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A Comparison of Later Stage Dental Maturation in a Small Group of Children from Chernobyl and British children.

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ABSTRACT The aim of this study was to investigate the dental radiographic development of a small group of children born in Chernobyl, Ukraine, around the time of the nuclear disaster with an age matched group of British children. The design was a cross sectional non random retrospective study consisting of five boys and five girls from Chernobyl (age range 10.03 to 12.37) and 20 age and sex matched British children of white Caucasian origin. Developing permanent mandibular teeth were assessed from rotational tomograms using criteria described by Demirjian, Goldstein and Tanner (1973). Third molar formation was also assessed. Dental age was calculated and compared to real age using a t-test. The difference in dental age (DA) and real age (RA) was not significant when the two groups were compared. Dental age in both groups of children was advanced compared to the standards. These results suggests that the Chernobyl disaster has not affected root formation of late forming permanent teeth of these children.

INTRODUCTION

Irradiation is known to alter or destroy cells that are actively proliferation or differentiating at the time of exposure (Coggle, 1983; Hall, 1994). Developing teeth were shown to be radiosensitive to x-rays soon after their discovery, but the effect of atomic or nuclear irradiation on developing teeth has not been reported. This study investigated permanent tooth formation in a small group of children aged around 12 years from Chernobyl who were born just before or soon after the nuclear disaster.

MATERIALS AND METHOD

The sample studied consisted of radiographs of five girls and five boys from Chernobyl (aged 10.03 to 12.37 years) and a control group from London, UK. The ten unrelated children, all resident in Chernobyl since birth had their radiographs taken on 10 June 1998 as part of a thorough dental examination (including rotational pantomographs) in a general dental practice. This group was compared with an age ($\pm$0.2 years) and sex matched group of healthy white Caucasian children from London (n = 20). The control group was selected from the primary care daybook in the Department

TABLE 1. Real age, dental age, and the difference in years of the Chernobyl Children.

Number	Sex	Date of Birth	Real Age	Dental Age	Diference
1	male	31 May, 1988	10.3	12.30	2.27
2	female	8 September, 1987	10.75	12.60	1.85
3	male	11 October, 1986	11.66	13.60	1.94
4	female	5 September, 1986	11.76	13.00	1.24
5	male	5 May, 1986	12.10	15.50	3.40
6	female	3 May, 1986	12.10	14.70	2.60
7	male	26 May, 1986	12.12	12.30	0.18
8	female	13 April, 1986	12.16	14.70	2.54
9	male	13 April, 1986	12.16	16.00	3.84
10	female	24 January, 1986	12.38	11.90	-0.48

of Paediatric Dentistry at St. Bartholomew's and the Royal London Dental Hospital. Radiographs of these children were taken as part of their dental treatment at the hospital. Real age of each child on the day of the x-ray was calculated using date of birth (Eveleth and Tanner 1990). Dental age was evaluated from the method described by Demirjian Goldstein, and Tanner (1973), and Demirjian and Goldstein (1976), whereby the radiological appearances of the seven permanent teeth on the left side of the mandible are examined. Each tooth is rated into one of eight developmental stages, converted into a score, the total of which in turn is converted to the dental age. Dental age was calculated for each child and compared to the real age, with the mean difference for boys and girls for each group compared using a t-test. The age of the children means that a number of teeth have finished development. This method of assessing dental maturation in ten to twelve year olds is largely root growth of canines, premolars, and the second molars. Thus, in this study, only the later stage of dental maturation is investigated. This method also does not allow comparison of data of individual teeth, unless raw data are presented in other ways. Another drawback of this method is that root stages are few and widely spaced in time thus small differences between groups are less easily noted. The formation stage of the lower left third molar was also assessed separately; with an additional stage zero indicating the presence of a crypt but no cusp tips. Further analysis of the raw data allowed a comparison of the number of individuals from each group in each individual stage. The proportion and range of formation stages for the second and third permanent molars (M_2 and M_3) was also calculated. The second author examined all the radiographs after training and calibration; intra-examiner accuracy was 96% after triplicate scoring of each radiograph with discrepancies never more than one stage.

RESULTS

Results of dental age, real age and the difference for the Chernobyl children are shown in Table 1. The difference between DA and RA plotted against real age is illustrated in Figure 1 showing both groups of children; The horizontal reference line represents zero difference between dental and real age, and each dot represents one child. The vertical reference line is the date of the nuclear disaster. Children older than 12.12 years were born prior to 26 April, 1986.

A comparison of the mean difference between dental and real age of the two groups (Table 2) was not significant for either boys or girls. The bar charts showing the distribution of growth stages of M_2 and M_3 show that the Chernobyl group appearS less variable than the control group (Figs. 2 and 3).

