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TRENDS IN DENTAL ANTHROPOLOGICAL RESEARCH

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The beginning of the new year seems an appropriate time to assess the health of the field of dental anthropology and examine recent research trends in our discipline. I did this by searching for citations on Medline, a computer data base compiled by the National Library of Medicine on more than 4,000 medical and health science journals. Medline has some limitations as a source of information on dental anthropological research. Much important work is published in anthropological journals, conference proceedings, and edited volumes not cited in Medline. However, Medline does index a broad range of journals including the American Journal of Physical Anthropology, the Journal of Forensic Sciences, and so on that are key publication venues for dental anthropological research.

Counts of journal articles published between 1966 and 1996 show that dental anthropology is a rapidly growing research area (Fig. 1). In my survey, I defined articles on dental anthropological topics as those indexed under the key words "teeth" or "dental" and "anthropology" or "primates" or "evolution" or "genetics." Although somewhat different key words might have been used, these searches retrieved many of the dental anthropological papers I am aware of. About 1.5% of the over 200,000 dental articles published during this 30-year period are indexed on these topics that are of special interest to dental anthropologists. During the 1990's, the proportion of anthropological articles in the dental literature has more than doubled. At present, about 3% of the dental literature deals with dental anthropological topics. This increase is highly significant ($\chi^2=27.7$, $p < 0.0001$).

The growth in dental anthropological research roughly coincides with the founding of the Dental Anthropology Association ten years ago. The relationship between more dental anthropological publications and the formation of our association is probably not direct. Nevertheless, the recent membership growth our association has experienced reinforces the conclusion from the literature survey that interest in dental anthropology is increasing.

To get an idea of research trends, I analyzed the content of the dental articles published in the *American Journal of Physical Anthropology* (AJPA). Although certain types of dental anthropological research are not published in the AJPA, most would agree that this journal is a leading venue for dental anthropological research and that its contents provide a good overview of developments in the field. The dental articles published in the AJPA show a growth pattern different from that seen in the dental literature as a whole. The proportion of AJPA articles on dental topics increased markedly in the late 1970's. Between 1966 and 1975, dental articles made up 8.4% of the journal's content. In the succeeding years, the proportion of dental articles rose to around 20% of its content, a level that has been maintained into the present. The recent increase in dental anthropological publications seen in Figure 1, therefore, is not a result of the publication of papers in the AJPA.

To obtain data on changes in the types of studies dental anthropologists are conducting, I classified the topics of the 417 AJPA dental articles published between 1975 and 1996 under the following headings: Functional Morphology (topics such as jaw mechanics and mastication), Growth and Development (dental and/or craniofacial development), Non-metric Traits (variation in discrete dental traits

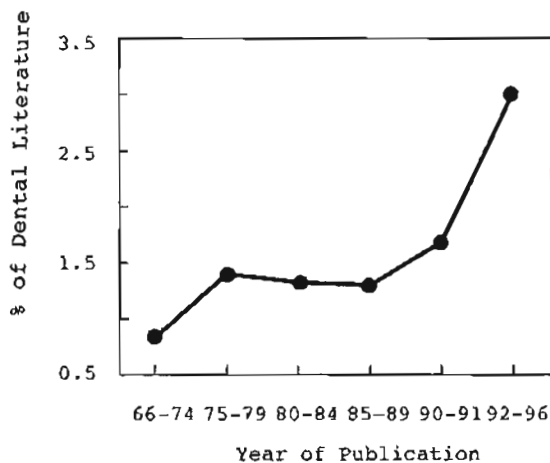


Fig. 1. Graph showing the growth of dental anthropological research. Articles on dental anthropological subjects (indexed under the key words teeth or dental and anthropology or primates or evolution or genetics) as a percent of the dental literature (articles indexed under the key words teeth or dental)

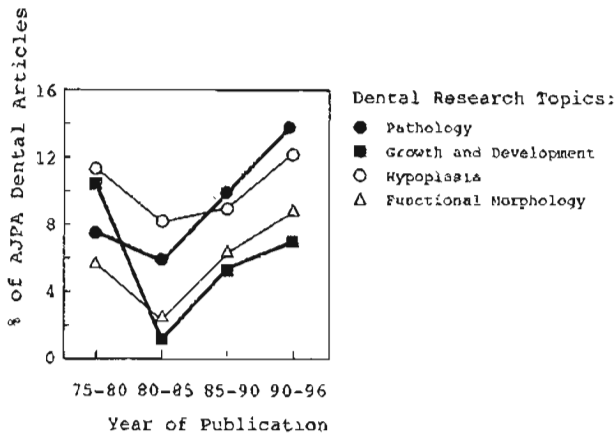


Fig. 2. Growth areas of dental anthropological research as reflected in the percentage of articles on that topic relative to the total number of dental articles published in the *American Journal of Physical Anthropology* during five-year intervals between 1975 and 1996.

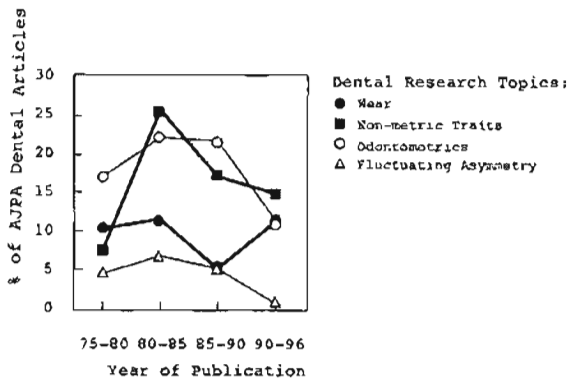


Fig. 3. Areas of dental anthropological research showing a decline or no growth as reflected in the percentage of articles on that topic relative to the total number of dental articles published in the *American Journal of Physical Anthropology* during five-year intervals between 1975 and 1996.

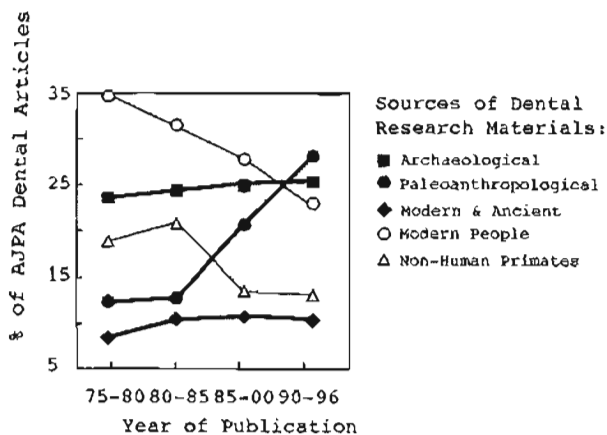


Fig. 4. Trends in the sources of dental anthropological research materials as reflected in the percentage of *American Journal of Physical Anthropology* articles on dental topics during five-year intervals between 1975 and 1996.

such as the number and form of cusps), Odontometrics (tooth size excluding fluctuating asymmetry), Fluctuating Asymmetry, Dental Pathology (caries, abscesses, and other pathologies, exclusive of enamel hypoplasia), Enamel Hypoplasia, and Tooth Wear. The bibliography used in the analysis can be found on the Dental Anthropology Association web site: <http://www.sscf.ucsb.edu/~walker/>.

The numbers of articles published on these topics show some interesting trends. Four research areas (pathology, growth and development, hypoplasia, and functional morphology) show similar patterns of decline in publication rate during the early 1980's followed by increase during the 1990's (Fig. 2). Three research topics (non-metric traits, odontometrics, and fluctuating asymmetry) show the inverse pattern with an increase during the early 1980's and a steady decline in publication rate since then (Fig. 3). Contributions on tooth wear have remained more-or-less constant through time at about 10% of the journal's dental content.

Some insights into these changing publication patterns can be gained by looking at the types of research materials dental anthropologists use (Fig. 4). There is a clear trend toward increase in publication of papers on early hominid dental remains. During the past decade, the rate of publication of such paleoanthropological studies has more than doubled. Articles concerned with the teeth of modern people and non-human primates, on the other hand, decreased significantly during the same period.

These trends, to some extent, reflect changes in the availability of research materials. During the past 20 years, paleoanthropological research throughout the world has produced much new material for dental anthropologists to describe. The steady decrease in studies of modern people, on the other hand, undoubtedly reflects the rapid decline that is occurring in opportunities to document dental conditions among people who have had little contact with Western culture, the traditional subjects of dental anthropological research.

The studies of recent archaeological materials, which account for about 25% percent of the dental articles published in the AJPA, have not increased significantly during the past twenty years. This at first glance is surprising. Many dental studies are being conducted in North American and Australia on archaeological collections threatened with destruction through repatriation to indigenous peoples. Most of this repatriation-related research is quite recent. The lack of an increase in studies of archaeological material may, therefore, reflect a lag between data collection and publication. A future increase in the publication of archaeological studies seems likely.

Although the bibliographic sources I have used to assess research trends have certain inherent limitations and biases, they clearly suggest that dental anthropology is a healthy, growing discipline.

ENAMEL HYPOPLASIA RELATED TO HISTORICAL FAMINE STRESS IN THE CONTEMPORARY CHINESE POPULATION

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ABSTRACT Linear enamel hypoplasia (LEH), a defect in enamel formation, has been frequently attributed to malnutrition and other physiological stress during periods of enamel development (Sarnat and Schour, 1941; Kreshover, 1960). LEH has been widely used as an indicator of developmental stress in skeletal studies among historic and prehistoric populations (Goodman et al., 1980; Corruccini et al., 1985; Goodman and Rose, 1990). A study of 3,014 subjects in 26 birth-year cohorts, sampled from urban and rural communities of China, indicated that significant differences in LEH frequencies occurred between persons whose teeth developed during the famine years (1959-1961) and those whose teeth calcified during non-famine years. This result points to a causal link between enamel hypoplasia and childhood nutritional stress at the population level, and casts some light on the magnitude and effects of the little-documented Chinese famine.

INTRODUCTION

Although LEH has great potential as an indicator of population nutritional stress, the relationship has not been completely resolved (Goodman and Rose, 1990; Goodman and Capasso, 1992). Some epidemiological studies, which focused at the individual and small group level, have been conducted to assess this relationship (Goodman et al., 1987, 1991). This study examined the possibility of a direct link between LEH and nutritional stress at the population level during a large-scale famine.

A famine in China between 1959 and 1961 is considered to have been among the most devastating famines in human history (Kane, 1988; Rodzinski, 1988; Newman, 1990). Massive starvation resulted from failed national policies, mainly Mao's Great Leap Forward, which was a utopian production drive in which Mao formed rural communes and attempted to achieve rapid industrialization (Ashton et al., 1984; Kane, 1988; Rodzinski, 1988; Newman, 1990). According to Chinese official statistics released 20 years later, this famine is estimated to have caused more than 30 million deaths plus 30 million lost and postponed births. Famine stress is thought to have been evenly distributed among the entire population of 650 million people due to the socialist system (Ashton et al., 1984; Banister, 1984; Bernstein, 1984; Peng, 1987; Riskin, 1987; Rodzinski, 1988; Kane, 1988; Newman, 1990). In recent years, new information on the famine indicates that at least 40 million people died from the famine, and that "it was more widespread than long believed and could have been avoided" (Southerland, 1994:6-7).

The bioanthropological perspective of this famine remains poorly studied (Kane, 1988; Southerland, 1994). We report here the results of a study of the prevalence of LEH in relation to famine stress among the contemporary Chinese population.

MATERIALS AND METHODS

An eight-month field project was carried out in China in 1993 and 1994 by one of us (LZ). LEH was assessed on the buccal surface of the anterior teeth of individuals born between 1949 and 1974. The sample consisted of 3,014 individuals in 26 birth-year cohorts. Of these 1,544 (806 females, 738 males) were from urban communities in the city of Shanghai and 1,470 (741 females, 729 males) from rural villages near Qingji township, Anhui province, 500 km northwest of Shanghai.

The recording of LEH followed the epidemiological standard for classification of developmental defects of dental enamel (DDE index) of the Federation Dentaire Internationale adapted by Goodman et al. (1987, 1991). The examiner and recorder of LEH were always blind to the subject's age and birth year. Information regarding birth date, birth place, height and body weight and other variables were collected after the dental examinations and recording had been completed. For estimation of the reliability of the field assessment, 600 photos of 2,400 teeth (6.67 % of sample) were taken from randomly selected subjects to serve as permanent record.

The LEH data were analyzed in two ways. The first involved comparisons of frequencies of dentitions with at least one LEH on the 12 anterior teeth (maxillary and mandibular incisors and canines). The second entailed comparisons of percentages of the presence of LEH on one of six developmental zones of the mandibular canines.

The 12 anterior teeth were chosen for the first part of the analysis because they are the easiest to examine, are often studied by other researchers, and have relatively high hypoplastic rates (Goodman & Armelagos, 1985). For this part of the analysis, data for 26 birth-year cohorts were pooled into three birth cohorts: pre-famine (1949-1953), famine (1954-1961), and post-famine (1962-1974) (Table 1). When interpreting the results, the 4.5 to 6.5 postnatal developmental period of anterior teeth is important to consider. Thus, the 1954-1961 cohorts have some anterior teeth which developed during the famine years.

