Prevalence of dental paleopathology in a Peruvian pre-hispanic population.

Prevalencia de paleopatologías dentales en una población prehispánica peruana.

Marco Reátegui-Navarro.[1]
Ann Chanamé-Marín.[1]
Heber Arbildo-Vega.[2,3]

Affiliations: [1]Facultad de Estomatología, Universidad Nacional de Trujillo, Trujillo-Peru. [2] Escuela de Odontología. Universidad Particular de Chiclayo. Chiclayo-Peru. [3]Centro de Salud Odontológico San Mateo. Trujillo-Peru.

Corresponding author: Heber Arbildo Vega. Avda Húsares de Junín 611, Peru. Phone: (044) 616644. E-mail: hiav_666@hotmail.com; hiav30@gmail.com

Abstract: Objective: To determine the prevalence of dental paleopathologies in a Peruvian prehispanic population. Material and Method: A descriptive, observational and transversal study was carried out. The sample consisted of 106 skeletal remains of pre-hispanic inhabitants, over 18 years of age, found in the El Brujo - Magdalena de Cao Archaeological Complex, Lambayeque - Peru. The selection criteria were defined and the presence of dental caries, malocclusion, crowding, dental anomalies of direction and site, age and sex of each bone was assessed using a data collection instrument designed for that purpose. Results: The sample showed presence of dentin caries (62.3%), enamel caries (37.7%), Class I malocclusion (76.4%), Class II malocclusion (4.7%), Class III malocclusion (4.7%), maxillary crowding (15.1%), mandibular crowding (19.8%), crowding in both jaws (13.2%), gyroversion (20.8%), vestibule-versions (15.1%), linguo-versions (17.9%) and dental transposition (5.7%). Conclusion: The results show a high prevalence of caries and malocclusions in this Peruvian pre-hispanic population.

Keywords: Dental caries; malocclusion; hispanic americans; skeletal remains; prevalence.

Resumen: Objetivo: Determinar la prevalencia de paleopatologías dentales en una población prehispánica peruana. Material y Método: Se realizó un estudio descriptivo, observacional y transversal cuya muestra estuvo conformada por 106 restos óseos de habitantes prehispánicos, mayores de 18 años, hallados en el Complejo Arqueológico El Brujo – Magdalena de Cao, Lambayeque – Perú. Se definieron los criterios de selección y se evaluó la presencia de caries dental, maloclusión, apiñamiento, anomalías de dirección, anomalías de sitio, edad y género de cada uno de los restos óseos utilizando un instrumento de recolección de datos destinado para tal fin. Resultados: La muestra mostró presencia de caries de dentina (62.3%), caries de esmalte (37.7%), maloclusión clase I (76.4%), maloclusión clase II (4.7%), maloclusión clase III (4.7%), apiñamiento en el maxilar superior (15.1%), apiñamiento mandibular (19.8%), apiñamiento en ambos maxilares (13.2%), giroversiones (20.8%), vestíbulo-versiones (15.1%), linguo-versiones (17.9%) y transposición dental (5.7%). Conclusión: Los resultados demuestran una alta prevalencia de caries y maloclusiones en la población peruana prehispánica.

Palabras Clave: Caries dental; maloclusión; américa latina; restos esqueléticos; prevalencia.

INTRODUCTION.

Bioarcheology or archeobiology is the study of human remains using biological techniques for a better understanding of ancient civilizations. The term was first used by the British archaeologist Grahame Clark to designate the examination of skeletal remains in archaeological sites. Since its introduction in 1972, the term has been used in many a specific scientific domain, as well as in the publication of multi-disciplinary forensic documents.[1,2]

Since teeth tend to present the least damage, their examination is an important part in the bioarcheological evaluation of remains, allowing the study of a diverse range of paleopathological conditions that have not been altered by means of dental treatment, with the exception of the extraction of teeth damaged by caries.[3,4]

It is for this reason that the finding of dental remains from ancient civilizations provides important data on dental care in these communities. This can be observed, for example, regarding caries. Caries are caused by the demineralization of the tooth tissue following the release of organic acids during the decomposition of carbohydrates by bacteria, under genetic control. Their frequency, however, is affected by cultural factors such as eating habits, nutrients consumed and food production techniques.[4-6] The same can be said of malocclusion, periodontal diseases and other tooth direction and site anomalies. The diagnosis and examination of archeological dental tissue, as well as the evaluation of ancient lifestyles would indicate what people consumed and how they lived.[4-7] Thus, the aim of this study is to determine the prevalence of dental paleopathology in a Peruvian pre-Hispanic civilization.

MATERIALS AND METHODS.