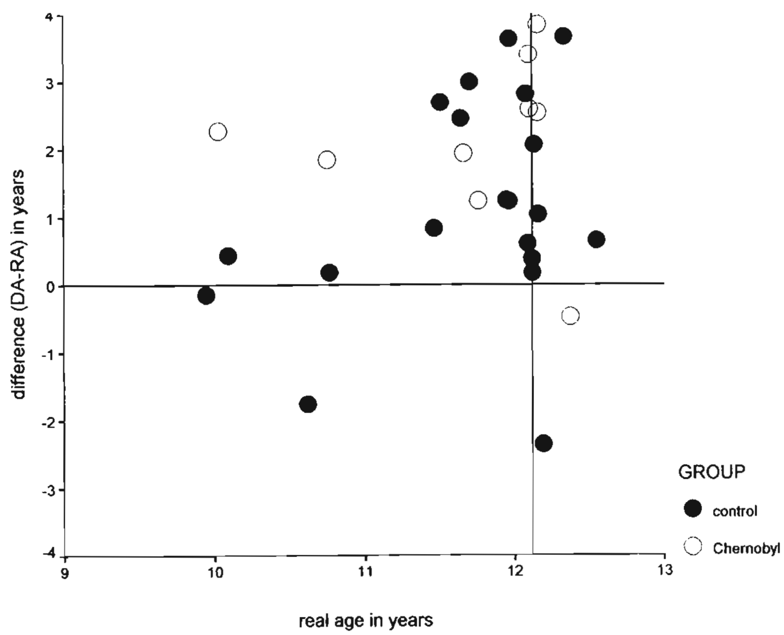

Fig 1. Scatter plot of the difference between Dental Age and Real Age against Real Age in years.

DISCUSSION

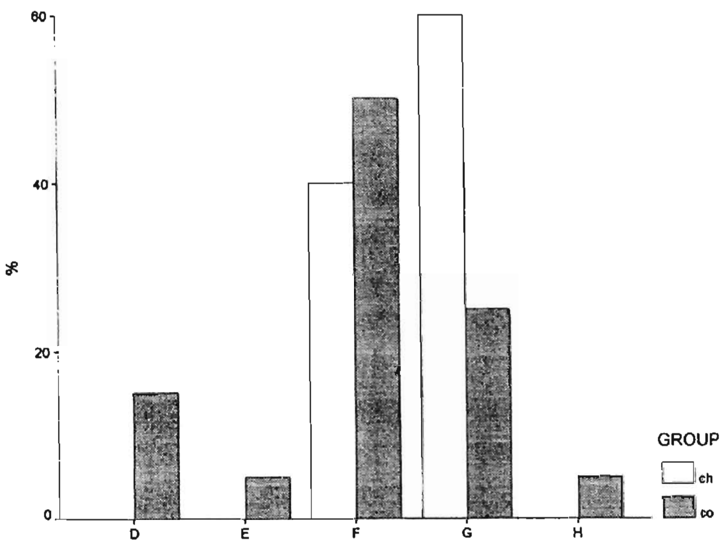

Fig 2. Bar chart of stages of dental development of M_2 (second permanent molar). Of the Groups ch is Chernobyl; co is Control.

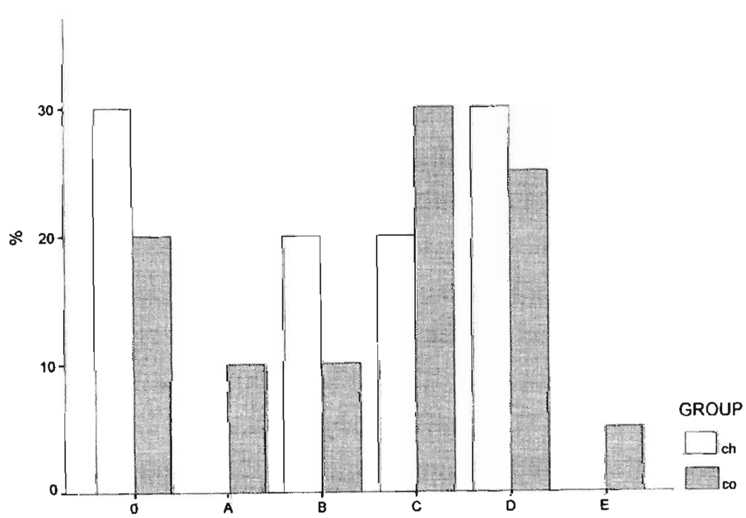

Fig. 3. Bar chart of stages of dental development of M_3 (third permanent molar). Of the Groups ch is Chernobyl; co is Control.