The mandibular canines were studied in the second part of the study because they were the most hypoplastic teeth of the present study. Moreover, the canine has a development period of six years. Each LEH can be accurately attributed to a specific horizontal zone roughly corresponding to a particular one-year period (Goodman et al., 1987). This feature allowed us to estimate the time of formation of a LEH from the distance to the cemento-enamel junction relative to the person's birth year. The results provided an accurate picture of the relationship between LEH and famine stress (Goodman et al., 1987). For this portion of the study, 21 birth-year cohorts were pooled into three birth cohorts: pre-famine (1954-1958), famine (1959-1962), and post-famine (1963-1974) (Table 2).

RESULTS

Out of the 3,014 subjects observed for LEH on the 12 anterior teeth, 1,486 (49.30%) had at least one LEH (Table 1). The differences between the frequency of LEH in the famine (1954-1961) birth cohorts (55.91%) and those in the pre-famine (49.04%) and post-famine cohorts (45.50%) is real ($p < 0.05$) in both cases, despite substantial overlap in tooth-forming ages and birth cohort years. These differences can only be explained by the affects of the famine stress.

In the 6,019 mandibular canines analyzed for the second part of the study, 26,997 developmental zones formed between 1954 to 1974 were recorded (Table 2). Of these developmental zones, 3,433 (12.72%) had LEH. The results of statistical tests comparing the percentages of LEH zones between pre-famine (1954-1958) and famine (1959-1962) birth cohorts, between famine and post-famine (1963-1974) birth cohorts, and between pre-famine and post-famine birth cohorts are summarized in Table 2. The null hypothesis that no difference exists in LEH formation between famine years and pre-famine years and between famine years and post-famine years cannot be accepted ($p < 0.05$).

This diachronic pattern of LEH frequencies of developmental zones on mandibular canines is compatible with the differential survivorship of birth-year cohorts of the population, another well accepted biological indicator of famine stress. Fewer randomly selected informants were born between 1959 and 1961 (96 per year) than between other years (119 per year), especially rural subjects (38 per year) compared with urban subjects (59 per year). This selective mortality probably removed the most stressed individuals, especially rural individuals, from potential study. The diachronic patterns of LEH frequencies thus provide a unique biological confirmation and record of the great Chinese famine between 1959 and 1961 (Kane, 1988; Ashton et al., 1984; Peng, 1987).

CONCLUSIONS

We conclude that LEH frequencies are significantly higher in teeth developed during the famine years than in the teeth developed during the pre- and post-famine years in the contemporary Chinese population. This result suggests a causal link between the nutritional stress of the famine and increasing LEH frequencies at the population level. Additional details of these results will be reported elsewhere. For example, LEH was significantly elevated in males versus females, and in rural versus urban subjects.

The results are all the more noteworthy in view of two factors. First, a steady rate of hypoplasia persisted during the relatively good times, that is during pre- and post-famine years. However, a lesser peak in LEH was observed in the sample over the years of disruption owing to the Cultural Revolution about 1969. We continue to suspect that

TABLE 1. Contingency table comparing LEH frequencies of birth cohorts of pre-famine (1949-1953), famine (1954-1961), and post-famine (1962-1974) birth cohorts. Data based on the presence of at least one LEH on the 12 anterior teeth.

Birth cohort	n	N	%		Birth cohort	n	N	%	Chi-square	p
Pre-famine	282	575	49.04	vs	Famine	506	905	55.91	6.66	0.0100
Famine	506	905	55.91	vs	Post-famine	698	1,534	45.50	24.67	0.0001
Post-famine	698	1,534	45.50	vs	Pre-famine	282	575	49.04	2.11	0.1465
Total	1,486	3,014	49.30			1,486	3,014	49.30		

n is the number of individuals with at least one LEH. N is the number in the sample. % is the frequency of n/N.

TABLE 2. Contingency table comparing LEH frequencies of developmental zones on teeth of birth cohorts formed in pre-famine (1954-1958), famine (1959-1962), and post-famine (1963-1974) birth cohorts. Data based on the presence LEH in six developmental zones on the mandibular canines.

Birth cohort	n	N	%		Birth cohort	n	N	%	Chi-square	p
Pre-famine	786	6,186	12.71	vs	Famine	641	3,937	16.28	25.40	0.0001
Famine	641	3,937	16.28	vs	Post-famine	2,006	16,874	11.89	55.50	0.0001
Post-famine	2,006	16,874	11.89	vs	Pre-famine	786	6,186	12.71	2.85	0.0916
Total	3,433	26,997	12.72			3,433	26,997	12.72		

Abbreviations are the same as those in Table 1.

many minor hypoplasia lines are trivial. They might not necessarily be related to clear-cut episodes of developmental disruption, while the stress signal may be clear when attention is restricted to the palpably indented major growth arrest lines (Corruccini et al., 1985). Second, the most affected individuals were missing from the sample, as they did not survive the famine. Thus, recovery from LEH-inducing stress ironically may be a sign of increased adaptability during the famine.

LITERATURE CITED

- Ashton B, Hill K, Piazza A, and Zeitz R (1984) Famine in China, 1958-1961. *Pop. Devel. Rev.* 10:613-645.
 Banister J (1984) An analysis of recent data on the population of China. *Pop. Devel. Rev.* 10:241-271.
 Bernstein T (1984) Stalinism, famine, and Chinese peasants. *Theory and Society* 13:339-377
 Corruccini RS, Handler JS, and Jacobi KP (1985) Chronological distribution of enamel hypoplasias and weaning in a Caribbean slave population. *Hum. Biol.* 57:699-711.
 Goodman AH, and Armelagos GJ (1985) Factors affecting the distribution of enamel hypoplasia within the human permanent dentition. *Am. J. Phys. Anthropol.* 68:479-493.
 Goodman AH, and Rose JC (1990) Assessment of systemic physiological perturbation from dental enamel hypoplasias and associated histological structures. *Yearb. Phys. Anthropol.* 33:59-110.
 Goodman AH, Armelagos GJ, and Rose JC (1980) Enamel hypoplasias as indicators of stress in three prehistoric populations from Illinois. *Hum. Biol.* 52:515-528.
 Goodman AH, and Capasso LL (eds.) (1992) Recent Contributions to the Study of Enamel Developmental Defects. *J. Paleopath.* Monographic Publication 2.
 Goodman A H, Hernandez GP, Amador A, Arriola LV, Chavez A, and Pelto GH (1987) Prevalence and age at development of enamel hypoplasias in Mexican children. *Am. J. Phys. Anthropol.* 72:7-19.
 Goodman A H, Martinez C, and Chavez A (1991) Nutritional supplementation and the development of linear enamel hypoplasias in children from Tezonteopan, Mexico. *Am. J. Clin. Nutr.* 33:773-781.
 Kane P (1988) Famine in China, 1959-61: Demographic and Social Implications. New York: St. Martin's Press.
 Kreshover SJ (1960) Metabolic disturbance in tooth formation. *Ann. N.Y. Acad. Sci.* 85:161-167.
 Newman LF (ed.) (1990) *Hunger in History*. Cambridge: Basil Blackwell.
 Peng XZ (1987) Demographic consequences of the Great Leap Forward. *Pop. Devel. Rev.* 13:639-670.
 Riskin C (1987) *China's Political Economy. The Quest for Development Since 1949*. Oxford: Oxford University Press.
 Rodzinski W (1988) *The People's Republic of China: Reflections on Chinese Political History Since 1949*. London: Collins.
 Sarnat BG, and Schour I (1941) Enamel hypoplasia (chronologic enamel aplasia) in relation to systemic disease: A chronologic, morphologic and etiologic classification. *J. Am. Dent. Assoc.* 28:1989-2000.
 Southerland D (1994) The Horrors of Mao - The Cost of His Vision May Have Been 80 Million Chinese Lives. *Washington Post* 11(40):6-7.

CRYSTALLOGRAPHIC AND COLORIMETRIC ANALYSIS OF DENTAL ENAMEL

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ABSTRACT Tooth color and the correlation of the composition of dental enamel with color were investigated in samples of teeth from two medieval Serb cemeteries. Differences in the composition of apatite crystals in the dental enamel of the two samples were found. Color ranges of teeth from the two samples differ in hues and chromas. This result suggests that enamel composition may have an influence on the color of teeth. The prevalence of chlorapatite in enamel causes tooth color to be closer to red and of higher chroma than teeth whose enamel consists of hydroxylapatite. No evidence indicated that soil ingredients were incorporated into the dental enamel of either sample.

INTRODUCTION

In this study we investigated tooth color and the correlation of tooth composition and color. The main inorganic elements of dental enamel are found in the form of apatite crystal, which comprises more than 90 percent of the enamel. Inorganic components significantly determine the color of teeth.

The color of teeth is not, of course, solely dependent on the optical properties of enamel. One of the main optical characteristics of enamel is translucency. Therefore, the layer of dentin situated under the enamel, which has its own optical properties, also influences the color of a tooth. Dentin is characterized by about 40 percent organic component (Arwill et al., 1969). In the case of a skeletal sample, the influence of dentin on tooth color is not important for two reasons. First, skeletal dentin does not have an organic component because the

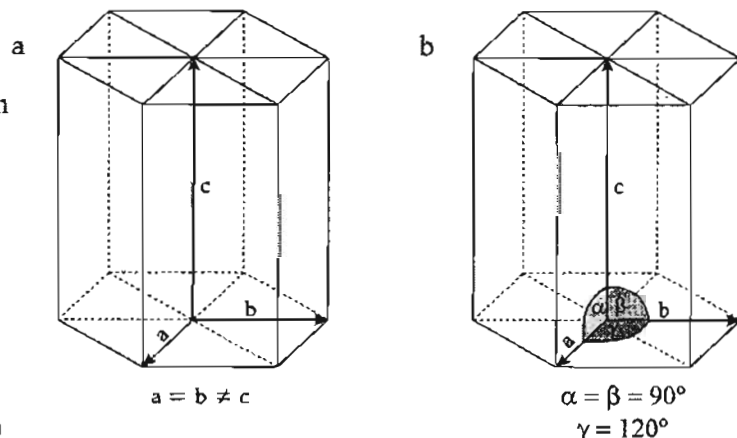


Fig. 1. Hexagonal structure of the apatite crystal.

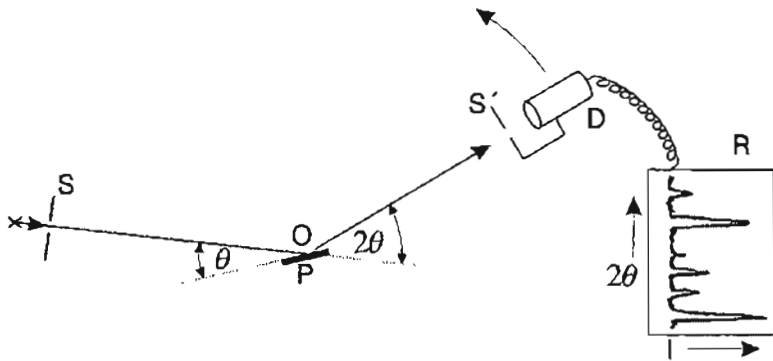


Fig. 2. Scheme of the Röntgen diffractometer.

apatite may be present in a test sample of enamel. The hydroxyl ion may be substituted by the chlorine ion in chlorine apatite, by the fluorine ion in fluorapatite, and by the carbonate ion in dentil.

Contrary to bone in which the constituent elements of hydroxylapatite can be replaced chemically by other ions under various geochemical and hydrolytic conditions (Garland, 1987) of the soil, enamel undergoes little change. This property is due to the high mineralization of hydroxylapatite (Aiello and Dean, 1990).

The measurements of the crystal apatite unit cell, the a and c axes (Fig. 1), are important because the presence of hydroxylapatite, chlorapatite, fluorapatite or some other form of apatite in large quantity in a sample of enamel can be determined on the basis of their sizes. Whether ion substitution occurred from the solution whose diffusion is controlled by ions from the apatite crystal itself can be determined by calculating the values of the measurements of the hexagonal-shaped crystal apatite unit cell.

The unit cell of the apatite structure has two axes (a -axis and b -axis) of the same length under a 120° ($\gamma=120^\circ$) angle and a third axis (c -axis) under a right angle relative to these two a -axes ($\alpha=\beta=90^\circ$) (Fig. 1). The axes of the unit cell with apatite structure, which is hexagonal-shaped, are: $a = b = c$. The angles formed by these axes are $\alpha=\beta=90^\circ$ and $\gamma=120^\circ$. The dimensions of these cells are particularly important in crystallographic research (Tables 1 and 2), yet the changes of the apatite structure are difficult to measure and require the implementation of extremely accurate research methods.

RESEARCH OBJECTIVE

The principal aims of this paper were: 1) to determine the composition of the apatite crystals in the dental enamel of exhumed medieval human skeletons; 2) to assess the color range of medieval teeth; and 3) to evaluate the correlation between the composition of the enamel and the color of the teeth.

MATERIAL

The investigations were done on 22 extracted human upper incisors: 11 from each of two cemetery sites, Žiža and Stara Torina. The results of the analysis of 107 adult skeletons have already been published (Đurić-Srejić et al., 1992).

METHODS

Crystallographic analysis (X-ray diffraction) and digital image analysis were the methods employed. These have not been previously used in anthropological research. Before measurements were taken the samples were cleaned ultrasonically. In the laboratory, the enamel was pulverized in an agate mortar. Identical quantities of pulverized enamel were placed into tubes, coded, and subjected to crystallographic testing.