The present study used an observational, descriptive and transversal design. It was carried out in the Universidad Nacional de Trujillo (UNT) and the El Brujo Archeological Complex, Lambayaque-Peru. It was approved by the Bioethics Committee of the UNT Medical Science Graduate School. The sample used consisted of 106 pre-Hispanic skeletal remains (skulls) found in the El Brujo Archeological Complex in Lambayeque, Peru.

Selection criteria

The remains selected were those found in the El Brujo Archeological Complex, fitting the criteria of being over 18 years of age and being well preserved. The human skulls that presented any sign of congenital syndrome or condition, acquired disease or teeth missing its alveolus post mortem were excluded from the study.

Data collection

First, authorization was granted by the Director of the El Brujo Archeology Complex for gaining access to the human skeletal remains. Then, the process of identifying and analyzing each skull and its mandible individually was performed. The identification was carried out by the lead archeologist in order to comply with the above mentioned criteria.

The data obtained from each skull were included: age, sex, and the presence of any dental paleopathology. The following data were registered: dental caries (enamel caries and dentin caries); malocclusion (Class I, Class II, Class III, and unclassified); dental crowding (mandible, maxilla, upper and lower jaw, unclassified); direction anomalies (gyroversion, vestibule-version, linguo-version, unclassified); site anomalies (transposition, site anomalies, unclassified). Each piece of data was registered using a data collection instrument designed for this purpose.

Statistical analysis

Data were processed using the SPSS 23.0 (IBM, Inc.) statistical package and presented in simple tables with the number of cases and the corresponding percentages.

RESULTS.

The following results were obtained from the 106 remains studied: enamel caries (37.7%); dentin caries (62.3%); Class I malocclusion (76.4%); Class II malocclusion (4.7%); Class III malocclusion (4.7%); maxillary crowding (15.1%); mandibular crowding (19.8%); teeth crowding on both jaws (13.2%); gyroversion (20.8%); vestibule-version (15.1%); linguo-version (17.9%); and dental transposition (5.7%). (Table 1)

The following results were obtained regarding age and observed dental paleopathology in the studied remains: from a total of 38 young-adults, 55.3% presented caries on their enamel; 92.1% Class I malocclusion; 21.1% mandibular crowding; 31.6% linguo-version, and 2.6% presented transposition. In the case of 61 mature adults the results showed that 68.9% presented dentin caries; 73.8% Class I malocclusion; 21.3% mandibular crowding; 24.6% gyroversion, and 6.6% dental transposition. Regarding seven elder adults, 100.0% presented dentin caries; 14.3% Class I malocclusion; 28.6% mandibular crowding and crowding on both jaws; and 14.3% presented transposition. (Table 2)

According to sex, the most frequent dental paleo-pathologies in a total of 59 male skeletal remains, 69.5%

presented dentin caries; 72.9% Class I malocclusion; 20.3% teeth mandibular crowding; 20.3% gyroversion; and 6.8% presented dental transposition.

Finally, from a total of 47 female remains, 53.2% presented dentin caries; 80.9% Class I malocclusion; 19.1% mandibular crowding and dental crowding in both jaws; 21.3% gyroversion; and 4.3% presented dental transposition. (Table 3)

Table 1. Dental paleopathology in skeletal remains from a Peruvian pre-Hispanic community.

Dental paleopathology		n	%
Dental caries	Enamel caries	40	37.7
	Dentin caries	66	62.3
Malocclusion	Unverifiable	15	14.2
	Class I	81	76.4
	Class II	5	4.7
	Class III	5	4.7
Dental crowding	Unverifiable	55	51.9
	Maxilla	16	15.1
	Mandible	21	19.8
	Both jaws	14	13.2
Direction anomalies	Unverifiable	49	46.2
	Gyroversion	22	20.8
	Vestible-version	16	15.1
	Linguo-version	19	17.9
Site anomalies	Unverifiable	100	94.3
	Transposition	6	5.7
Total		**106**	**100**

Table 2. Dental paleopathology in skeletal remains from a Peruvian pre-Hispanic community, by age.

Dental paleopathology		Age (years)					
		Young adult (18- 30)		Mature adult (31-50)		Elder adult (≥51)	
		n	%	n	%	n	%
Dental caries	Enamel caries	21	55.3	19	31.1	0	0
	Dentin caries	17	44.7	42	68.9	7	100
Malocclusion	Unverifiable	1	2.6	8	13.1	6	85.7
	Class I	35	92.1	45	73.8	1	14.3
	Class II	0	0	5	8.2	0	0
	Class III	2	5.3	3	4.9	0	0
Dental crowding	Unverifiable	20	52.6	32	52.5	3	42.9
	Maxilla	3	7.9	11	18	2	28.6
	Mandible	8	21.1	13	21.3	0	0
	Both jaws	7	18.4	5	8.2	2	28.6
Direction anomalies	Non-confirmable	13	34.2	31	50.8	5	71.4
	Gryoversion	6	15.8	15	24.6	1	14.3
	Vestible-version	7	18.4	8	13.1	1	14.3
	Linguo-version	12	31.6	7	11.5	0	0
Site anomalies	Non-confirmable	37	97.4	57	93.4	6	85.7
	Transposition	1	2.6	4	6.6	1	14.3
Total		**38**	**100**	**61**	**100**	**7**	**100**

Table 3. Dental paleopathology in skeletal remains from a Peruvian pre-Hispanic community, by sex.