The effects of radiation on general health have been monitored since the Second World War by the Atomic Bomb Casualty Commission (now known as Radiation Effects Research Foundation) and continuing evaluation of current knowledge on the effects of ionizing irradiation is reported to several national bodies including United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Age at irradiation is an important factor in risk determination and developmental effects of irradiation on the fetus are related to the stage at which exposure occurs (BEIR, 1980). Irradiation in utero or early childhood can retard growth and development of the brain (UNSCEAR, 1986; Brent, 1996; Streffer, 1997) and induce malignancy; a marked increase in thyroid cancer has been reported in Belarus since the Chernobyl accident (WHO, 1995). The effect of irradiation on somatic growth reviewed by Nakamura and Akiyama (1995) and maturation is uncertain (UNSCEAR, 1977).

Children exposed in utero to the atomic bombs in Japan were not significantly different to other Japanese children in maturation of the wrist bones (Russell et al., 1973). Growth status including bone age was retarded among children exposed to fallout radiation in the Marshall Islands (Sutow et al, 1965).

However, the number of very young children in this study was small. No radiation-related effect on height has been observed in children living in Russia, Belarus or Ukraine at the time of the Chernobyl accident (IAEA, 1991). The effects of the accident are under evaluation by the World Health Organization in its International Programme on the Health Effects

TABLE 2. Mean difference between real age and dental age in years .

	N	mean	sd	p-value
males				
Chernobyl	5	2.33	1.43	
control	10	1.11	1.06	0.08
females				
Chernobyl	5	1.55	1.26	
control	10	1.17	2.10	0.72

sd is standard deviation

of the Chernobyl Accident (WHO, 1995). In addition, a programme of oral health care in Belarus is underway (Wright et al., 1993, Operation Belarus website).

The effect of radiation on developing teeth has been known for almost a century, however, teeth have only recently been included in the UNSCEAR reports. Both ameloblasts and odontoblasts are affected and the extent of damage is dependent on the dosage and stage of histo-differentiation (Dahllöf et al., 1994). Most clinical data assessing growth are based on small and heterogeneous groups of patients treated in different ways at varying ages and the effects of irradiation are complicated by direct radiation damage, malnutrition, other treatment modalities, the presence of residual tumours and endocrine late radiation effects (UNSCEAR, 1993). This fact applies to developing teeth also (see reports of groups of children (Jaffe et al., 1984; Maguire et al., 1987; Sonis et al., 1990; Holtgrave et al., 1995; Nasman et al., 1997). The clinical manifestation of irradiation on the developing dentition (reviewed by Goho, 1993; Maguire and Welbury, 1996) usually consists of several types of injury reflecting the number of teeth developing at any time during childhood. Dahllöf et al. (1988) have classified injury ranging from microdontia, altered or arrested root growth, delayed eruption to failure of a toothbud to develop.

This very small group of children from Chernobyl was not significantly different in their dental maturation compared to the control group. An important factor that needs to be considered in this study is the sample of children from Chernobyl. The children were all on a visit organised by a charity for a month long holiday in Hertfordshire, UK, from their home environment in Belarus. The selection criteria for these children is unknown but one imagines that health status and social skills played a part. When dental age of each child from Chernobyl is plotted on the standard percentile curves, seven of the ten children are at or above the 90th percentile. Both groups of children, as a whole, were advanced compared to the standards; a finding in common with other reports (see Liversidge et al., 1999).

An interesting finding was the distribution in formation stage of the molars suggesting that the group from Chernobyl is relatively more homogeneous. Two of the ten children from Chernobyl in this study were born one year after the accident. The remainder were born around the time of the disaster. Tooth germs of the permanent incisors, canines, as well as the first molars, have formed by 30 weeks in utero. However, the only permanent tooth where dentino- and amelogenesis occurs prior to birth is the first molar (Tonge, 1969). Clinical examination of the ten children showed no macroscopic enamel defects on first permanent molars. One child had a white enamel opacity in the incisal third of the upper central incisors and upper left lateral incisor. However, as no other teeth were affected, the opacity can be assumed to be unassociated with any systemic disruption. None of the children from Chernobyl in this sample presented with missing or abnormal teeth.

The conclusion from this study is that the Chernobyl disaster has not affected later dental maturation in this small group of children.