Crystallographic Analysis

Crystallographic analysis of soil samples from the cemeteries was performed to assure that no ingredients from the soil were present in the dental enamel. Thus, factors determining the enamel composition could have been only dietary habits and water.

X-ray radiation on a grid was used to measure the size of the basic crystal. Whether the binding of the organic and inorganic molecules occurred in the crystal grid structure can be determined based on the changes of the values of the size of the basic enamel crystal cell.

X-ray diffraction is based on the phenomenon of X-ray diffraction that appears in the passing of X-rays through crystal, if the conditions of Bragg's law have been met. The powder diffractometer was used

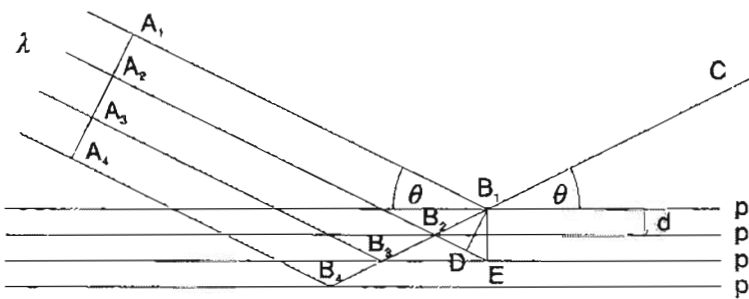


Fig. 3. Diffraction of equidistant X-rays.

to obtain data on X-ray diffraction on the particles of the crystal matter. An X-ray tube with a copper anode (anti cathode) was used as a radiation source. The wave length of the radiation specific for copper is $\lambda_{CuK\alpha} = 0.154178$ nm. Since copper has two characteristic lines, $CuK\alpha 1 = 0.154040$ nm and $CuK\alpha 2 = 0.154434$ nm, of which the first is twice as intensive as the second, the wave length of the radiation for $CuK\alpha$ was obtained according to the formula:

In order to accomplish the emission of specific radiation with an intensity sufficient for diffractometry, voltage U_a of about 40kV was brought to the tube anode and a current I_a of about 20 mA was passed. An X-ray generator often

$$\lambda_{CuK\alpha} = \frac{-2\lambda_{CuK\alpha 1} + \lambda_{CuK\alpha 2}}{3}$$

has a stabilized source of anode current. The beam of X-ray was directed to the powder goniometer. The width of the X-ray beam was limited by crevice S shown in Fig. 2. This collimated beam was dropped on the preparation P.

The preparation P was made by pressing the powder of the test material into an aluminum frame with an opening of 20x10x2 mm. The sample was placed in the center of the goniometer so that the upper surface of the test powder was in the axis of the goniometer O (Fig. 2). The beam diffracted from the preparation passed through the crevice S' and dropped on the X-ray detector D. During the acquisition of diffraction data the detector moved at a constant rate around the axis O, whereas the preparation moved at half this rate. The usual rate for the detector movement is 2°/min.

Intensified and formed impulses were led from the X-ray detector to the integrator which was used to give the number of impulses in the unit of time as voltage values. A recorder logged the changes of the voltage on a paper strip. The paper strip moved at a constant rate that was synchronous with the movement of the detector on the goniometer. Thus the diagram of the abscissa formed an angle 2θ , and the ordinate, the intensity of the diffracted ray (the number of impulses per second) (Fig. 2).

One diffractogram was composed of the basic line (phon or background) for the time without diffraction and maximum (reflection) of different heights with different angles 2θ . Each of these angles represented one family of grid planes whose position in space was indexed by Miller indices (hkl) (Fig. 3). The intensity I and angles 2θ were determined from each diffractogram. The reflection intensity was determined in units 1/100 of the height of maximum (reflection) of the highest intensity on the diagram. Thus, all other values had an intensity of less than 100.

The values of the diffraction angle were measured by lowering the normal on the abscissa from the middle of the maximum (of reflection) measured at half of its height. According to the equation: where d is the distance of the grid planes of Miller indices (hkl); λ is the wavelength of X-ray radiation, and θ is the angle formed by the X-ray with a family of parallel planes. Assuming that $n=1$, the interlayer distances are

$$d = \frac{\lambda}{2 \sin\theta}$$

calculated for all reflections.

The X-ray diagrams of both groups of sample preparations were filmed on a Philips diffractometer, type 1820, with a Philips generator, type 1729. The operating voltage of the X-ray was 40 kV, and the current power of 30 mA. The powder diagrams were recorded in a range from 4-130°. The Philips APD system with a computer, which automatically calculated the interlayer distance and determined the intensity, was used for data processing.

Digital Image Analysis

Digital image analysis was used for colorimetric evaluation of the teeth (Miličević, 1994). Since color measurement and specification relative to some known color (differential colorimetry) has an advantage over identification of color in absolute terms, measurements were made using a physical standard as a reference. The standard selected was an artificial ceramic tooth with the shade guide Lumin Vacuum (Vita, Bad Saeckingen, Germany) labelled D3. This shade guide is widely accepted as a referent and differs the least from the other shades on the guide. Digitization of the sample teeth and Vita shade D3 was done using a Hewlett Packard SJ IIcx scanner at 400 dots per inch resolution. Analysis of the digitized images was performed by the commercial graphic software package, Corel Photo Paint V6.0 (Fig. 4).

Although color phenomena rely upon the spectral characteristic of the reflected light, colors could be specified through the relationship of the three primary



Fig. 4. Color analysis of the digitized image of a tooth.

TABLE 1. Dimensions of unit cells of enamel crystals - data from the literature.

Type of apatite	a-axis (nm)	c-axis (nm)	$V_a(\text{nm}^3)$
Hydroxylapatite	0.941	0.688	52.705
Hydroxylapatite	0.942	0.688	52.892
Fluorapatite	0.937	0.688	52.258
Fluorapatite	0.936	0.688	52.183

TABLE 2. Volume of unit cells - standard.

Hydroxylapatite	Chlorapatite	Fluorapatite
$V_o=52.88\text{nm}^3$	$V_o=53.76\text{nm}^3$	$V_o=52.42\text{nm}^3$

TABLE 3. Parameters of unit cells of enamel crystals - experimentally obtained data.

Specimen	a-axis (nm)	c-axis (nm)	$V_o(\text{nm}^3)$
Žiča	0.9425 (6)	0.6868 (4)	52.85 (8)
Stara Torina	0.9439 (9)	0.6887 (4)	53.10 (1)

TABLE 4. Color differences relative to the physical standard.

	Total difference ΔE units	Value ΔE units	Spectral position (*)	Chroma ΔE units
Žiča	8.82	7.82	-8.28	0.26
Stara Torina	12.49	7.43	-26.13	6.30

TABLE 5. ANOVA - Average value difference relative to the physical standard.

Source of Variation	SS	df	MS	F	P-value	F criteria
Between Groups	0.826957	1	0.826957	0.06529	0.800931	4.35125
Within Groups	253.3176	20	12.66588			
Total	254.1446	21				

TABLE 6. ANOVA - Average color difference relative to the physical standard.

Source of Variation	SS	df	MS	F	P-value	F criteria
Between Groups	73.70711	1	73.70711	17.64562	0.00044	4.35125
Within Groups	83.54152	20	4.177076			
Total	157.2486	21				

TABLE 7. ANOVA - Average hue difference relative to the physical standard.

Source of Variation	SS	df	MS	F	P-value	F criteria
Between Groups	1752.659	1	1752.659	93.28198	5.66E-09	4.35125
Within Groups	375.7766	20	18.78883			
Total	2128.436	21				

TABLE 8. ANOVA - Average chroma difference relative to the physical standard.

Source of Variation	SS	df	MS	F	P-value	F criteria
Between Groups	200.0051	1	200.0051	69.79966	5.93E-08	4.35125
Within Groups	57.30833	20	2.865416			
Total	257.3134	21				

colors. Maximal intensity of all three primary colors makes pure white; absence of all three primary colors corresponds to black; while any other color can be made combining the primary colors in different intensities.

Analysis of color by a computer was based on the principal that a digital image contains numeric information about the specification of color for every element of a picture (dot or pixel). Color was measured analyzing an area of approximately one square mm in the middle third of the labial surfaces of the teeth. Results were obtained from the image as the relative presence of the three additive primary colors. The results were numerically transformed into the CIELab system with equal color space, because that system includes physical, physiological, and psychological aspects of the color phenomena (Trussel, 1993).

The CIELab system has three parameters. Parameter L interprets value (the quantity of light contained in the color, independent of chromatic attributes), while the other two parameters, a and b, show chromatic properties of color. Parameter a interprets the balance between green and red, while parameter b is a measure of the blue-yellow balance in color. The values of the CIELab parameters correspond to the abilities of an average observer to perceive colors. For example, a color whose value is 60 seems twice as light to an observer than a color with a value of 30, independent of the physical properties of light.

The distance between two colors in the CIELab system corresponds to the ability of an observer to differentiate colors. The distance between colors is measured in ΔE units, where the difference of one ΔE unit represents a limit for discrimination between two colors. As parameters a and b are not commonly used, the results are interpreted in psychometric determinants of color (value, hue, and chroma), but using the metrics of CIELab system.

Value is a parameter of color which determines the quantity of light present in color. Depending on value, we talk about relatively light and dark colors. Hue is related to the spectral position of color, and indicates the part of the spectra which is dominantly present in the color observed. Commonly, this represents the name of the color (blue, red, orange, greenish-yellow, etc.). Chroma determines the purity of the dominant color or the degree of saturation of color.

Therefore, with higher chroma we can easily recognize a dominant color, where lower chroma indicates a more neutral color, which is closer to gray, than high chroma. In this article, value and chroma were interpreted in ΔE units, while hue has been shown as an angular position in the color spectra.

Diffractiongrams were made, analyzed, and compared in both test groups. The sizes of unit cells were calculated by the least square methods and reflections were indexed using the LSUCR program. Statistical processing of data was performed using analysis of variance.

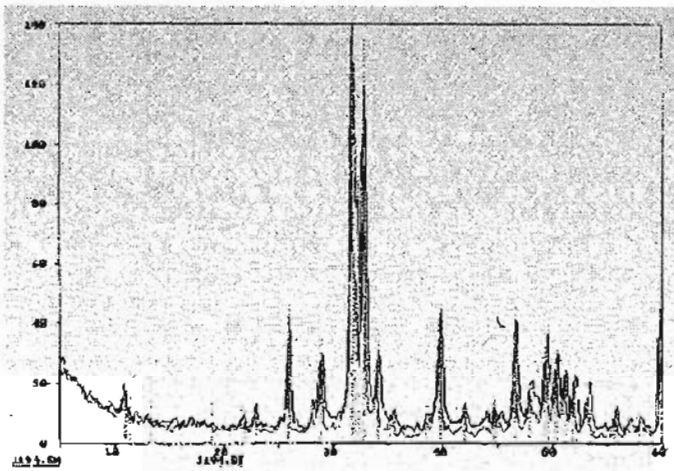


Fig. 5. Diffractograms of dental enamel from Žiča (solid line) and Stara Torina (dotted line) samples.

RESULTS

Crystallographic analysis showed the composition of soil from both cemetery sites. The sample soils were mainly composed of quartz, feldspar, liscunes, pherphidites, and traces of other ingredients. The values of the measurements and the volumes of the unit cells of the dental enamel crystals from Žiča and Stara Torina are shown in Table 3. Diffractograms for both samples are shown comparatively in Fig. 5. The results of the colorimetric analysis of both groups of samples are given in Table 4. All values were interpreted relative to the standard, Vita shade D3.

Analysis of variance showed that the average total color differences from the physical standard vary significantly ($P=0.00044$) between the two samples (Table 5). The average differences in value relative to the physical standard differ slightly between groups, but the results lack statistical significance (Table 6). However, the differences in hues (Table 7) and chroma (Table 8) relative to the physical standard are highly statistically significant.

The difference in the parameters of the elementary cells (a- and c-axis) need not be a precise indication of true

relations of crystal dimensions. Possibly, the different crystals of enamel have in one case a shorter and wider habitus than another, where the habitus is narrower and more elongated than the other. In such seemingly different crystals of the enamel, the volumes of the elementary cells may be identical (Tihacek-Sojoc, 1996).

In order to determine the accuracy of the unit cell using the existing angles and measurements, the volume of the enamel crystal unit cells was calculated according to the formula: $V = a^2 \cdot c \cdot \cos 30^\circ$, where: V is the unit cell volume; a is the α -axis of the unit cell; and c is the c-axis of the unit cell.

DISCUSSION

Results of the crystallographic analysis of the enamel sample from Žiča indicate that the volume of the unit cell is close to the values characteristic for hydroxylapatite. These results closely match the values for hydroxylapatite from the Table of Minerals, as well with the experimentally obtained data of Beevers and Joung and Elliot (Elliot, 1986). Those results were obtained by assessing natural teeth. Therefore, we were not surprised that our values differ slightly, and are closer than Elliot's (1986) to those from the Table of Minerals (Đurić, 1996).

The values of the volume of the unit cell of enamel from Stara Torina indicate the prevalence of chlorapatite. Comparison of the Stara Torina unit volume (Table 3) with the values in Table 2 shows that the chlorapatite are more similar than those of Žiča. The differences between our data and values published in the Table of Minerals (Fig. 7) indicate that other minerals were also present in the sample.

Comparing the diffractogram of soil with diffractograms of enamel from both cemetery sites, we concluded that no ingredients from the soil, such as quartz, feldspars, liscunes, pherphidites, or traces of other elements, had been incorporated into the enamel. Factors that determine the composition of the enamel could have been solely dietary habits and water.

