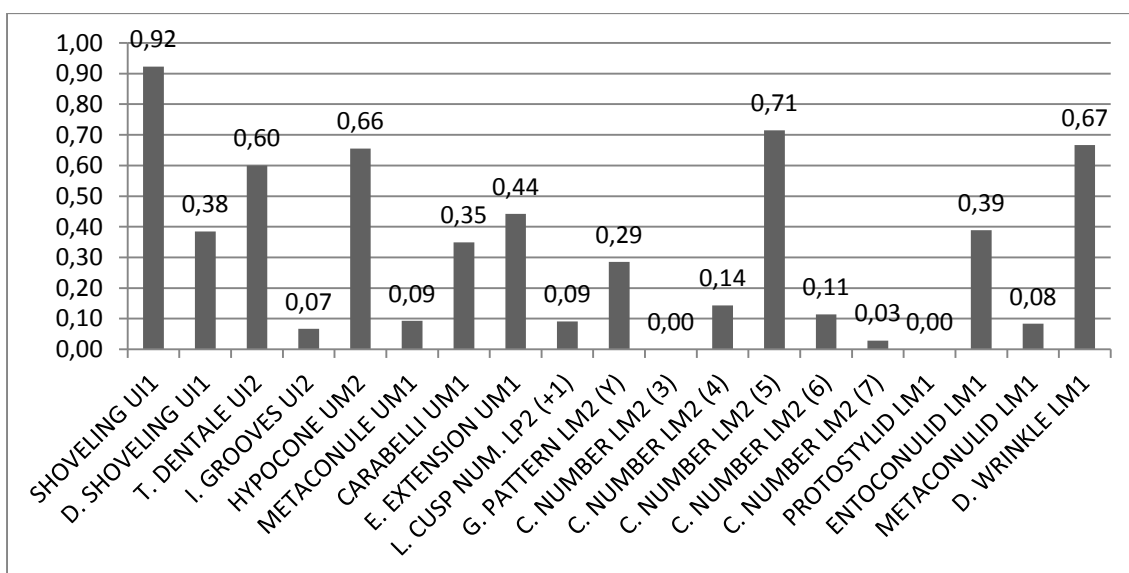
Figure 4 Prevalence of traits in permanent dentition from Las Delicias.

Figure 5 Prevalence of traits in permanent dentition from Soacha-Portoalegre.

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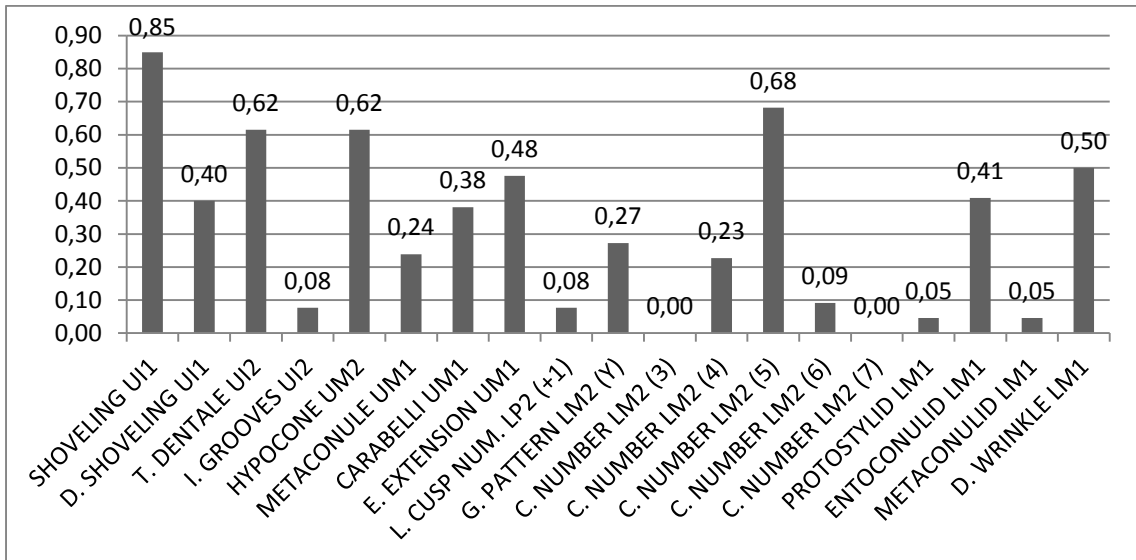
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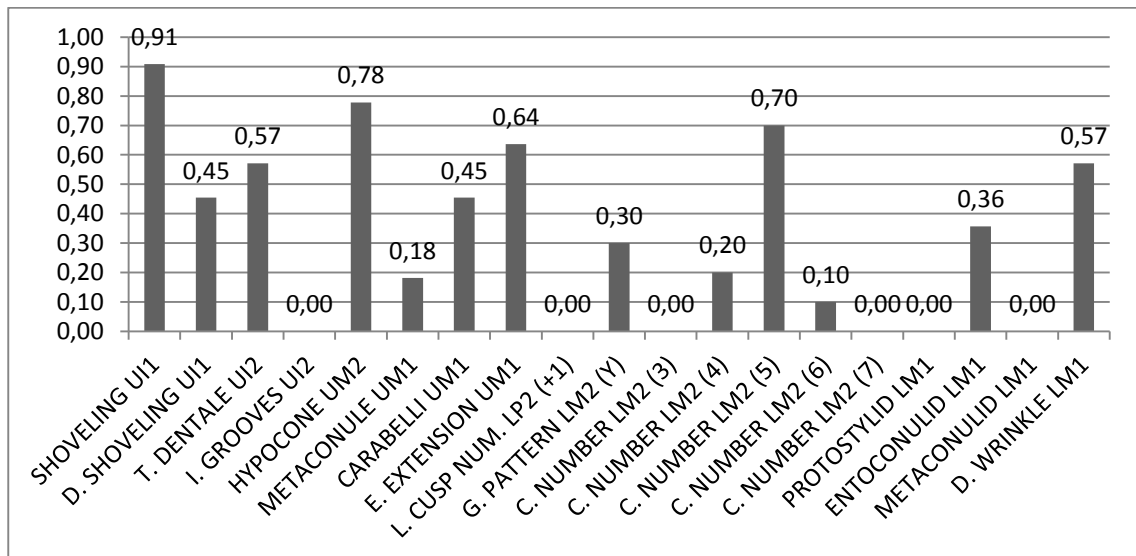Figure 6 Prevalence of traits in permanent dentition from Candelaria-La nueva.

Figure 7 Prevalence of traits in permanent dentition from Marín + Nemocon.

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