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Absence of Association between Body Size and Deciduous Tooth Size in American Black Children

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ABSTRACT Weak positive associations between tooth size and body size have been documented for the permanent dentition. Presumably, if the deciduous dentition were under the same genetic controls as the permanent, there would also be a discernible association for the deciduous teeth in young children. The deciduous dentition of 133 modern American Black children was examined to determine the correlation between body size and tooth size. The results, based on Spearman's rank-order correlations, disclosed no statistically significant association with body weight or stature, expressed as age - and sex- specific centiles, and crown diameters at the alpha level of 0.05. It is speculated that maternal influences - which modulate perinatal growth of the offspring - dissociate the tooth size-body size association in children, whereas the individuals' own genotypes are relatively more strongly expressed with increasing age.

INTRODUCTION

It is known that prenatal environmental factors can appreciably affect tooth crown diameters (e.g. Mellanby, 1941; Kreshover and Clough, 1953; Paynter and Grainger, 1956; Bailit and Sung, 1968; Garn, Osborne and McCabe, 1979; Heikkinen, 1996). What is not understood is the degree to which the maternal environment impacts tooth size in the deciduous dentition versus the later-forming permanent dentition of an individual.

In previous studies (e.g. Filipson and Goldson, 1963; Garn, Lewis and Kerewsky, 1968; Lavelle 1974; Henderson and Corruccini, 1976) weak positive associations were reported for the permanent dentition and adult stature. Garn's data yielded significant correlations on the order of 0.2 to 0.4, indicating that roughly five to ten percent of the variation in tooth size is accounted for in the statistical sense by stature. When permanent tooth size is tested against relatively more proximate biological structures, such as skull size (Lavelle, 1974), the correlations are again positive and of the similar magnitudes, 0.2 to 0.3.

Studies to date have analyzed sizes of the permanent dentition in relation to completed adult stature or skull size. None has tested for associations between the size of the deciduous teeth and corresponding body size in children. Researchers have assumed that the biological relationships between tooth size and body size are the same for the primary and permanent dentitions.

MATERIALS AND METHODS

Children who were routine dental patients at the graduate program of Pediatric Dentistry at the University of Tennessee, Memphis, were examined. Only American Blacks (n = 133) were used in the present study, where ancestry was based on parental assessment. Full-mouth dental study casts were made using rigid disposable trays, and the impressions were poured immediately using dental stone.

Not all children had complete complements of deciduous teeth. Mean age at examination was 5.5 years, with a range of two to nine years. Sample sizes were, as a result, larger for the late-exfoliating deciduous premolars and canines than the incisors.

Stature was measured to the nearest millimeter on all children by the same examiner using a stadiometer and procedures detailed by Weiner and Lourie (1969). Children were dressed in light school clothes, with socks but with their shoes removed. Body weight was obtained to the nearest 0.5 kg.

Maximum mesiodistal and buccolingual crown diameters of all sound deciduous teeth were measured by a single examiner using methods described by Moorrees (1957). Left and right homologous variables were averaged, when possible, yielding a total of 20 crown dimensions. Each tooth dimension was transformed to a sex-specific z-score (Garn and Shamir, 1958) so the data from males and females could be combined, and these standardized scores were used for statistical analysis.

Each individual's height and weight were converted to sex-specific centiles using charts from the National Center for Health Statistics (Hamill et al., 1977). Interpolations to the nearest centile were computer-generated.

Bivariate correlations between each tooth crown dimension and stature and then body weight were calculated using Spearman's rank-order correlation coefficient corrected for tied ranks (Siegel and Castellan, 1988). This nonparametric statistic was used to guard against non-normal distributions.

RESULTS

There were 20 correlation coefficients between deciduous crown diameters and stature and 20 between crown size and body weight (Table 1). None of the 40 correlations was statistically significant at the conventional alpha level of 0.05. Indeed, only four correlations were significant at a relaxed alpha of 0.10.

Most of the correlations between stature and crown size were negative (19/20), which exceeds expectations of a random split between positive and negative scores (X2 = 10.2; P = 0.001). In contrast, the majority of correlations between weight and crown size were positive (13/20; X2= 0.9; P = 0.34).

Of note, the four stature-tooth size correlations significant at alpha of 0.10 were negative, implying that the weak association is between tall-for-age children and smaller-than-average crown sizes and vice versa.

We also investigated whether partialing-out the effect of age would alter the results. There are two possibilities here, one is that tooth size was linked to age in this cohort of children and the other is that older children might have smaller tooth crown dimensions because of attrition. In fact, none of the 20 correlations between tooth size and age achieved statistical significance. All correlations were less than 0.10, which is consistent with the observation that tooth wear characteristically is trivial in contemporary, soft-diet populations. Consequently, since the tooth size-age associations were low and centered on zero, Kendall partial rank-order correlation coefficients (Siegel and Castellan, 1988) were not systematically or significantly different from those in Table 1.