Some authors (Ferguson and Chestnut, 1978) disagree about the vitality of human dental enamel. A number of articles deal with assessment of the enamel structure and the dynamic processes in it. One group of authors (Doi, 1986; Callens et al., 1986) assumes that enamel is alive because of intensive dynamic processes and the presence of remineralization. In contrast, other authors (Carlstrom et al., 1983) accent the disproportion of inorganic and organic components of enamel. They argue that enamel probably cannot be considered alive because no other human tissue has such a high percentage of inorganic components and a very low amount of water.

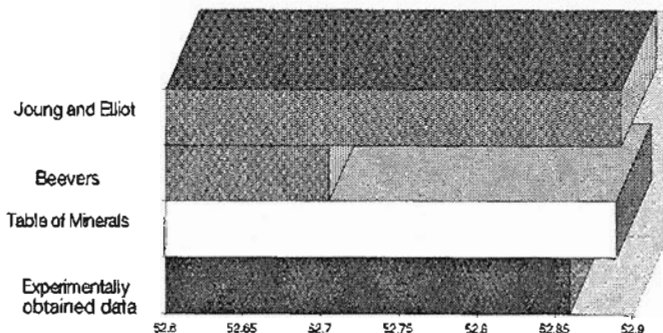


Fig. 6. Žiča (black bar): comparison of values of unit cell of hydroxylapatite crystal from different sources.

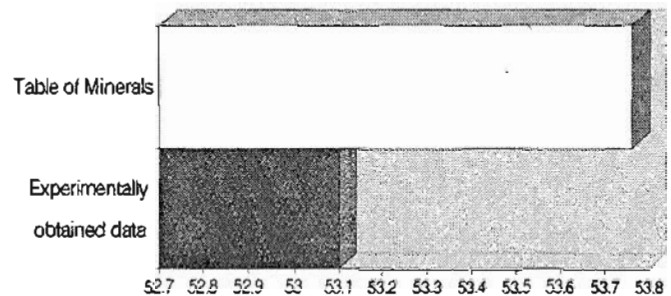


Fig. 7. Stara Torina (black bar): comparison of values of unit cell of chlorapatite crystal from different sources.

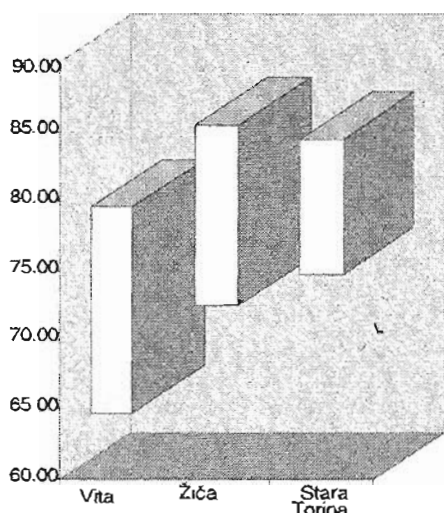


Fig. 8. Comparison of ranges of values for teeth from Žiča, Stara Torina, and the Vita shade guide.

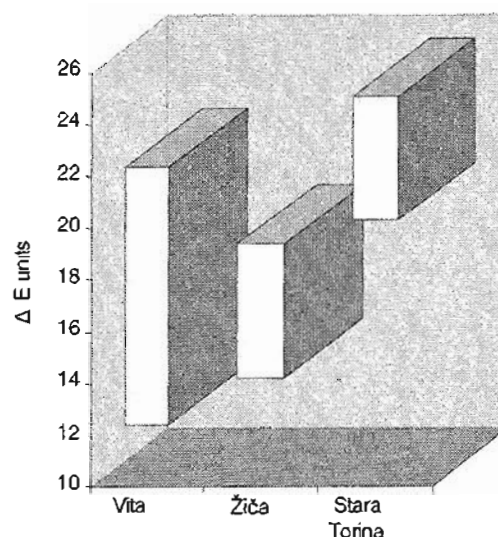


Fig. 9. Ranges of chromas for teeth from Žiča, Stara Torina, and the Vita shade guide.

Results presented in this article show differences between the enamel from two populations, caused by different diet habits and water. Therefore, vital enamel must be subject to changes under the influences of various chemical agents, both external and internal. This result argues that the dental enamel in our sample had once been alive.

Comparison of the color ranges of the teeth shows the similarity of the values in the two samples (Fig. 8). Compared with the color range which represents the tooth colors of a modern population (Vita), the average value of both groups of samples are higher than that of the Vita range. Moreover, the ranges in values of both groups overlap the range of contemporary tooth colors (Vita), which means that shades with equivalent values can also be found in the modern population.

Chroma of teeth from Žiča are completely within the range of chromas found in Vita, mainly covering its lower segment. Colors of teeth from Stara Torina are of significantly higher chroma than those of Žiča. Some of chroma were even beyond the maximum found in the referent shade guide (Vita) (Fig. 9).

The sample groups differ by hues. The range of hues of Vita is located in the part of spectra to the left of both Žiča and Stara Torina, with the range of hues from Žiča situated between those of Vita and Stara Torina.

From the results of this study, the hypothesis that the composition of enamel affects the color of teeth has been confirmed. The samples with a prevalence of chlorapatite had colors with completely different hues and significantly higher chromas than did those with hydroxylapatite. However, the differences were not significant because of the sizes of the samples.

CONCLUSIONS

The compositions of apatite crystal from dental enamel of two populations of medieval Serbs differ from one another. Pure hydroxylapatite occurs in the enamel from Žiča, whereas chlorapatite prevails in the enamel from Stara Torina. No evidence exists that ingredients from the soil had been incorporated into the enamel from either sample.

The color ranges of teeth from Žiča and Stara Torina differ from one another in hues and in chromas. Hues of teeth from Stara Torina are in the reddish-orange part of spectra. Hues of Žiča teeth are in the orange region and closer to the hue range of modern teeth than that of Stara Torina. Yet, the Stara Torina sample had significantly higher chromas than those from Žiča.

The results indicate that enamel composition may have an influence on the color of a tooth. The prevalence of chlorapatite in enamel causes tooth color to be closer to red and of higher chroma than teeth whose enamel consists of hydroxylapatite.

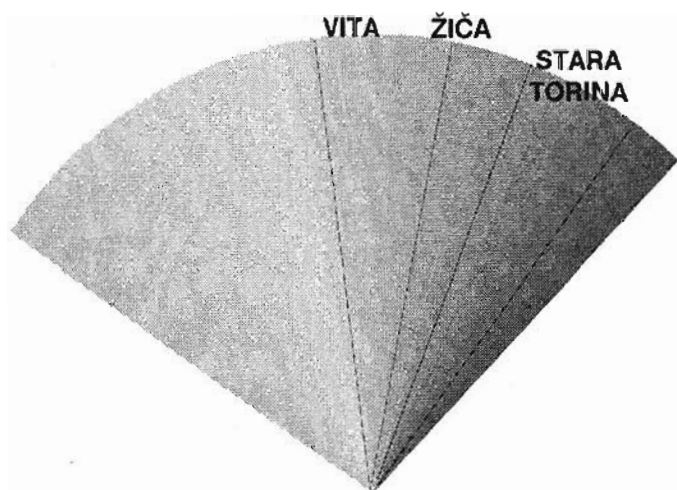


Fig. 10. Ranges of hues for teeth from Žiča, Stara Torina, and the Vita shade guide.

LITERATURE CITED

- Aiello L, and Dean C (1990) *An Introduction to Human Evolutionary Anatomy*. London: Academic Press.
- Arwill J, Myrberg N, and Soremark R (1965) Penetration of radioactive isotopes through enamel and dentine. 1. Diffusion of ^{22}Na in fresh and coagulated dental tissues. *J. Dent. Res.* 44(6):1299-1303.
- Callens FJ, Matthys PFA, Verbeeck RM, and Martens LC (1986) Contribution of the CO_2 and CO radicals to the asymmetric ESR signal near G-2 in human tooth enamel. *Zobozdrav. Vestn.* 41(Suppl. 1):79-97.
- Carlstrom D, Glas JE, and Angmar B (1983) Studies on ultrastructure of dental enamel. V. The state of water in human enamel. *J. Ultrastruct. Res.* 8:24-29.
- Đurić S (1996) Interview, Belgrade.
- Đurić-Srejić M, Letić V, and Pejković B (1992) Variability of some morphological traits and epigenetic characters of the skulls of medieval Serbs. *Rivista di Antropologia (Roma)* 70:159-169.
- Doi Y (1986) ESR studies of tooth enamel. *Zobozdrav. Vestn.* 41(Suppl. 1):43-58.
- Ellior JC (1969) Recent progress in the chemistry, crystal chemistry and structure of the apatites. *Calc. Tiss. Rec.* 3:293-307.
- Ellior JC (1986) The structure and function of hydroxylapatite. *Zobozdrav. Vestn.* 41(Suppl. 1):25-42.
- Ferguson S, and Chesnut DB (1978) A magnetic resonance spin label study of human dental enamel. *Arch. Oral Biol.* 23:85-90.
- Garland AN (1987) A histological study of archaeological bone decomposition. In A Boddington et al. (eds.): *Death, Decay and Reconstruction*. Manchester: Manchester University Press.
- Milićević V (1994) *Tooth Color Matching by Digital Image Analysis*; M.A. Thesis, Belgrade.
- Tiháček-Šojić Lj (1996) Research of diffusion process of organic and inorganic molecules on the retention teeth for a partial skeletal prosthesis. Ph.D. Dissertation, Belgrade.
- Trussel HJ (1993) DSP solutions run the gamut for color systems. *IEEE Signal Processing Magazine* 4:8-23.

DIAGNOSTIC CHARACTERISTICS OF HUMAN BITE MARKS: A REVIEW OF SOLVED CASES

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ABSTRACT Despite their non-standardized documentation and interpretation, human bite marks are very useful in the legal arena. A literature review of case histories was undertaken to search for some basic dental traits that characterize bite marks successfully used to identify suspects in forensic cases. Information for eighteen cases indicated that the two dental traits that occurred most frequently, diastema and malposition of teeth, were usually sufficient to identify a suspect. The relative simplicity of these findings suggests questioning the necessity and cost-effectiveness of lengthy and complex analyses in many forensic cases.

INTRODUCTION

Human bite marks have been accepted as evidence in courts in the United States since the 1870s. Their utility is based on the distinctiveness of individual dentitions (Rothwell, 1995). The legal value of bite mark evidence lies not only in its uniqueness, but also in its frequent occurrence in crimes. Bite marks are found on victims or perpetrators of sex crimes, child abuse, assault, and homicide (American Board of Forensic Odontology, 1986).

Regardless of the specificity of bite mark evidence, many legal, clinical, and forensic authorities question its accuracy. Sources of error can be numerous and vary with the many techniques (e.g., computer tomography scan, scanning electron microscopy, dusting and various overlay and casting procedures, photographic techniques) used for preservation and analysis. Training and verification of odontological expert witnesses is haphazard and non-standard. Disagreement occurs even among respected authorities (Weigler, 1992).

The American Board of Forensic Odontology (ABFO) devised standards for bite mark analysis in 1986, but no general agreement yet exists about national or international standards for bite mark comparison (Rothwell, 1995). The ABFO system employs information about demographics of the victim, anatomical location and shape of the body surface involved, the shape of the bite, and other soft tissue observations, such as the presence of abrasions and lacerations. An important part of the system is the ABFO score sheet, a lengthy itemized list of tooth-by-tooth matches between traits of the bite mark and the suspect's dentition. Discrepancies between the bite mark and the suspect's dentition are noted in three categories of "gross features." These are presence of each tooth in the suspect and consistent size, and consistent shape of arches. In addition, "tooth position" (in labiolingual position, in rotational position, and in terms of spacing between tooth margins) and "interdental features" (e.g., mesiodistal and labiolingual lengths of each tooth, distinctive curvatures of any teeth) are compared between the bite mark and the individual teeth in the suspect. This format leaves a category for other features. With this scoresheet, the odontologist may score eight or ten characteristics for each tooth in the suspect's dentition (ABFO, 1986:386).

Despite some research showing great reliability (Rawson et al., 1986), much criticism has been levelled at the ABFO method for its scorecard style approach. Some experts have questioned the reliability of some of its criteria, such as the measurements of the bite mark (Ebert, 1988). Other researchers could not reproduce the high reliability reported by Rawson et al. (1986) when different techniques of evidence preservation were used (Rothwell, 1995).

The ABFO system of data collection, ponderous and detailed, is the only major standardization of bite mark analysis. Despite the ABFO's valiant 1986 effort and several interim revisions, the method is the subject of controversy to this day.

Therefore, this study was the first step toward the development of a more sparse, easy, and standardized format that will be more understandable and less controversial than that of the ABFO. This paper presents the results of an analysis of dental characteristics commonly found in solved forensic cases involving human bite marks. Such an analysis is uncommon in the forensic literature, which emphasizes case studies and technical reports rather than attempts at generalization or standardization. Hopefully, the information will contribute to forensic and clinical guidelines and protocols that will give investigations, evidence preservation, and training of forensic and clinical staff increased uniformity, thoroughness, efficiency, and speed, especially for busy, over-burdened jurisdictions.

