ANTHROPOLOGIE • XXX/1 • 1992

DOUGLAS H. UBELAKER

TEMPORAL TRENDS OF DENTAL DISEASE IN ANCIENT ECUADOR

ABSTRACT: Research conducted since 1973 on archaeologically recovered samples of human remains from Ecuador has resulted in the published analysis of over 1000 skeletons from 10 different pre-European contact sites. The sites date from as early as 6000 B. C. to about the time of European contact. The cultural periods represented by these samples extend from the early pre-agricultural, pre-ceramic populations, through the subsistence shift to agriculture and include the latest periods of extensive agriculture and urbanism. The data available suggest a general decline in dental health through time, apparently resulting from subsistence change as well as a general increase in morbidity, likely related to increased sedentism and population density.

KEY WORDS: Ecuador – Dental disease – Morbidity – Teeth.

Since 1973, I have collaborated with a multinational group of archaeologists and museum personnel in the excavation and analysis of prehistoric mortuary sites in Ecuador, South America (Ubelaker 1988a). This effort has resulted in the published analysis of over 1000 human skeletons from 10 different sites and the ongoing analysis of material from several others. These sites range in antiquity from as early as 6000 B. C. to about 1500 A. D. The earliest site, Sta. Elena from Guayas Province dates to about 6000 B. C. (Ubelaker 1980a) and yielded 192 skeletons from a pre-ceramic pre-agricultural population living on the coast. Other site samples include 199 from Cotocollao of the highlands dating from 1000 B. C. to 540 B. C. (Ubelaker 1980b) when subsistence included maize, potato and other agricultural products; 24 from the coastal site of La Libertad dating between 900 B. C. and 200 B.C. (Ubelaker 1988b), Engory culture; 30 skeletons from OGSE-MA-172, a coastal Guangala site dating to about 100 B. C. (Ubelaker 1983a); 106 skeletons from San Lorenzo del Mate of Jambelí culture dating from 500 B.C. to 500 A. D. (Ubelaker 1983b); 18 skeletons from La Tolita on the northern coast, dating from 90 A. D. to 190 A. D. (Ubelaker 1988c); 52 skeletons from the highland high status shaft tombs of La Florida, dating to about 340 A. D.; 51 skeletons from the non-urn component of Ayalán dating from between 500 B. C. and 1155 A. D. (Ubelaker 1981); 7 skeletons from the coastal Manteño site of Agua Blanca (Ubelaker 1988d), dating from 800 A. D. to 1500 A. D.; and 384 skeletons from the urn component of Ayalán, dating from 730 A.D. to 1730 A. D. (Ubelaker 1981).

Collectively, samples from these sites span the sweep of Ecuadorian history (Ubelaker 1984) and offer an opportunity to document aspects of variation and temporal change of morphological and morbidity factors and to correlate them with cultural events (*Table 1*). Such analysis suggests that levels of infectious disease, porotic hyperostosis and other indicators of morbidity were lowest within the earliest sample of Sta. Elena. All indicators of morbidity increase steadily in the later samples, apparently reflecting a temporal increase in sanitation problems associated with increasing population density and sedentism.

Data collected on dental disease from these samples include dental hypoplasia, dental caries,

Paper presented at the 3rd Anthropological Congress of Aleš Hrdlička, held on September 3 – 8, 1989 in Humpolec, Czechoslovakia.

Table 1. Human skeletal samples from Ecuador utilized in study.

Site	Date	Location (Province)	Culture	Approximate Number in Sample
Agua Blanca	800 A.D. – 1500 A.D.	Manabi	Manteno	7
Ayalán Urn	730 A.D. – 1730 A.D.	Guayas	Milagro	384
Ayalán Non-urn	500 B.C. – 1155 A.D.	Guayas	Milagro	51
La Florida	340 A.D.	Pichincha	Cotocollao	52
Jama-coaque	200 B.C. – 800 A.D.	Manabi	Jama-coaque	1
La Tolita	90 A.D. – 190 A.D.	Emeraldas	Tolita Tardio	18
OGSE-MA-172	100 B.C.	Guayas	Guangala	30
La Libertad (OGSE-46)	900 B.C. – 200 B.C.	Guayas	Engory	24
Cotocollao	1000 B.C. – 540 B.C.	Pichincha	Cotocollao	199
Sta. Elena	6000 B.C.	Guayas	Vegas Complex	192