DISCUSSION

Intuitively, one might expect that size-controlling genes would influence body size and tooth size in parallel fashions in childhood, leading to positive body size-tooth size correlations. However, there was no statistically significant association in the present study with percentile weight or stature and any of the 20 crown diameters at the conventional alpha level of 0.05. This suggests that the size-promoting genes responsible for deciduous crown size have little or no overlap with the phenotypic expression of height and weight during childhood. The literature suggests that, in contrast, by the time growth is effectively complete in early adulthood, weak but measurable size communalities have developed between tooth and body size (e.g., Garn, Lewis and Kerewsky, 1968; Henderson and Corruccini, 1976; Garn, Smith and Cole, 1980).

One conjectural explanation for the lack of association in the present study is that body size in childhood is a poor predictor of size at maturity because the tempos of growth vary considerably among children. Perhaps a measure of body size as a function of biological age (e.g., so-called bone age or dental age) would better control body size variation in children, thus disclosing stronger associations. Alternatively, the low but obvious correlations attained by the completion of growth in adults may simply not be present early in life when most growth remains potential and the degrees of maturity vary by tissue system (Scammon, 1930; Tanner, 1962).

Another, more likely consideration is that maternal influences and/or other environmental factors play a larger role in childhood growth than generally appreciated. It is documented that the intrauterine environment has a greater impact on size variation of the deciduous dentition than it does on the permanent dentition (e.g., Ayers et al., 1974; Brown, Margetts and Townsend, 1980). All of the deciduous tooth crowns achieve final size either in utero or in infancy, where - just as for body size and other dimensions (Ounsted and Ounsted, 1973; Penrose, 1973) - maternal size and health modulate growth substantially more than at later ages when the offspring's own genotype is manifested.

Previous studies have found that maternal influence ranges from 15% for human tooth size (Townsend, 1980) to 16 - 25% for tooth size in mice (Bader, 1965). Maternal influences on later-developing permanent teeth are only about 6% (Townsend, 1980). In turn, while the correlations between deciduous and permanent crown sizes within individuals are positive and statistically significant, they are not particularly high (ca. $r^2 = 0.25$), suggesting that different factors are influencing the two dentitions (Mootrees and Reed, 1964).

Finally, from an evolutionary standpoint, there is no reason to expect a correlation similar to the permanent dentition and body size. If tooth size is related to diet consistency, then the deciduous dentition will not have the same selective pressures as the permanent dentition. Deciduous teeth are present for a limited time of an individual's lifespan, and selection has a short time period to impact the underlying genetics. This lack of selective pressure may also explain the thinner, less dense enamel of the deciduous teeth (Sumikawa et al., 1999).

Still, the preponderance of negative associations between stature and deciduous tooth size (Table 1) is striking. Most (19/20) correlations were negative, though the correlations are not independent of one another because tooth dimensions are all positively intercorrelated (Moorrees and Reed, 1964; Harris and Bailit, 1988). Children with lower centiles for stature tended to have larger teeth, whereas tall-for-age children had smaller crowns.

This contrasts with prior results based on permanent teeth in adults and awaits further data for confirmation. There was no trend among the associations for weight-for-age and tooth size, and the ponderal index (i.e., weight/stature3) was also tested (results not shown) to see whether body-build was reflective of tooth size, but no statistically significant correlation was found.

On the basis of these data, then, the weak but discernible correlations between body size and permanent tooth crown size, on the order of 0.2 to 0.3, do not have any corresponding correlations in children with regard to the deciduous dentition and stature. Indeed, the weak trends between stature and crown size exhibit negative relationships. This lack of significant findings provides a further cautionary note against inferring body size from tooth size or vice versa, just as forewarned by Garn and coworkers (1979) and Henderson and Corruccini (1976) based on analyses of the permanent dentition.

TABLE 1. Rank correlation coeficients btween body size and deciduous tooth crown diameters.

	Tooth Crown Dimensions						
Body Size	Ui1	Ui2	Uc	Um1	Um2	Li1	Li2
	Lc	Lm1	Lm2				
			Mesiodistal Crown Diameters				
Height	-0.09	-0.19†	-0.08	-0.06	-0.03	-0.18	
Centile	0.02	-0.10	-0.09	-0.03			
Weight							
Centile	0.07	0.03	-0.05	-0.08	0.11	-0.09	-
0.10	-0.02	0.03	0.08				
			Buccolingual Crown Diameters				
Height							
Centile	-0.09	-0.12	-0.07	-0.13	-0.17†	-0.05	-
0.15	0.18†	-0.06	-0.14				
Height							
Centile	-0.09	0.02	-0.08	0.03	-0.02	-0.04.	-
0.17†	0.02	-0.02	0.10				

†$0.10 > P \geq 0.05$

*$P < 0.05$

CONCLUSION

This study supports the idea that the maternal environmen not only impacts the size of the deciduous dentition but may degrade the correlations between biological systems ofthe mother and her offspring. Alternatively, the discernible synchrony between body size and tooth size seen by late adolescence may be weaker at earlier ages.