METHODS AND MATERIALS

A retrospective review of bite mark cases was made in the forensic literature. Cases were accepted if the report included a photograph, a diagram, or a thorough verbal description of the bite mark. All cases from any state or country and from any time period were included in this study if they fit the above criteria. The surveyed literature was limited to books and journals in the various libraries of the Arizona State University.

The photographs, sketches, and verbal descriptions of the bite marks were scrutinized in order to determine the visually obvious characteristics of the dentition, such as malposition, diastema, missing teeth, dental wear, and arch shape. When a book or journal had a photograph or an overlay of an appropriate bite mark, a description of the bite mark traits was sought in the accompanying written text. The photograph and description of the bite mark were then compared.

In some cases (Cases #2, #3, #6, #9, and #14), I added traits that were visible in an illustration, not noted in the text. I accepted the author's identification of the bite mark traits. I did not add more information than I could find by looking at the illustration of the bite mark. For each bite mark, a list of traits was compiled. Table 1 contains a list of these traits in the 18 bite mark cases reviewed.

The same kind of data was not available for all of the cases. Although the reports on all 18 cases included photographs of bite marks, none of these photographs showed the same amount of detail. Some of the reports also contained diagrams of some sort. The reports on cases #11 and #12 had diagrams made from overlays on the bite marks. The accounts of cases #13 and #14 showed tooth imprints that had been dusted and lifted from the bite mark. The description of case #18 included a simple schematic diagram of the teeth in the upper arch to show a diastema. Some written description accompanied each report of a bite mark case. These descriptions varied from a short caption to a four- to five-page long textual account. In other words, this study was done using data collected and presented in many different ways. This use of non-standardized information brought about a loss of detail in some cases and potentially contributed to sources of error for this study.

Counts and percentages were done based on the number of different traits and their occurrences. A trait was defined as an unusual characteristic in a given tooth in the dentition. For example, a fracture of the upper right lateral incisor and a fracture of the upper left lateral incisor were considered as two different traits. Diastemata between the lower central incisors and between the upper central incisors were considered different traits, also. These various traits, specific down to the level of the individual tooth/teeth affected, were sometimes grouped into larger categories, such as fractures, diastemata, etc., for the purpose of discussion and generalization. A number of different traits (e.g., lingual displacement and fracture or rotation plus buccal displacement) can occur in a single tooth. In this situation, the traits were counted as multiple traits (e.g., a rotated and buccally displaced canine showed two traits: rotation and buccal displacement).

Traits, such as the presence of dental treatment (e.g., bridges, fillings, crowns) and missing teeth, were considered as localized traits. Other kinds of traits, such as wear and overall size, that similarly affected four or more teeth of all types (e.g., affected molars and incisors or premolars and canines) were considered as a single generalized trait and counted as one trait. Those traits that involved only one type of tooth (e.g., pitting of the canines, pegging of the lateral incisors) were tabulated as a number of localized traits (e.g., pitting of the upper left canine, pitting of the lower left canine), even if four teeth were involved. The rationale behind the decision to use these criteria was that one or the other(s) of these individual traits could be used to distinguish dentitions. Traits were defined as non-overlapping categories.

Occurrences of the characteristics and the number of different traits were counted and used to generate percentages. Some data have been given as the percentage of the total number of traits; some, as the percentage of the total number of cases; and some, as the percentage of occurrences. Complete tooth-by-tooth scoring of all traits was not possible for most of the cases, because the typical bite mark involved only the anterior dentition. Also, some of the textual

descriptions were less detailed than others. Some information was not given by the author and not visible to my perusal of the photographs and texts. In this review, systematic scoring of all cases was not the goal. Instead, the study concentrated on readily visible traits in illustrations and written descriptions.

RESULTS

General Trends

According to my observations, the 18 bite marks found in the literature review show 68 distinctive traits, involving either a single tooth or multiple teeth. The number of occurrences of these 68 traits totalled 82 for the entire sample. The average number of traits per case was 4.5 with a range of two to seven traits per case. Seven generalized traits occurred in five (27.8%) of the cases. All of these five cases also had localized traits. Table 1 has a list of the cases, diagnostic traits of the teeth indicated by the bite mark, and locations of the bite marks.

Anatomical Location of Bite Marks

In this study, the anatomical location of the bite mark was given in only 15 of the 18 cases. Upper extremities had the most bite marks of the study (five cases or 33.3% of the 15 cases), followed by the face (four cases or 26.6% of the 15 cases), breast (three cases or 20.0% of the 15 cases), and the back (two cases or 13.3% of the 15 cases). One case each involved the chest, scalp and head area, lower extremities, neck, and abdomen. Two cases involved multiple locations.

Maxillo-dental Features Reflected in Bite Marks

Arches

The bite was made by upper teeth alone in eight cases (44.4% of the total number cases). Lower teeth alone were involved in only two cases (11.1% of the total number of cases). Evidence of involvement of teeth of both arches was present in the remaining eight cases (44.4% of the total number of cases).

Arch shape was reported in only four cases (22.2% out of the 18 cases). The maxillary arch shape was used in two cases; mandibular arch shape, in only one; and the shapes of both arch shapes in one case. The maxillary arch was described as V-shaped by the authors (Karazulas, 1984; Bernstein, 1985) of the original references in two cases. However, other than these details, no other information was given about the specifics of arch shape. In case #9, the original authors (Jakobsen and Kaiser-Nelson, 1981) mentioned maxillary and mandibular arch shapes a factor in the investigation. I observed that the arches in this case were V-shaped also.

Malposition

The most commonly occurring trait was malposition. This category, divided into seven subgroups, affected ten cases (55.5% of the cases) in this review. The seven sub-groups within the malposition category are: angulation or tipping (the teeth were placed at some angle to the normal vertical orientation, such as tipped buccally or lingually), displacement (tooth was positioned outside of the usual arc of the dental arcade, such as buccal or lingual to the arch), overlapping (with or without angulation), rotation, angulation between teeth (adjacent teeth were appropriately aligned in the dental arch but did not meet one another at an angle, such as winging of the incisors), and mild misalignment (very minor displacement from a perfect arch but without significant displacement or angulation of either type), and mesial drift.

The average of malposition in the ten cases was 2.1 malpositions per case with a range of one to four occurrences per case. These 21 characteristics accounted for 25.6% of the 82 trait occurrences in this review.

Forty percent of the malposition traits were lingual or buccal displacements of teeth. Four rotation traits occurred in three cases. These three cases accounted for 16.7% of the total number of cases in the study, and the number of rotation traits, 7.3% of the total number of different traits in the study. Angulation and overlapping occurred in three cases each (each trait 16.7% of the cases). Mesial drift occurred in a single case. Only one case (#3) involved three categories of malposition (overlapping, displacement, and angulation). Some cases had two or more types of malposition each. In many cases, more than one type of malposition involved one tooth. For example, a tooth was buccally displaced and also overlapped its neighbor (case #3) or was displaced and rotated (case #15).

Diastemata

Diastemata accounted for ten different traits or 14.7% of the traits identified in this study (Table 1). Diastemata made up 20 of the 82 trait occurrences (24.4%) and occurred in seven out of the 18 cases (38.8%). The average number of diastemata per case was 2.8 and the range, one to five diastemata per case. Of the seven diastema cases, three (42.8%) had a single diastema. Three cases involved four diastemata, and one case, five. The most commonly occurring diastema was that between the upper central incisors. This trait occurred five times and accounted for 25.0% of all diastema occurrences. Yet lack of a diastema was a critical trait in case #18. This case was not included in the tally of diastema cases.

DIAGNOSTIC CHARACTERISTICS OF HUMAN BITE MARKS

Table 1. Characteristics of the dentitions responsible for the bite marks and the locations of the bite marks in this review.

Case #	Diagnostic characteristics of the teeth as indicated by the bite mark	Arch	# Teeth Involved	Generalized Traits	Missing Teeth	Bite Location	Reference
1	Diastema between upper central incisors	upper	2			Breast	Harvey (1976)
	Diastema between lower central incisors	lower	2				
	Diastema between lower right central and right lateral incisors	lower	2				
	Diastema between lower right lateral incisor and canine	lower	2				
2	Diastema between lower central incisors	lower	2			Scalp, forehead, arm	Harvey (1976)
	Diastema between lower left central and left lateral incisors	lower	2				
	Diastema between lower right lateral incisor and canine	lower	2				
	Diastema between lower left lateral incisor and canine	lower	2				
	Unusual shape and location of the apex of the lower right canine	lower	1				
	Unusual shape and location of the apex of the lower left canine	lower	1				
	Fracture of lower left central incisor		1				
3	Malposition: angulation between lower right central and lateral incisors	lower	2			Not given	Vale (1983)
	Malposition: buccal displacement of lower right central incisor	lower	1				
	Malposition: overlapping of lower right central and right lateral incisors	lower	2				
4	Pitting on upper right canine	upper	1			Breast	Harvey (1976)
	Pitting on upper left canine	upper	1				
	Pitting on lower right canine	lower	1				
	Pitting on lower left canine	lower	1				
	Fracture of upper left central incisor	upper	1				
	Fracture of upper left lateral incisor	upper	1				
5	Flat edge wear on upper and lower teeth due to grinding	upper, lower	?	yes		Cheek	Harvey (1976)
	Wide diastema between upper central incisors	upper	2				
6	Missing upper right lateral incisor	upper	1		1	Back	Whittaker and MacDonald (1989)
	Missing upper right canine	upper	1		1		
	Malposition: angulation between upper left lateral incisor and left canine	upper	2				
	Deep sagittal sulcus between buccal and lingual cusps of upper left second premolar	upper	1				
	Malposition: labial displacement of lower right central incisor	lower	1				
Malposition: labial displacement of lower left canine	lower	1					
7	Mandibular arch shape	lower	4			Wrist	Whittaker and MacDonald (1989)
	Malposition: angulation between upper central incisors	upper	2				
8	Large size of upper central incisor	upper	1			Breast	Whittaker and MacDonald (1989)
	Malposition: buccal rotation of upper right central incisor	upper	1				
	Unusual curved shape of incisal edge of upper right central incisor	upper	1				
	Unusual shape of lower right lateral incisor due to metal-backed crown	lower	1				
	Malposition: slight rotation of lower right canine	lower	1				
9	Arch shape (V-shaped according to observation in this study)	upper				Back	Jakobsen and Kaiser-Nielson (1981)
	Greatly increased wear on all incisors and canines	upper, lower	12	Yes			
	Large lingual cusp on upper right first premolar	upper	1				
	Large lingual cusp on upper left first premolar	upper	1				
	Malposition: lingual displacement of lower right central incisor	lower	1				
	Malposition: buccal displacement of lower right lateral incisor	lower	1				

DIAGNOSTIC CHARACTERISTICS OF HUMAN BITE MARKS

TABLE 1. Continued.

Case #	Diagnostic characteristics of the teeth as indicated by the bite mark	Arch	#Teeth Involved	Generalized Traits	Missing Teeth	Bite Location	Reference
10	Peg-shaped upper right lateral incisor	upper	1			Chest, knee	Irons, et al. (1983)
	Peg-shaped upper left lateral incisor	upper	1				
	Diastema between upper central incisors	upper	2				
	Diastema between upper right central and lateral incisors	upper	2				
	Diastema between upper left central and lateral incisors	upper	2				
	Diastema between upper right lateral incisor and canine	upper	2				
	Diastema between upper left lateral incisor and canine	upper	2				
11	Missing upper right lateral incisor	upper	1		1	Arm	West et al. (1990)
	Malposition: mesial drift of upper right canine	upper	1				
12	Diastema between upper right central and lateral incisors	upper	2			Cheek	West et al. (1990)
	Diastema between upper left central and lateral incisors	upper	2				
	Diastema between upper right lateral incisor and canine	upper	2				
	Diastema between upper left lateral incisor and canine	upper	2				
	Shape of teeth		all	Yes			
13	Shapes of biting edges of all upper teeth	upper	all	Yes		Not given	Rao and Souviron (1984)
	Shapes and sizes of upper premolar and molar cusps	upper	10	Yes			
	Diastema between upper central incisors	upper	2				
14	Malposition: anterior overlapping of upper left central over upper right central incisor	upper	2			Not given	Rao and Souviron (1984)
	Malposition: buccal protrusion of upper left central incisor	upper	1				
	Shapes and sizes of incisal edges of all upper incisors and canines	upper	6	Yes			
	Shapes and sizes of upper molar cusps	upper	6	Yes			
	Missing upper right second premolar	upper	1		1		
	Missing upper left second premolar	upper	1		1		
15	Malposition: rotation of upper right lateral incisor	upper	1			Nose	Vale et al. (1976)
	Malposition: rotation of upper left lateral incisor	upper	1				
	Malposition: lingual displacement of upper right lateral incisor	upper	1				
	Malposition: lingual displacement of upper left lateral incisor	upper	1				
	Diastema between upper central incisors	upper	2				
16	Missing upper left lateral incisor	upper	1		1	Forearm	Bernstein (1985)
	Fracture of upper right lateral incisor	upper	1				
	Fracture of upper left canine	upper	1				
	Fracture of upper left premolar	upper	1				
	Sharp edge of lower right lateral incisor	lower	1				
	Sharp edge of lower right canine	lower	1				
17	Unusual V-shaped maxillary arch	upper	6			Abdomen	Bernstein (1985)
	Malposition: rotation of upper left central incisor	upper	1				
	Malposition: rotation of upper left lateral incisor	upper	1				
	Large sharp upper right canine	upper	1				
18	V-shaped maxillary arch	upper	6			Arm	Karazulas (1984)
	Malposition: overlapping of upper central incisors	upper	2				
	Lack of diastema between upper central incisors	upper	2				

Generalized means that four or more teeth were involved. "Dusting technique" was applied in cases 13 and 14.