Dental paleopathologies		Sex			
		Male		**Female**	
		n	**%**	**n**	**%**
Dental caries	Enamel caries	18	30.5	22	46.8
	Dentin caries	41	69.5	25	53.2
Malocclussion	Unverifiable	10	16.9	5	10.6
	Class I	43	72.9	38	80.9
	Class II	4	6.8	1	2.1
	Class III	2	3.4	3	6.4
Dental crowding	Unverifiable	31	52.5	24	51.1
	Maxilla	11	18.6	5	10.6
	Mandible	12	20.3	9	19.1
	Both jaws	5	8.5	9	19.1
Direction anomalies	Unverifiable	27	45.8	22	46.8
	Gyroversion	12	20.3	10	21.3
	Vestible-version	9	15.3	7	14.9
	Linguo-version	11	18.6	8	17
Site anomalies	Unverifiable	55	93.2	45	95.7
	Transposition	4	6.8	2	4.3
Total		**59**	**100**	**47**	**100**

DISCUSSION.

The present study determined the prevalence of dental paleopathologies among a pre-Hispanic Peruvian community. It is currently known that the prevalence of oral disorders varies depending on geographic region, and that exogenous factors are involved. Thus, we present evidence that ancient dental issues are the same that afflict modern society; however, on that time they presented no public health importance.[4,8,9]

According to the study of 106 skeletal remains, caries are one of the most prevalent paleopathology, with dentin caries being the most common. According to age, enamel caries were the most prevalent among young adults, yet, as they aged, dentin caries became more prevalent. According to sex, dentin caries were prevalent among both males and females. These results are similar to those obtained by Valdivia[10] and Uceda et al.,[11] yet opposed to those obtained by Botetano.[12]

Each of the studies mentioned were conducted on Peruvian communities, yet they differed in the size of the studied sample, as well as in their registration and evaluation processes. One of the strengths of the present study, setting it apart from those previously mentioned, is that it is the first time in Peru that a study classified the tooth caries found in skeletal remains into the categories of enamel and dentin caries. As a result, this allowed for a better understanding of the cultural evolution regarding food production, food types and eating habits among ancient Peruvian communities.[4,8,9]

Furthermore, it was observed that malocclusions were the second most prevalent paleopathology, with Class I the most common, being prevalent in both male and female subjects in all age groups. This was confirmed by Botetano,[12] who found that 88% of a sample of 100 facial bones remains presented Class I malocclusion, followed by Class II with 9% and Class III with only 3%.

These results, however, contradict those of Fiorin et al.,[13] who mentioned that malocclusion was not as widespread in ancient times as it is today. This difference may be due to the fact that the study conducted by Fiorin et al.,[13] took place in Spain, which does not correlate with the daily lives of Peruvian populations at the time, mostly because of cultural differences.

In most skeletal remains, dental crowding could not be confirmed; however, in the cases where it was classifiable as such it was more prevalent on the mandible. These results are similar to those of Botetano[12] and Polanco et al.,[14] who found a low prevalence of dental crowding

(9% and 36%, respectively). This can be a result of the type of analysis performed in each study: the present study evidences a low prevalence of dental crowding and diverse position patterns that, regardless of not being fully confirmable, were still present.

In addition, although many of the direction anomalies found in the skeletal remains studied could not be confirmed, gyroversion was the most prevalent. When classified by age, young adults presented a higher prevalence of linguo-version, yet as they aged this changed to gyroversion. Males presented a higher prevalence of direction anomalies compared to females. These results were similar to those obtained by Valdivia,[10] thus it can be concluded that direction anomalies among pre-Hispanic communities were rare, being observable only in individual cases.

Finally, although site anomalies could not be confirmed, teeth transposition was the most prevalent among the remains that presented anomalies. According to age, mature adults presented a higher prevalence of dental transposition. Males presented a higher prevalence of dental transposition. A possible explanation for this low frequency could be the firmness of their anatomic structure, as well as their diet rich in uncooked meals, both of which can result in a wider maxilla.

CONCLUSION.

The results of the present study demonstrate a high prevalence of caries and malocclusion among pre-Hispanic Peruvian communities.

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