alveoar abscess and antemortem tooth loss. Dental hypoplasia refers to incomplete or poorly completed calcification of the dental crowns. Hypoplastic teeth usually display lines or bands extending around the circumference of the crown. The lines are usually indented and frequently discolored. They appear to result from interruption of the crown formation due to environmental insult, disease or other stress. As such, the frequency of dental hypoplasia offers an indicator of morbidity in the population at least for the preadult years when the teeth are forming. The location of the lines or defects within the individual tooth allows calculation of the age at which the defect occurred. Some have further suggested that the thickness of the defect indicates the relative duration of the stress episode suffered by the individual.

The Ecuadorian data are expressed as the percentage of fully formed permanent teeth with hypoplasia (*Figure 1*). They indicate early low levels of hypoplasia until shortly before the time of Christ when hypoplasia increased dramatically. The frequency then rapidly declines between 100 B. C. and 400 A. D. and subsequently dramatically increases again into historic times. The highest values come from the latest samples of Ayalan urn and Agua Blanca while the lowest originate from the early sample of Sta. Elena, as well as Cotocollao, La Tolita, and La Florida.

Carious lesions consist of abnormal cavities on the tooth crown or associated area of the root produced by a destructive disease process. Lesions were counted if they were the size of a pinhead or larger and obviously resulted from tissue necrosis and subsequent hard tissue collapse, rather than from developmental defects or mechanical abrasion. Such observations offer important data on diet, since worldwide caries frequency shows a temporal increase augmented especially by high sugar intake and/or consumption of sticky, starchy foods. In 1978, Turner suggested that caries frequency in ancient Ecuador offers direct evidence for agriculture and high maize consumption. He argued that a low frequency of carious lesions within teeth of Valdavia C. Machalilla phase indicated a low carbohydrate diet which argues against intensive maize agriculture for that group. No lesions were found by him in 76 Valdavia Period C teeth, while 2 of 14 Machalilla teeth were carious. This suggests an overall caries frequency of 2.2% for his entire sample.

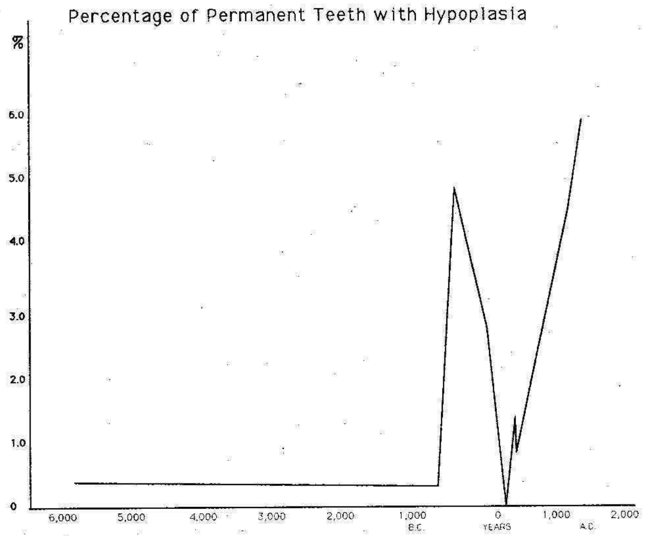

Figure 1. Percentage of permanent teeth with hypoplasia.

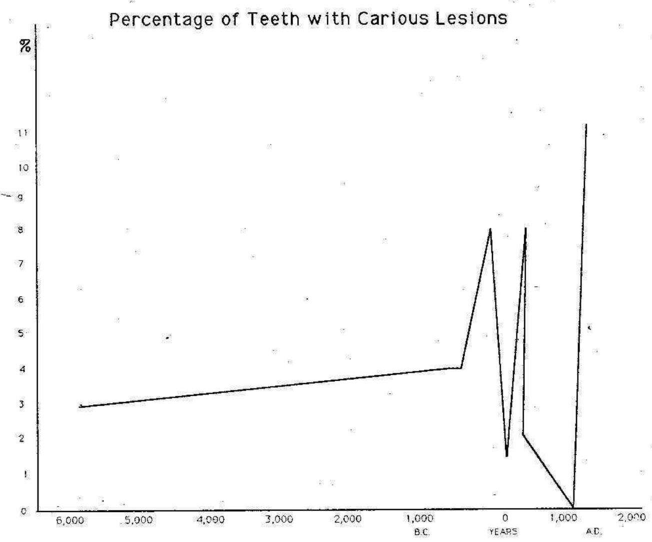

Figure 2. Percentage of permanent teeth with carious lesions.