Diastema and malposition appeared together in only one case (5.5%) in the review. One or both types of traits (diastema and malposition) occurred in 16 out of the 18 cases (88.9%). Only two cases (#4 and #16) lacked diastema or malposition. These two cases had twelve other trait occurrences, an average of six per case, above the overall case average of 4.5 occurrences in this study.

Of the 16 cases which involved diastema, malposition, or both traits, 14 cases also included one or more additional traits (range of one to three other traits). Yet, as mentioned above, the two traits occurred together in only two cases.

Other Localized Traits

Six fracture traits were noted in this study and accounted for 8.8% of the traits. These dental fractures were reported in only three cases (16.6%). Five traits (7.3%) involved various missing teeth in four cases (22.2%) in the review. One trait, a missing upper right lateral incisor occurred in two cases (#6 and #11).

Both fractures and missing teeth occurred in premolars as well as in the anterior dentition. The involvement of the premolars seems to be a distinction from malposition and diastemae. In two of the three fracture cases, more than one fracture occurred in each dentition. In half of the cases (two cases) with missing teeth, more than one tooth was missing from the dentition.

Dental therapeutics such as crowns, fillings, and prostheses occurred in only one (5.5%) case. This finding did not fit my expectation, given the prevalence of major dental work in much of the population. However, dental prosthetics may reflect demographic, economic, and cultural factors.

Additional localized traits in this review included peg-shaped teeth (two traits involving upper lateral incisors) and canine pitting (four traits, one trait involving each of the four canines in one dentition). Each of the traits occurred in only one case.

Tooth and Arch Size and Shape

Consideration of overall tooth and arch size and shape is part of every forensic bite mark case. In three (16.6%) of the cases reviewed, the authors specified the general size and/or shape of teeth as factors in their analyses. General considerations of both size and shape were involved in two (11.1%) cases, while consideration of general shape alone was important in a single (5.5%) case. Specific size criteria were not given by the authors in these cases. If an author mentioned shape or size, the feature was included in this study, but details were not clarified beyond those given.

Size or shape of an individual tooth were important traits in three (16.6%) cases. Case #2 had an unusual shape and location of the curved crown apex of a canine. Case #8 involved a very large upper lateral incisor. Case #17 demonstrated the large size of an unusually sharp upper canine.

Occlusal Surface Abnormalities

Abnormalities of the occlusal surface were noted in six (33.3%) of the cases. These traits included wear, sharp edges of biting surfaces, and unusual cusp shapes. Features of the molar or premolar cusps were demonstrated in four (22.2%) of the cases, including the two very detailed cases in which the fingerprint dusting technique was used. These four cases represent 22.2% of the 18 cases but account for 57.0% of the occlusal surface findings.

Wear was an important character in two cases. Grinding wear affected the upper and lower teeth in case #5. All incisors and canines in case #9 were more worn than the rest of the dentition.

The dusting technique used in cases #13 and #14 gave a great deal of information about the biting surfaces of the anterior teeth and the molar and premolar cusps. The large amount of overall detail made possible by this technique put these two cases well above the level of information obtainable in the other 16 cases in this study. Due to the vast amount of relatively minute observations that could be made on the cusp surfaces and biting edges in these two cases, I could not enumerate specific traits. I included these very detailed cases under general traits (i.e., overall size and shape of teeth).

In contrast to cases #13 and #14, four other cases displayed occlusal abnormalities in individual teeth. Case #6 had a very deep sagittal sulcus on an upper second premolar. Case #9 had very large lingual cusps on both upper second premolars. Case #8 had an unusual, curved shape to the incisal edge of an upper incisor. Case #16 had especially sharp edges on the lower right lateral incisor and canine.

DISCUSSION

Standardization of Bite Mark Analysis

The previous sections have presented a compilation of simple, easily identifiable dental traits that were reported in successfully prosecuted investigations involving bite marks. The goal of this study was the application of the patterns of trait occurrence to a protocol of bite mark analysis in order that frequency information could become the basis for a relatively simple and systematic approach of dental traits associated with bite marks.

Review of these 18 bite mark cases supports a non-numerical approach to the early stages of forensic bite mark analysis, because all of these cases had characteristics that were easily recognized by a newcomer to the subject and no measurements were reported. Though no actual measurements were taken, some cases did involve size of certain

dental structures. Two cases involved the large sizes of one tooth relative to its antimere (cases #8 and #17) and one case utilized the large size of the premolar lingual cusps. The detailed cases #13 and #14 showed information about the size of all of the teeth. In the four cases that involved the dental arches, shape rather than size was the pivotal factor. The results of this review seem to indicate that dental measurements may not be necessary in every analysis and should be reserved for cases that are not amenable to simple interpretative methods.

When discussing standardization of forensic bite mark impressions, one must consider the ABFO's effort to be a foundation and a landmark. The ABFO protocol is complicated, but has a major advantage: a high degree of reliability. Hundreds of forensic odontologists used the ABFO format to evaluate a series of experimental bite mark impressions, photographs, and models from solved cases. One study (Rawson et al., 1986) showed a high degree of inter-observer concordance among experts, as well as various degrees of matches between bite marks and biters' dentitions. Rawson et al. (1986) indicated a high degree of reliability of the ABFO scoring technique when looking at the range of scores, 90% confidence values, and mean scores from many interpreters.

Unfortunately, other researchers could not reproduce the high confidence level of this thorough, systematic study. Rothwell's (1995) review summarized some studies that showed high rates of inaccuracy by multiple odontologists who participated in controlled studies of bite marks in various media. Rawson's (1986) study did not really address the reliability of these guidelines under the variable conditions of everyday forensic procedures.

A number of the variables in the ABFO protocol, such as tooth absence, arch shape, incisal edge abnormalities, rotation, and displacement, are represented in this review. The ABFO guidelines demand many measurements of tooth size but are not nearly as precise about other traits. This review fleshes out the category of "other distinctive features" much more thoroughly than the ABFO scoring form.

Interpretation of bite marks according to some uniform routine protocol seems useful in terms of collecting, comparing, and presenting data. However, many factors in the biting event itself may make standardization difficult. Many researchers voice concerns about the skin's ability to distort bite marks through movement, stretching, or bunching. Movement of extremities may change the shape of bite marks due to skin position variations of up to several centimeters along Langer's Lines (normal lines in the skin due to subcutaneous tissue and skin surface tension) (Harvey, 1976). Facial or neck bites may be affected by the victim's jaw movement (case #12) (West et al., 1990). Also, shape, size, and clarity may change according to the struggling movements of the victim or the biter's mandibular movement during the infliction of the injury (Furness, 1981; Sperber, 1990). The mechanisms of both suction and tongue thrust can change the skin position and tension so much that bite marks can vary considerably, even to the point of showing lingual tooth surface markings and tongue impressions (Beckstead et al., 1979; Sperber, 1990). The effects of biting through clothing are poorly studied.

Individuality of the Dentition

This paper presents a simple analytic approach and arrives at some very basic information on trait frequencies in successfully identified bite mark cases. Yet, the overall dentition is not necessarily simple, and many dental traits did not occur in this study. Possibly, simple analyses lack so much specificity that features of multiple dentitions could be consistent with a basic series of traits, such as those discussed in this study. This concern leads to the subject of the individuality of the dentition.

The uniqueness of the individual dentition is assumed in the legal cases. Rawson et al. (1984) examined this issue to determine the validity of this very basic assumption. These workers estimated the probability of exact matches in the degree of rotation among the upper and lower anterior teeth of 397 individuals. A match was consideration of involvement of the same rotations in six out of the twelve anterior teeth. One of the assumptions was that all types of rotation were equally likely to occur. Given that dental traits are heritable, this might not be a valid assumption within certain populations, such as a number of family members who might be suspects in a given bite mark case. Yet, Rawson and his group (1984) found no statistically significant indicators of sex or race in their distribution of tooth positions. They calculated that the probability of even five teeth having exactly matched rotations was so high that the ratio involved a denominator larger than the population of the world (Rawson et al. 1984).

Another study (Sognaes et al., 1982) of dental uniqueness involved computerized comparisons of standardized bite marks made by five pairs of monozygotic (MZ) twins. Assuming that MZ twins are likely to have the highest possible genetic similarity, their bite marks should be the most similar of any possible pair of people. However, computerized comparisons involving rotation showed that even identical twins were dentally distinctive.

The results of these two studies (Sognaes et al., 1982; Rawson et al., 1984) lead to the observation that individual dentitions are distinctive enough to be identified by a simple series of common traits and by the general considerations of tooth size and shape. Both of the studies also reported one of the two most common traits found in this review, malposition, as their sole criteria. Addition of data for diastema should add power to the analysis.

Sources of Error

One major source of potential error in this analysis was small sample size. Certainly, this small sample limited the use of statistical methods. Additionally, the small sample size might not be representative of successfully concluded forensic cases.

Distortions of bite mark photographs in books, journals, or photocopies were other sources of potential error. The variable degrees of photographic and written information in each of the 18 cases also could have had an impact on the accuracy of the results of the study. This lack of standardization of original data made my study an uncontrolled one, and possibly subject to greater error than a study using standardized criteria.

Experts systematically use multiple points of correspondence in any bite mark to exactly match shapes, sizes, and locations of teeth. This complicated process was outside of the realm of this paper and the skills of this reviewer.

The sample used in this study was not random because only solved and published cases found in the Arizona State University libraries were used. The sample was also not standardized with respect to forensic technique. The eighteen case reports reflect differences in sensitivity and specificity due to the wide variety of techniques used in evidence collection, photography, casting, overlay, and tracing.

CONCLUSIONS

The results of this study suggest that a relatively simple protocol of dental trait analysis may be successfully used in the preliminary phases of the majority of forensic bite mark cases. This protocol is simply the comparison of the bite mark and the suspect's dentition in terms of the basic traits that occurred in this study. The review demonstrated the importance of dental malposition and diastema pattern as useful traits for bite mark interpretation. These characters occurred in relatively high frequencies and could easily be identified. The ABFO scoresheet lists these two traits under their "tooth position" category, which included traits of rotation, labial or lingual displacement, and diastemae ("spacing between the adjacent marking edges") (ABFO, 1986:386). The scoresheet condenses other kinds of malposition noted in this study (e.g., angulation and overlapping) into the category of "rotational position" and puts the malposition trait of tipping into "vertical position of tooth/occlusal plane matches" (ABFO, 1986:386).

Other traits that occurred in low frequency in this study, such as arch shape, fractures, dental work, pitting, and wear might also be critical, either singly or in combination, in any given case.

This series of dental traits may also be considered an addition to the ABFO outline as an enhanced scorecard of "other distinctive features."

This protocol of comparison of simple dental traits in the bite mark with those in the dentition of a suspect may eliminate the need for dental measurements, if dentitions do not match the bite mark. This method seems most suitable for ruling suspects out of an investigation. If a suspect's dentition is compatible with features of a bite mark according to this basic protocol, a thorough analysis, such as the full ABFO scoresheet and work up should be done.

The conclusions of this study do not advocate changing the current ABFO scoring technique at this time. Research of larger samples than the one analyzed here may lead to modification and streamlining of analytic techniques after large-scale studies have been done. Future work should: 1) consist of studies of large bite mark samples, 2) be obtained and preserved using standardized techniques, 3) compared with cases in which the bite marks were and were not useful in eliminating or implicating suspects, and 4) interpreted by the same, experienced forensic odontologists.

LITERATURE CITED

- American Board of Forensic Odontology, Inc. (1986) Guidelines for Bite Mark Analysis. *J. Amer. Dent. Assn.* 112(3): 383-386.
- Beckstead JW, Rawson RD, and Giles WS (1979) Review of bite mark evidence. *J. Amer. Dent. Assn.* 99:69-74.
- Bernstein ML (1985) Two bite mark cases with inadequate scale references. *J. Forensic Sci.* 30 (3):959-964.
- Ebert JI (1988) Discussion of 'The Bite Mark Standard Reference Scale-ABFO #2'. *J. Forensic Sci.* 33(2):301-304.
- Furness J (1981) A general review of bite-mark evidence. *Amer. J. Foren. Med. Path.* 2(1):49-52.
- Harvey W (1976) *Dental Identification and Forensic Odontology*. London: Henry Kimpton Publishers.
- Irons F, Steuterman MC, and Brinkhous W (1983) Two bite marks on assailant: primary link to homicide conviction. *Amer. J. Foren. Med. Path.* 4(2):177-180.
- Jakobsen JR, and Keiser-Nielsen S (1981) Bite mark lesions in human skin. *Forensic Science International* 18(1):41-55.
- Karazulas P (1984) Presentation of bite mark evidence resulting in the acquittal of a man after serving seven years in prison for murder. *J. Forensic Sci.* 29(1):355-358.
- Rao VJ, and Souviron RR (1984) Dusting and lifting the bite print: A new technique. *J. Forensic Sci.* 29(1):326-330.
- Rawson RD, Koot A, Martin C, Jackson J, Novosel S, Richardson A, and Bender T (1984) Incidence of bite marks in a selected juvenile population: A preliminary report. *J. Forensic Sci.* 29(2):254-259.
- Rawson RD, Omnen RK, Kinard G, Johnson, and Yfantis A (1984) Statistical evidence for the individuality of the human dentition. *J. Forensic Sci.* 29(1):245-253.
- Rawson RD, Vale GL, Sperber ND, Hershaft EE, and Yfantis A (1986) Reliability of the scoring system of the ABFO for human bite marks. *J. Forensic Sci.* 31(4):1235-1260.
- Rothwell BR (1995) Bite marks in forensic dentistry: A review of legal, scientific issues. *J. Amer. Dent. Assn.* 126(2):223-231.