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DENTAL ANTHROPOLOGY AT THE OHIO STATE UNIVERSITY

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The Ohio State University Department of Anthropology is pleased to announce the recent founding of our Laboratory of Dental Anthropology. Through the efforts of Dr. Paul Sciulli and two graduate students, the department has been building a comparative dental cast collection of modern dentitions. Several collections will soon be available for study. The Dayton Museum of Natural History collection includes serial casts of one hundred individuals throughout the course of orthodontic treatment. The R.M. Menegaz Collection consists of several samples from American populations, including Pima, Seminole, Gullah, Hollister-Haliwa, and European-Americans. Approximately 1600 individuals are represented. The Freedman's Cemetery collection includes photographs of 1100 African American dentitions from a turn-of-the century cemetery in Dallas, Texas. Soon to be added is the Melvin Moss West African deciduous dental cast collection. The laboratory now houses casts or photos of approximately 3000 individuals. Computers, photographic equipment, and statistical advice are available to researchers working in the laboratory.

Our department has two dental anthropology faculty and several graduate students. **Paul Sciulli**, Professor of Anthropology, is currency working on a project concerning dental asymmetry. He is also working on questions of inter- and intra-observer error in dental morphological observations, and morphological and metric evolution of deciduous dentition. Dr. Sciulli's latest articles include "Comparison of Population Structure in Ohio's Late Archaic and Late Prehistoric Periods" in the July 2000 *AJPA*, with co-author Nancy Tatarek (Ph.D. OSU 1999) of Ohio University.

A welcome addition to the faculty, **Debbie Guatelli-Steinberg**, recently joined the Department of Anthropology as an Assistant Professor, with primary teaching responsibilities on the Newark campus. Dr. Guatelli-Steinberg earned her doctorate at the University of Oregon, where she studied with Dr. John Lukacs, Chair of her dissertation committee. Her work has primarily focused on linear enamel hypoplasia (LEH) in nonhuman primates. This year she had an article in *Folia Primatologica* with Dr. Mark Skinner on LEH in African and Asian monkeys and apes. She also published an article in AJPA on LEH in Gibbons.

Fig. From left to right: Debbie Guatelli-Steinberg; Teri Tucker; Loren Lease; Heather Edgar; Paul Sciulli, congenitally absent.

With Wendy Dirks of NYU, Dr. Guatelli-Steinberg is currently working on determining the timing of hypoplastic events in a sample of gibbons from Thailand. She is interested in expanding her work on LED to early hominid samples from South and East Africa.

Dr. Guatelli-Steinberg also plans to study the teeth of monkeys from Tai forest for evidence of developmental defects of enamel.

Heather Edgar, a doctoral candidate, researches recent microevolutionary trends in populations as reflected in the morphological traits of the permanent dentition. Her dissertation is a biocultural study of admixture of African-Americans. Recently, she was awarded a National Science Foundation Dissertation improvement grant for this research. Her other interests include ritual destruction of human remains, paleopathology, and the peopling of the New World. She is currently working on an article reporting on a comparison of human and mammalian taphonomy at a archaeological site in southeast Ohio.

Loren R. Lease, a doctoral candidate, studies deciduous dentition. Her research focuses on sexual dimorphism in crown size and shape, determination of non-metric population complexes, and the evolution of hominid deciduous teeth. She is using European, European-American, African-American, West African, and Indian samples for her analysis. Other interests include in-utero development and maternal influences on the dentition and skeletal evidence of infectious diseases. She is has worked with Ed Harris on deciduous tooth size and body size correlation.

As part of her dissertation research, **Teri L. Tucker** is using dental indicators of health such as caries frequency, dental wear, and LEH to complement her biocultural analysis of health and centralized authority in the Roman period of Ancient Egypt. Tucker is also researching the influences of local environment and diet on dental wear and attrition in Roman ancient Egypt. More specifically, she is quantifying and comparing dental wear patterns from the Nile Delta, the Nile Valley, and the Western Oases ranging from the Predynastic through the Byzantine time periods.