Comparative data on carious lesions from my research are presented as the percentage of fully formed permanent teeth with at least one carious lesion (*Figure 2*). The pattern is similar to that shown with the hypoplasia data; early low frequency at Sta. Elena, an increase at about the time of Christ followed by a rapid decline and then a rapid increase again.

These data suggest a general increase in caries frequency with time in prehistoric Ecuador, but the correlation is much more complex than suggested by Turner. His reported frequency for the small Machalillia sample (14%) is the highest in prehistoric Ecuador. The absence of carious lesions with the small Valdivia C sample was also found with the small Agua Blanca sample which dates from the Late Integration Period and is derived from a population that surely practiced intensive agriculture. The frequencies at La Tolita (2%) and Cotocollao (3%) are also low for populations that date well into the agricultural period.

Another indicator of dental morbidity is the frequency of alveoar abscess (*Figure 3*). These lesions

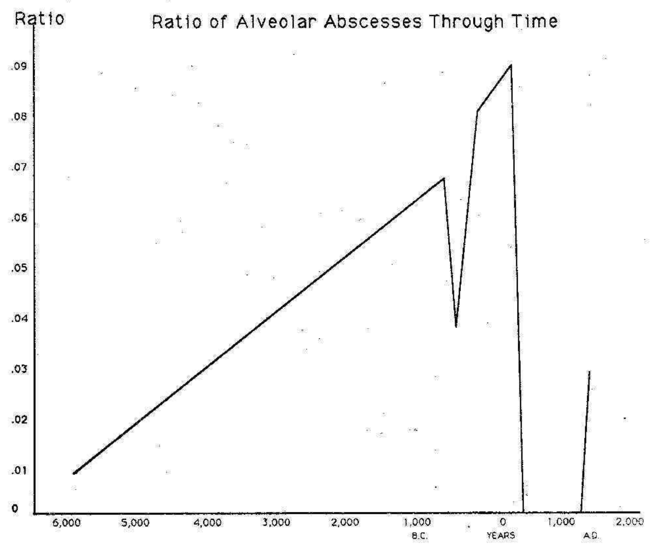

Figure 3. Ratio of alveolar abscesses through time.

occur when some aspect of the pulp cavity becomes exposed, usually through crown loss due to attrition or carious destruction, and subsequently becomes infected. When the infection is prolonged, an abscess will form in the bone at the base of the tooth. In the absence of treatment, the abscess will lead to loss of the tooth with subsequent remodelling of the alveolus. Data on alveolar abscess are expressed as the ratio of the number of alveoar abscesses in adults to the number of observations on abscess recorded (presence or absence) associated with permanent teeth. In these samples, the highest value is from La Tolita, followed by OGSE-MA-172 and Cotocollao.

The high rate of dental attrition is the major factor influencing the formation of alveoar abscesses in these samples, although caries does contribute. Obviously, the age at death also is a factor, since the likelihood of attrition penetrating the pulp cavity increases with the age of the individual.

Antemortem loss of teeth is the ultimate product of most untreated dental disease. Data from the

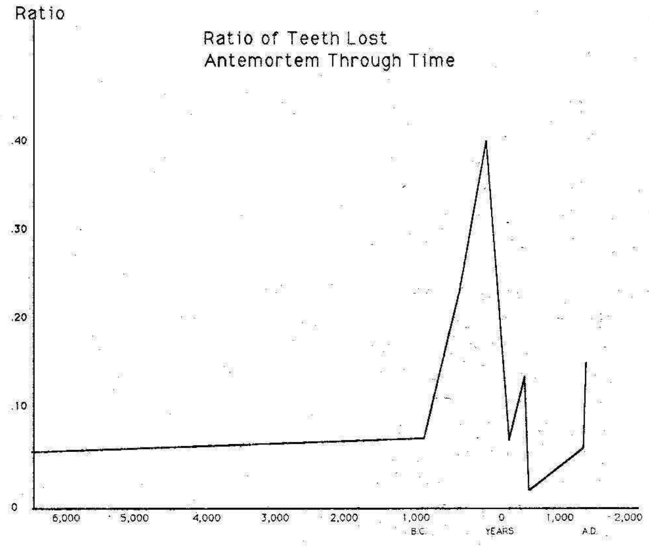

Figure 4. Ratio of teeth lost antemortem through time.