- Sognnaes RF, Rawson RD, Gratt BM, and Hyugen NBT (1982) Computer comparison of bite mark patterns in identical twins, *J. Amer. Dent. Assn.* 105:449-451.
- Sperber N (1990) Lingual markings of anterior teeth as seen in human bite marks. *J. Forensic Sci.* 35(4): 838-844.
- Vale GL, Sognnaes RF, Felando GN, and Noguchi TT (1976) Unusual 3 dimensional bite mark evidence in a homicide case. *J. Forensic Sci.* 21(3):642-652.
- Vale GL, and Noguchi TT (1984) Anatomical distribution of human bite marks in a series of 67 cases. *J. Forensic Sci.* 28(1):61-69.
- Weigler S (1992) Bite mark evidence: forensic odontology and the law. *Health Matrix* 2(2):303-323.
- West MH, Barsley RE, Frair J, and Seal MD (1990) The use of human skin in the fabrication of a bite mark template: two case reports. *J. Forensic Sci.* 35(6):1477-1485.
- Whittaker DK, and MacDonald DG (1989) *A Colour Atlas of Forensic Dentistry.* London: Wolfe Medical Publications, LTD.

AN UNUSUAL TALON CUSP

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A 13 year-old male Caucasian presented for routine orthodontic treatment. He had a Class II division 1 malocclusion with significant crowding in both mandibular and maxillary labial anterior segments of the dentition. He had no significant medical history. Marked tubercles of Carabelli were noted on the maxillary first permanent molars. The mandibular right second molar was infra-occlusal and a facial talon cusp was noted on the permanent left mandibular central incisor (Fig. 1).

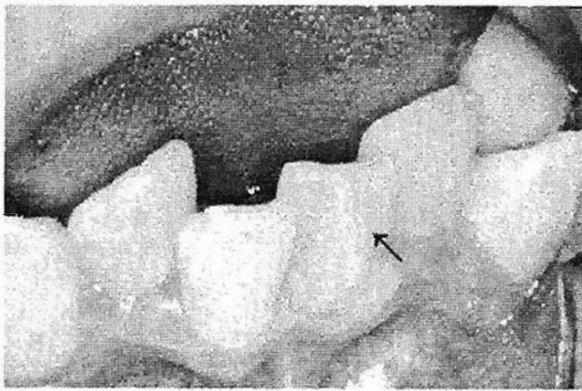


Fig. 1. 'Facial' talon cusp on a permanent mandibular left central incisor (arrow).

As the facial talon cusp of the mandibular incisor would prevent a proper reduction in overjet and ultimately interfere with the occlusion, the orthodontic treatment plan decided upon was extraction of this tooth, in addition to extraction of three of the first premolars. Uneventful fixed orthodontic appliance therapy is now underway.

The facial location of this talon cusp is unusual. The affected incisor tooth is currently being investigated to assess the extent of its pulp chamber.

The aetiology of talon cusps is unknown. However, the feature is thought to be a combination of genetic and environmental factors (Davies and Brook, 1992).

In the cases that I have found in the literature, talon cusps occurred most commonly on permanent incisors, 90% in the maxilla, with the maxillary lateral incisor the most commonly affected (Rismah, 1991). They have been reported primarily in the secondary dentition, though recent cases involving the primary maxillary incisors have been reported (Chen, 1986; Meon, 1990a,b; Rusmah, 1991). Males were more commonly affected than females, with racial variation reflected by a predominance of the feature in the Chinese population (Davies and Brook, 1992). The facial talon cusps usually occurred in single cases (Pledger, 1989; Meon, 1990a; Acs, 1992) or a few individuals (Meon, 1990b; Harris and Owsley, 1991). Talon cusps have been reported as an isolated finding (Chen, 1986) or in association with other dental anomalies such as shovel-shaped incisors, peg-shaped lateral incisors, unerupted canines, three-rooted mandibular first molars, impacted mesiodens, and odontomes (Davies and Brook, 1986; Acs, 1992). Syndromes associated with talon cusps include Mohr syndrome, *incontinentia pigmenti achromians*, and Rubenstein-Taybi syndrome (Tsutsumi, 1991; Acs, 1992).

The example of the talon cusp shown in Fig. 1 differs from most of the examples in the literature. It occurs on the facial aspect of a mandibular permanent central incisor of a Caucasian, who lacks the anomalies and syndromes associated with published cases. Therefore, I am seeking comments from readers on the facial talon cusp shown in Fig. 1. Personal findings, bibliographic references on other cases of facial talon cusps, and information about the aetiology of this anomaly also would be greatly appreciated.

LITERATURE CITED

- Acs G (1992) Shovel incisors, three-rooted molars, talon cusp and supernumery on one patient. *Paediatr. Dent.* 13:236-237.
- Chen RJ (1986) Talon cusp in primary dentition. *Oral. Surg. Oral. Med. Oral. Path.* 62:67-72
- Davies PJ, and Brook AH (1986) The presentation of the talon cusp: diagnosis, clinical features, associates, and possible aetiology. *Brit. Dent. J.* 160:84-88.
- Harris E, and Owsley DW (1991) The talon cusp: A review with three cases from North America. *J. Tennessee Dent. Assoc.* 71:20-22.
- Meon R (1990a) Talon cusp in primary dentition-case report. *Sing. Dent. J.* 15:32-40.
- Meon R (1990b) Talon cusp in two siblings. *N. Z. Dent. J.* 86:42-44.
- Pledger DM (1989) Talon cusp: Report of two cases. *Brit. Dent. J.* 167:171-173.
- Rusmah M (1991) Talon cusp in Malaysia. *Aust. Dent. J.* 36:11-14.
- Tsutsumi T (1991) Labial talon cusp in a child with *Incontinentia pigmenti achromans*: case report. *Pediatr. Dent.* 13:236-237.

ANNUAL MEETING OF THE CANADIAN ASSOCIATION FOR PHYSICAL ANTHROPOLOGY

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The Canadian Association for Physical Anthropology (CAPA), in conjunction with the North Eastern Forensic Anthropology Association (NEFAA) held their annual meetings in Kingston, Ontario, Canada between October 31 and November 2, 1996. These were coordinated by Nancy Ossenber and Lynda Wood (Queen's University) and Deborah E. Gustavsen (University of Windsor). Although presentations represented a wide range of anthropological sub-disciplines (primatology, ecology of human health, primate evolution, odontology, skeletal biology, paleopathology, and forensic anthropology), this report deals with odontology.

Nancy Lovell (University of Alberta) began the odontology session with a paper entitled *Patterns of Enamel Hypoplasia at Ancient Mendes, Egypt*. Dental remains of 50 individuals from this site were examined by her for hypoplasia. Different patterns of enamel defects were found in the permanent and deciduous teeth. Linear enamel hypoplasia and enamel pits were found in the permanent teeth, although both never occurred in the same individual. The deciduous teeth exhibited enamel pits only. Lovell found that only the permanent canines displayed more than one lesion per tooth, with a mean of 1.3 defects per affected tooth. Though not statistically significant, her results indicate females exhibit more enamel defects than do males.

Next on the agenda, was a paper by Marion A. Maar (McMaster University) titled *Metric and Morphological Relationships of the Dentition and Cranio-Dental Allometry of the Skeletal Population at Altenerding, Germany*. Her paper investigated size and shape relationships within the human dental and facial complex. Her results were based on a statistical summary of dental and cranial metrics together with dental morphology of 175 individuals. Using allometric regression analyses Maar found that individual tooth size is more influenced by the size of other teeth in the same arcade than by jaw or face size. Maar's analysis also indicated that large viscerocranial bones are associated with larger teeth, yet large crania have proportionately smaller teeth than smaller crania. Maar hopes that her research will help us to better understand the biological mechanisms responsible for the trend of dental reduction in hominid evolution.

Charles Fitzgerald (McMaster University) presented a paper titled *Interpreting Growth and Development from the Microstructural Markers of Enamel and Dentine*. Fitzgerald reviewed the evidence to support the contention that the histological microstructures of enamel and dentine can be used to accurately reconstruct the developmental and chronological history of teeth.

Another paper, *A Dental Health Analysis of the Altun Ha Maya: Examining Enamel Hypoplasia and the Weaning Hypothesis*, was presented by Rhan-Ju Song (Trent University). The dental health of 276 prehistoric Maya individuals from Altun Ha, Belize, was examined. Rhan-Ju's research emphasizes enamel hypoplasia, but hypocalcifications, caries, calculus and attrition were also considered in his presentation. Rhan-Ju's results indicate a well-buffered fetal and infant population, with relatively few mothers experiencing health or dietary stress during pregnancy, yet a high level of physiological stress affected children between three and four years of age. Rhan-Ju argued that differential enamel structural sensitivity was an important factor in enamel defect distribution. Also, weaning could not be confidently inferred by hypoplasia in the Altun Ha Maya. Instead, Rhan-Ju feels that the high hypoplasia frequency in this population may be the adaptive response to the site setting, which is notable for high settlement density and ecological instability, rather than due to dietary factors.

Tracy L. Prowse (McMaster University) and Nancy C. Lovell's presentation, *Biological Affinities at Naqada, Egypt: Concordance of Cranial and Dental Nonmetric Traits*, contained an analysis of cranial nonmetric traits in three Naqada skeletal populations. The conclusions confirmed the results of a recent nonmetric dental morphological study. Their findings indicate that cranial and dental nonmetric data independently support the hypothesis that individuals from the elite cemetery at Naqada were biologically distinct from those found in the other two non-elite cemeteries. Results of comparison of the elite, pooled non-elite, and three other Nile Valley samples showed that the Naqada samples are closely affiliated with the sample from Lower Nubia. Archaeological evidence of extensive trade contacts between Upper Egypt and Nubia, and the results of their analysis suggest that these relations may reflect biological affinities.

John T. Mayhall (University of Toronto) and Ikuro Kageyama (Nippon Dental University School of Dentistry) presented a paper, *Tooth Wear: A Comparison of Three Quantitative Methods*. Both workers think that subjectivity is inherent in qualitative tooth wear assessment methods. To help alleviate this problem, they compared three methods of quantitative assessment of tooth wear: 1) a method proposed by Tornenchuk and Mayhall; 2) a procedure using the same techniques as the first except with a narrower contact point than the first; and 3) a method that utilizes moire contourography and digital image analysis. In a longitudinal study of young Australian aborigines, Mayhall found that the moire/digital image method allowed for an accurate estimation of the amount of tooth material lost per year. This method and the "improved" depth method yielded depth measurements that were very similar to one another, thus allowing the use of the depth gauge alone to determine the amount of tooth material lost in a particular class of tooth.

Mayhall and Kageyama argued that these methods have the advantage of allowing wear determinations in samples where subjective methods have been ineffective (stone casts and teeth exhibiting wear without exposed dentine).

The date and location of next year's meetings have not been finalized. I will make an announcement in an upcoming newsletter once I know this information. I highly recommend the CAPA and NEFAA meetings for anyone interested, or working in anthropology. They are not only well organized and cover a wide range of topics, but are small enough to allow everyone to become acquainted.

BOOK REVIEW

China. Hominid Remains, an Up-Date - No 7. Edited by Wu Rukang and Wu Xinzhi. General editors R. Orban and D. Roels, Bruxelles, Belgium; Laboratory of Anthropology and Human Genetics, Université Libre de Bruxelles. 1994. 105 pp.

CHINA is the most recent addition to the updating of *CATALOGUE OF FOSSIL HOMINIDS* (Oakley and Campbell, 1967; Oakley et al., 1971, 1975). The book reviews and adds new information to that originally reported by Limbrey (1975) in Part III of the series (Oakley et al., 1975).

The book has data for 62 sites, an increase of 44 sites over the 18 listed in Limbrey (1975). Four sites, Hong Kong, Hsiatsaowan, Keiyuan, and Peking, have been omitted from the update. Especially interesting to dental anthropologists is that 35 (72.9%) of the 44 new site reports have listings of one or more teeth. Moreover, updated information, especially about publications, has been published for 13 (92.9%) out of the 14 sites listed in both Limbrey (1975) and in *CHINA*.

The textual format of the book is similar to that of the original series. Under each site catalogued is a listing of information, such as location, hominid remains, and bibliographic references. *CHINA* and the preceding six books in the updated series have a major improvement over that followed in the three volumes of *CATALOGUE OF FOSSIL HOMINIDS*: the placement of a textual heading over each item in the outline of data for each site. The headings for the data in the books of the original series had been numerically coded, with the codes explained in the introduction. Thus, the reader no longer has to remember the meaning of 18 codes in order to understand the information.

Although *CHINA* is a small book (14.75 by 20.67 mm, 105 pages) and is bound in paper, it is a valuable research tool for those whose work concerns prehistoric materials. I heartily recommend *CHINA* to DAA members as an addition to their own libraries. I also suggest that members encourage their institute or university library to purchase this book. Interested individuals may contact Rosine Orban at her address in the DAA membership list.