Chris Barrett, a doctoral student, is currently working on questions regarding the interaction of cultural, biological, and genomic stressors and their effects on human dental development.

You can learn more about our department as a whole by going to our website: **www.monkey.sbs.ohio-state.edu.** Dental Anthropology at Ohio State is active, exciting, and growing. Watch for a bright future for our faculty, our students, and our department.

CONSTITUTION AND BY-LAWS: DENTAL ANTHROPOLOGY ASSOCIATION

ARTICLE I: Name The name of this organization shall be Dental Anthropology Association (DAA).

ARTICLE II: Objectives

The general nature, object, and purpose of this Association shall be for any and all of the following purposes:

(a) For the exchange of educational, scientific and scholarly knowledge in the field of dental anthropology.

(b) To stimulate interest in the field of dental anthropology.

(c) To publish a journal, *DENTAL ANTHROPOLOGY*, the Official Publication of the Dental Anthropology Association.

ARTICLE III: Membership

Section 1. Membership in this organization shall be of two classes: (a) Regular and (b) Student.

Section 2. Those eligible for membership in this organization shall be persons who have an academic, research, and/or clinical interest in dental anthropology.

ARTICLE IV: Board of Directors

Section 1. The business of the Association shall be under the management of the Board of Directors, composed of the following elected officers: President, President-Elect, Secretary-Treasurer, Editor of *DENTAL ANTHROPOLOGY*, and one Executive Board Member.

Section 2. The Board of Directors shall meet annually, exceptions to be determined by the President.

Section 3. Special meetings may be called by the President.

Section 4. A quorum will consist of those members present.

Section 5. The elected officers of the Association shall constitute the Executive Committee, which may meet to consider any important matters which may arise between meetings of the Association. Every member of the Executive Committee having been notified of meeting, those present shall constitute a quorum.

Section 6. Members of the Association may attend the Board of Directors Meetings and may vote. They may have the privilege of the floor by consent of the presiding officer.

ARTICLE V. Officers and Elections

Section 1. Designation of officers. The elected officers of this organization shall be the President, President-Elect, Secretary-Treasurer, Editor of *DENTAL ANTHROPOLOGY*, and one Executive Board Member. The President, President-Elect, and Secretary-Treasurer shall serve for a period of two years, the Executive Board Member for a period of three years, and the Editor of *DENTAL ANTHROPOLOGY* for a period of four years.

Section 2. The slate of incoming officers shall be presented by the Nominations-Elections officer to the General Membership before the annual meeting.

Section 3. Nominations may be made from the General Membership at the annual meeting.

Section 4. If there is more than one nominee for an office, election shall be secret ballot counted by the Secretary-Treasurer. In case of a tie the President shall cast the deciding vote. If only one nominee is presented for an office, that office maybe filled by instruction from the floor to have the Secretary-Treasurer cast a unanimous vote for such nominee.

Section 5. Vacancies among officers may be filled by vote of the remaining members of the Board of Directors.

ARTICLE VI: Duties of Officers

Section 1. President:

(a) Shall preside at all General Membership Meetings and all Board Meetings.

(b) Shall be an *ex officio member* of all standing and special committees.

(c) Shall appoint the chairs of all standing and special committees.

(d) Shall serve as a liaison officer between the Association and other professional organizations.

Section 2. President-Elect

(a) Shall assume the office of President following the term of President

(b) Stand in and assume the duties for the President in the event that the President is not able to perform his or her duties.

Section 3. Secretary-Treasurer

(a) Shall assist the President in the discharge of his or her duties.

(b) Shall keep the minutes of meetings of the Board of Directors and submit them for approval. A copy of such minutes shall be sent to the President within ten days of the meeting.

(c) Shall keep an accurate roll call of each Board Meeting.
(d) All reports of officers and committees shall be filed with the secretary for record.
(e) Shall conduct the official correspondence of the Association under the direction of the President.
(f) Shall be the custodian of all funds of the Association which he or she shall disburse only on order of the Board of Directors. All bills must be accompanied by an itemized statement or receipt when reimbursement is in order.
(g) Shall send dues statements to all eligible members.
(h) Shall submit a regular written report at each Board Meeting, and at the Annual Meeting shall present a full and written report of the finances of the Association.
(i) Shall file all appropriate federal, state, and local forms according to law.

Section 4. Editor of *DENTAL ANTHROPOLOGY.*
(a) Shall publish *DENTAL ANTHROPOLOGY.*

Section 5. Executive Board Member
(a) Shall serve as Nominations-Elections officer, Program Chair, and Meeting Facilitator.