Ecuadorian samples (*Figure 4*) are expressed as the ratio of permanent teeth lost antemortem to the number of observations on the presence of permanent teeth (absent and present). The highest value comes from Guangala at 0.40, followed by La Libertad. Again, the data are highly variable, but suggest a general increase from early low levels, until shortly before the time of Christ with subsequent reductions.

The new data available on skeletal biology of prehistoric Ecuador reveal some general trends and greater complexity than previously realized. Like other indicators of morbidity in the populations, the dental evidence suggests declining dental health through time. Deviations from this pattern may represent sampling problems, but most likely suggest complexity in the factors that contribute to dental problems. The long term shift in subsistence and settlement pattern toward agriculture, sedentism, and increased population density appears to have been accompanied by a general decline in health, mediated by local conditions and complicating factors. Additional research with augmented samples from Ecuador hopefully will clarify the dynamics of this process.

REFERENCES

TURNER II, CHRISTY G., 1978: Dental Caries and Early Ecuadorian Agriculture. *American Antiquity*, Vol. 43, No. 4, pp. 694 – 697.

UBELAKER, DOUGLAS H., 1980a: Human Skeletal Remains from Site OGSE-80, a Pre-ceramic Site on the Sta. Elena Peninsula, Coastal Ecuador. *Journal of the Washington Academy of Sciences*, Vol. 70, No. 1, pp. 3 – 24.

UBELAKER, DOUGLAS H., 1980b: Prehistoric Human Remains from the Cotocollao Site, Pichincha Province, Ecuador. *Journal of the Washington Academy of Sciences*, Vol. 70, No. 2, pp. 59 – 74.

UBELAKER, DOUGLAS H., 1981: *The Ayalán Cemetery: A Late Integration Period Burial Site on the South Coast of Ecuador.* Smithsonian Contributions to Anthropology, No. 29. Washington, D.C. 175 pages, 119 figures, 170 tables.

UBELAKER, DOUGLAS H., 1983a: Human Skeletal Remains from OGSE-172, an Early Guangala Cemetery Site on the Coast of Ecuador. *Journal of the Washington Academy of Sciences*, Vol. 73, No. 1, pp. 16 – 26.

UBELAKER, DOUGLAS H., 1983b: Prehistoric Demography of Coastal Ecuador. *National Geographic Society Research Reports,* Vol. 15, pp. 695 – 703.

UBELAKER, DOUGLAS H., 1984: Prehistoric Human Biology of Ecuador: Possible Temporal Trends and Cultural Correlations. Chapter 19 in *Paleopathology at the Origins of Agriculture,* Mark N. Cohen and George J. Armelagos, editors, pp. 491 – 513. New York: Academic Press.

UBELAKER, DOUGLAS H., 1988a: Skeletal Biology of Prehistoric Ecuador: An Ongoing Research Program. *Journal of the Washington Academy of Sciences,* Vol. 78, No. 1, pp. 1 – 2.

UBELAKER, DOUGLAS H., 1988b: Human Remains from OGSE-46, La Libertad, Guayas Province, Ecuador. *Journal of the Washington Academy of Sciences*, Vol. 78, No. 1, pp. 3 – 16.

UBELAKER, DOUGLAS H., 1988c: Prehistoric Human Biology at La Tolita, Ecuador, a Preliminary Report. *Journal of the Washington Academy of Sciences,* Vol. 78, No. 1, pp. 23 – 37.

UBELAKER, DOUGLAS H., 1988d: A Preliminary Report of Analysis of Human Remains from Agua Blanca, a Prehistoric Late Integration Site from Coastal Ecuador. *Journal of the Washington Academy of Sciences,* Vol. 78, No. 1, pp. 17 – 22.

Douglas H. Ubelaker
Department of Anthropology
National Museum of Natural History
Smithsonian Institution
Washington, D. C.
20560