LITERATURE CITED

- Limbrey S (1975) China in KP Oakley, BG Campbell, and TI Molleson (eds.): *Catalogue of Fossil Hominids Part : III America, Asia, Australia*. London: Trustees of the British Museum (Natural History).
- Oakley KP, and Campbell BG (eds.) (1967) *Catalogue of Fossil Hominids Part I: Africa*. London: Trustees of the British Museum (Natural History).
- Oakley KP, Campbell BG, and Molleson TI (eds.) (1971) *Catalogue of Fossil Hominids Part II : Europe*. London: Trustees of the British Museum (Natural History)
- Oakley KP, Campbell BG, and TI Molleson (eds.): *Catalogue of Fossil Hominids Part : III America, Asia, Australia*. London: Trustees of the British Museum (Natural History).

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DENTAL ANTHROPOLOGY ASSOCIATION NEWS SECTION

Annual Business Meeting

The annual business meeting of the Dental Anthropology Association (DAA) will take place on Thursday, April 3, 1997, from 6:30 to 7:30 pm. The site of the meeting is the St. Louis A room in the Adams Mark Hotel, St. Louis, Missouri, U.S.A. Two items on the agenda are the election of a secretary-treasurer and a vote on a proposal to modify the name of the newsletter.

Stephen C. Reichardt (B.A., Arizona State University) has been nominated to serve as secretary treasurer for the 1997-1999 term. Reichardt is presently completing his M.A. thesis at Arizona State University. His topic is the biological history of the Iroquoian populations of southern Ontario, Canada.

The proposal to modify the name of the newsletter involves changing the name of the DAA publication from the *Dental Anthropology Newsletter* (DAN) to *Dental Anthropology*. The reason for the name change is that the scope of materials published in DAN presently exceeds that of a newsletter. However, the format of *Dental Anthropology* would continue to have a section, *Dental Anthropology Newsletter*, with news of DAA members and disciplinary matters of interest to them.

The DAA business meeting is being held during the annual meetings of the American Association of Physical Anthropologists (AAPA) (April 2-5, 1997, in the Adams Mark Hotel, St. Louis, Missouri, U.S.A). Individuals who are not members of the AAPA, but who wish to attend the AAPA sessions, can contact Charles Hildebolt (address in the

DAA membership list at the end of the newsletter) or register at the site. No registration is needed for people wishing to attend only the DAA business meeting. Persons wishing to stay overnight in St. Louis can obtain special rates at the Adams Mark Hotel by mentioning the AAPA when they make their reservations.

News of DAA Members

Phillip V. Tobias (Paleo-anthropology Research Unit, University of the Witwatersrand Medical School) will receive the Charles R. Darwin Lifetime Achievement Award at the Annual Meeting of the AAPA. The award was established in 1992 and recognizes distinguished members of the AAPA, who have demonstrated a lifetime of commitment to Physical Anthropology through their scholarship, training, and service to the AAPA.

Vladimir Anatolevich Dremov (Tomsk State University, Tomsk, Russia) died on March 22, 1996. Dremov's work focused on the skeletal and dental anthropology of the early peoples of Western Siberia. Dremov was director of the Laboratory of Physical Anthropology of the Laboratory of History, Archaeology, and Ethnography of Siberia at TGU.

The first **Albert A. Dahlberg** Dissertation Support Grant has been awarded to Dawnie Wolfe Steadman (University of Chicago). Steadman is using metric and non-metric cranial traits to examine population movements of three temporally sequential cultures of Amerindians east-central Illinois (Late Woodland, Mississippian, and Oneota). DAA members who wish to contribute to this fund, which supports University of Chicago Department of Anthropology students in the dissertation writing phase of their work, may contact Russell Tuttle, Department of Anthropology, University of Chicago, 1126 East 59th Street, Chicago, IL 60637.

Lassi Alvesalo (University of Oulu) will serve as President of the 11th International Symposium on Dental Morphology. Meetings will be held from August 26 to 30, 1998, in the Institute of Dentistry, University of Oulu, Finland. Interested individuals may contact Alvesalo at the address given in the Membership List at the end of the newsletter.

Dental Anthropology Newsletter

Materials for the next issue are due April 20, 1997. The format generally follows that of the American Journal of Physical Anthropology. Manuscripts must be submitted as printed text. Especially welcome are manuscripts accompanied by disk (IBM format) containing the files. The newsletter uses Word Perfect® for DOS, but can import text from Microsoft Word® and other versions of Word Perfect®.

Select List of Dental Anthropological Presentations at the AAPA Meeting April 2-5, 1997*

APRIL 3, 1996

BIOARCHAEOLOGY IN NORTHERN FRONTIER NEW SPAIN: THE CASE OF LA FLORIDA

9:00 Enamel hypoplasias and evidence for stress in north Florida. D.L. Hutchinson

9:15 Patterns of growth perturbation in La Florida: Evidence from enamel microstructure. S.W. Simpson

9:30 Microscopic evidence of anterior and posterior tooth use in native populations from Georgia and Florida. M.F. Teaford, et al.

PRIMATE EVOLUTION

8:45 Contour mapping as a new method for interpreting diet from tooth morphology. D.N.O. Reed.

9:15 Molar size sequence and metric size variation among early Miocene cercopithecoids. E.R. Miller, D.T. Rasmussen, et al.

10:45 Histological study of *Proconsul* teeth from Rusinga Island, Kenya. A.D. Beynon, et al.

11:00 The anterior lower premolar in catarrhine evolution. C.A. Robinson and T. Harrison

SKELETAL BIOLOGY II: POSTERS (8:30 am-12:00 pm)

10. Spontaneous cleft palate in a newborn gorilla (*Gorilla gorilla gorilla*). J.R. Siebert, et al.

EARLY HOMINID EVOLUTION: CRANIODENTAL AND POSTCRANIAL ANALYSES

1:00 Reevaluation of hominoid enamel thickness. D.G. Gantt, et al.

1:15 Patterning of enamel thickness in the postcanine dentition of *A. africanus*, *P. robustus* and early *Homo* from South Africa. G.T. Schwartz

APRIL 4, 1997

PRIMATE EVOLUTION FROM ARCHAEOLEMUR TO THE MESOLITHIC. POSTERS (8:30 am -12:00 pm)

1. Diet, dental eruption and dental variation in *Archaeolemur* specimens from northwestern Madagascar. C.V.M. Simons

3. Paleocene and Eocene primates and other fossil mammals from the Great Divide Basin, SW Wyoming. R.L. Anemone, et al.

9. Of pits and scratches: A preliminary investigation of dietary resource partitioning among middle Miocene primates from Maboko Island, Kenya using dental microwear analysis. A.K. Palmer and B.R. Benefet

DENTAL ANTHROPOLOGY I POSTERS (8:30 am- 12:00 pm)

25. Current dissections of the pterygopalatine fossa. R.T. Koritzer and L.E. St. Hoyme

6. Anterior tooth use and craniodental morphology in humans. M.A. Spencer and P.S. Ungar

27. Cortical defects of the mandible: Prevalence and etiology of Stafne's defect among the prehistoric Canary Islanders. J.R. Lukacs and C.R. Martin

28. Segregation analysis of the triform dental variant. S.E. Bailey, et al.

29. Quantitation of growth rate variability in mineralized tissue incremental structures. T.G. Bromage, et al.

30. Distribution of linear enamel hypoplasia in sympatric monkeys and apes. M. Skinner and D. Guatelli-Steinberg

*Non-AAPA members may obtain additional information from Charles Hildebolt (address in Membership List)

31. Oral pH in fruit, leaf and insect-feeding primates and bats. E.R. Dumont, et al.
32. Scanning electron microscopy of microwear and honing on the sloping crest of P3's of Japanese monkeys (*Macaca fuscata*). T. Hojo
33. Alveolar bone loss: Associations with clinical, demographic and dietary variables in postmenopausal women. C.F. Hildebolt, et al.
34. Dental caries and tooth loss in the Robert J. Terry collection. R. Sakashita, T. Kamegai, N. Inoue, Japan, D.R. Hunt.
35. An assessment of the accuracy of dental radiographs for determining enamel thickness. N.J. Stevens and F.E. Grine
36. Dental morphological analysis of Natufian population coherency and the hypothesis of biological continuity in the southern Levant. J.G. Lipschultz
37. Non-metric cranial and dental traits as population discriminators: A comparison. E.H. Harmon and J.L. Czarzasty
38. Odontometric analysis of the Slack Farm Population. L.M. Havill
39. Preservation of DNA in teeth. L.J. Moore
40. Relationship of carbon stable isotope ratios and caries prevalence for eight sites in Michigan. K.L. Brandt
41. Analysis of the amount and rate of dental attrition related to subsistence and dental health in seven Middle Holocene New World populations. J.L. Molina and P.D. Tomczak
42. Dental health patterns among an historic Chumash population. C.M. Kellner
43. Dental health of Mackey site inhabitants. L.M. Rankin-Hill, et al.
44. Dental mutilation at Pecos Pueblo, New Mexico: Two cases dating from 1400-1600 A.D. S.E. Burnett
45. Biological variability in prehistoric Florida Indians: Assessment of odontometric reduction. A. Cucina and M.Y. Iscan
46. Labial scratches on Krapina Neanderthal anterior teeth. D.W. Frayer and C. Lalueza Fox

PRIMATE BIOLOGICAL VARIATION

- 2:00 Redundant P3 enamel among some Old World anthropoids: A facet to be considered. A. Washburn
- 2:15 The role of correlated response in the evolution of female canine size in primates. J.M. Plavcan
- 2:30 Tooth form and mechanical dietary correlates in two Malagasy femur families. N. Yamashita
- 2:45 Premolar and incisor microwear patterns of African cercopithecoids. V.E. Noble

PREHISTORIC POPULATION STRUCTURE, VARIATION, AND INTERACTION

- 1:15 Dental variation and population structure: New views of Middle Archaic hunter-gatherers in the Eastern Woodlands. J.F. Powell

PALEOANTHROPOLOGY V: NEANDERTALS AND BEYOND

- 2:45 Population variability in molar enamel thickness. M. Glantz, et al.

PRIMATE BIOLOGICAL VARIATION. POSTERS (2:30 pm - 6:00 pm)

1. Incisor microwear of *Alouatta palliata*. A.M. Lubensky and K.E. Glander
2. Comparison of enamel thickness in the anterior dentition of Old World monkeys. C. Strickland, et al
3. 2-D analysis of molar occlusal morphology to infer dietary differences among subspecies of *Gorilla*. E.J. Smith, et al.
4. Molar enamel thickness distribution in pongids. L. Dyal, et al.

SATURDAY, APRIL 5, 1997

PALEOPATHOLOGY II

- 9:45 Transverse linear enamel hypoplasia in the PPNB population from Nevali, Cori (Turkey). W.-R. Teegen and M. Schultz
- 11:00 The health consequences of interactions between central Asian pastoralists and agriculturalists. P.L. Walker and L.T. Yablonsky
- 11:45 Dental health of elderly Confederate veterans. H.D. Dockall and J.E. Baker

WHAT IS 'MODERN' ABOUT MODERN HUMANS?

- 11:15 Morphological features of the upper face and the dentition of anatomically modern humans. B. Maureille and F. Houet

DENTAL ANTHROPOLOGY II

- 1:00 A three-dimensional, quantitative method for accurately determining tooth wear. I. Kageyama and J.T. Mayhall
- 1:15 Occlusal variation in modern India. G.C. Nelson
- 1:30 Population relationships and non-metric dental traits in Copper and Bronze Age Italy. R. Vargiu, et al.
- 1:45 Sexual dimorphism in caries rates and the Creek division of labor. M. Reeves
- 2:00 Prevalence of enamel hypoplasia in Jordanian children. S.A. Al-Abbasi
- 2:15 Asymmetry in human dental enamel hypoplasia. B.E. Ensor and J.D. Irish
- 2:30 The dental effects of congenital syphilis. S.W. Hillson
- 2:45 Attrition, passive eruption, and periodontal disease in two Sudanese Nubian cemeteries. Y.K. Hallein
- 3:15 The effects of coca chewing on teeth and the prehispanic distribution of coca chewing. E. Indriati
- 3:30 The nature and effects of inbreeding among the prehispanic Mixtecs of Oaxaca, Mexico. A.F. Christensen
- 3:45 Biological relations among prehistoric northern Chilean populations: A comparative study of dental morphology. R.C. Sutter
- 4:00 The Middle Paleolithic child from Teshik Tash: Morphometric analysis of the permanent dentition. A.M. Haeussler
- 4:15 Canary Island-North African population affinities: D. Guatelli-Steinberg, et al.
- 4:30 Were the Canary Islands colonized by North African Berbers? J.D. Irish and B.E. Hemphill
- 4:45 Dental paleopathology among the Guanches. H. Vallianatos and J.R. Lukacs

Select List Dental Anthropological Presentations: Paleoanthropology Society April 1-2*

- Morphology of the *Australopithecus anamensis* lower deciduous first molar and capitate M. G. Leakey and C. V. Ward
 Heterochronic process in dental development in Plio-pleistocene hominids. F. Ramirez Rozzi
 The effect of cortical thickness on mandibular torsional strength of South African early hominids. X. Chen and F. E. Grine
 Variability in the patterns of dental development of *Australopithecus africanus*: a first approach. J. Moggi-Cecchi

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