ARTICLE VII: Committees

Section 1. Standing committees may be established at the discretion of the President.

Section 2. Special committees may be created by the Board of Directors to perform the special function for which they are so created. The chair of such committees shall be appointed by the President.

ARTICLE VIII: Meetings

Section 1. Unless otherwise ordered by the Association or the Board of Directors, regular meetings shall be held annually.

Section 2. Special meetings may be called by the President with the consent of the Board of Directors, with adequate notification of the membership.

Section 3. The annual meeting shall be designated as the Annual Meeting held in conjunction with the American Association of Physical Anthropologists.

ARTICLE IX: Dues and Finance

Section 1. Dues
(a) To be included in the membership of the Association and receive a copy of *DENTAL ANTHROPOLOGY*, dues must be paid by January 31 of the current fiscal year.
(b) Dues of this organization shall be set by the Board of Directors with the approval of the general membership. The membership shall be notified of the proposed change at the Annual Meeting.

Section 2. Finance
(a) The Finance Committee shall consist of the Board of Directors.
(b) The Finance Committee shall present a proposed budget to the membership for approval at the Annual Meeting.
(c) The disbursement of monies not provided for in the budget shall be voted upon at the Annual Meeting.
(d) The signature of the President and the Secretary-Treasurer shall be on record at the depository and either signature is valid for all banking transactions.

Section 3. The fiscal year shall be from June 1 of one year through May 31 of the following year.

ARTICLE X: Amendments and Rules of Order

Section 1. The By-Laws may be revised or amended at any meeting of the general membership by a two thirds vote of those present and eligible to vote, the proposed amendments or revisions having been mailed to the general membership thirty (30) days prior to date the vote is to be taken.

Section 2. Robert's Rules of Order, Newly Revised, shall be the parliamentary authority for all matters of procedure not specially covered by the By-Laws of this organization.

ARTICLE XI: Dissolution of the Dental Anthropology Association

No person shall possess any property right in or to the property or assets of the Association. Upon dissolution of the corporation, and after all obligations are satisfied, all assets shall be distributed exclusively to the American Association of Physical Anthropologists.

GUIDELINES FOR CONTRIBUTORS TO *Dental Anthropology*

1. Manuscripts of articles and other correspondence should be sent to the editor, A.M. Haeussler, Department of Anthropology, Arizona State University Box 872402, Tempe, Arizona 85287-2402, U.S.A.

2. Books for review should be sent to Debbie Guatelli-Steinberg, Department of Anthropology, The Ohio State University-Newark, 1179 University Drive, Newark Ohio 43055, U.S.A.

3. Manuscripts should have a title page listing the title and the running title, the name(s) of the author(s), and the name(s) of their institute(s). The remainder of the manuscripts should consist of an abstract, text (usually with an introduction, materials and methods, results, discussion, conclusion, summary), and a bibliography.

4. Each manuscript should be typed double space or printed double space with a laser printer and be submitted as an original and two additional copies for review. Photographs should be on glossy photographic paper. The copies, including those of the illustrations, can be xeroxes if they are clear. Authors are encouraged to send raw data with graphic figures so that graphs can be reproduced in the case that the scanned version lacks accuracy.

5. Dental Anthropology follows a style that is similar to that used in the *American Journal of Physical Anthropology* and published in Volume 108, Number 1, pages 131-135 (1999). Abbreviations of journal names follow those found in *Index Medicus*, although unusual and non-English language titles are spelled out. The complete names of journals are also given in the section on recent publications. Individuals who do not have access to the *American Journal of Physical Anthropology* can view the guide on the Dental Anthropology web site (http://www.anth.ucsb.edu/faculty/walker) or by requesting one from the publisher, Wiley-Liss, Inc., 605 Third Avenue, New York, New York 10158-0012, U.S.A. Answers to individual questions about manuscripts can be obtained by contacting the editor of *Dental Anthropology*. The current issue of Dental Anthropology follows the approved style and has examples of many cases of format, including those of text, table, figures, and textual and bibliographic citations.

7. Tables, figures, figure captions, and appendices should occupy separate pages.

8. Manuscripts are reviewed by members of the editorial board. In cases of specialized topics, manuscripts are reviewed by a specialist in the subject of the manuscript.

9. Copies of manuscripts on diskette are welcomed, if they are accompanied by a printed manuscript and if they have been tested as free of viruses. *Dental Anthropology presently* uses *Word Perfect 6.1*© on a DOS platform that can run on Windows 95© or Windows 98©. Dental Anthropology is not at present compatible with an Apple© /Macintosh© platform. None the less, all manuscripts, including illustrations, must be submitted as printed copy.

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