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CROWN DIAMETERS OF DECIDUOUS TEETH IN JORDANIANS

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ABSTRACT Odontometric data on the deciduous dentition of Jordanians are lacking and such data on Arabs are generally scarce. The aim of this study was to provide a detailed description of crown-size dimensions in the deciduous dentition of Jordanians and to compare the findings with those of other populations.

Measurements of mesiodistal (MD) and buccolingual (BL) crown diameters were obtained from dental casts of 84 males and females aged 2.9 to 5.8 years. The differences in crown size (MD and BL diameters) between the right and left sides of the dental arch were not significant. All antimeric teeth showed high correlation coefficients in their crown dimensions ($p<0.001$). These findings suggest that either right or left side measurements can be taken to represent the tooth size of the study population.

The relative variability in crown size showed that the lateral incisors were the most variable teeth (coefficient of variation: CV=7.5%), while the second molars were the most stable teeth (CV=4.7%). The MD diameters were more variable in the males for all teeth except the mandibular first molars, whereas variabilities in BL dimensions showed a similar pattern in both sexes. No significant differences in crown size measurements were found between males and females. Male means exceeded females means only by 0.05 mm. The central incisors displayed the greatest percentage of sexual dimorphism, while the second molars were the least dimorphic teeth. No specific pattern of percentages of sexual dimorphism were noted between the MD and BL diameters. The percentage of sexual dimorphism in the present sample was considerably lower than those of other ethnic groups. Jordanian children had tooth size that was larger than their Egyptian and North American counterparts, close to those of Japanese, and smaller than those of British children.

INTRODUCTION

The mesiodistal (MD) crown diameter, also called tooth size, tooth crown size, crown length, or crown width; and the buccolingual (BL) crown diameter, also referred to as breadth or width, provide significant information on human evolution and biological problems as well as on forensic and clinical dentistry. From an evolutionary viewpoint the deciduous dentition is thought to have changed less over time than the permanent dentition (Margette and Brown, 1978; Axelsson and Kirveskari, 1984). For a century anthropologists used crown diameters to trace the reduction of tooth size, reaching conclusions that appear to be a concomitant of selective forces and technological and dietary changes during human evolution (LeBlanc and Black, 1974; Kieser, 1990; Bermudez de Castro and Nicolas, 1995). Tooth crown diameters furnish human biologists with an insight into the genetic relation between populations and environmental adaptation (Garn *et al.*, 1967; Margette and Brown, 1978; Haeussler *et al.*, 1989; Sciulli, 1990). In forensic odontology tooth size proved to be a reliable sex discriminator (Black, 1978; DeVito and Saunders, 1990). Of clinical interest is the interrelation between tooth size and arch alignment, in which large teeth are associated with dental crowding (Lundström, 1969; Doris *et al.*, 1981). That an increase in tooth size may be a step toward hyperdontia, while reduced crown diameters and right-left asymmetries of tooth size were associated with oligodontia of permanent dentition has also been stated (Brook, 1984; Schalkvan der Weide *et al.*, 1994).

Crown dimensions of deciduous teeth and the impact of biological factors on their sizes have been much less documented than those of the permanent dentition, a situation that is probably due to difficulties in data collection. Twin studies have demonstrated that crown size is genetically determined by factors acting during odontogenesis, yet estimates of heritability in different populations have ranged from 34% up to 90% (Dempsey *et al.*, 1995). Townsend and Brown (1978) confirmed the strong genetic component on tooth size, but thought that heritabilities tended to be elevated because of shared environmental effects. Interestingly, these authors found that the common environmental influence on BL dimensions exceeded that on the MD dimensions. Garn *et al.* (1979) provided evidence that maternal and fetal determinants may account for as much as half of crown-size variability. Apparently, intra-individual crown-size similarities between isomeres and antimeres and interpopulation differences in bilateral asymmetries of tooth size might well reflect environmental influences, rather than changes in gene frequency (Perzigian, 1977; Garn et *al.*, 1979). Harris and Bailit (1988) emphasized that tooth crown dimensions are not as highly heritable as was often claimed in the early literature. Evidence is accumulating that tooth size reflects a complex interaction between a variety of genetic and environmental factors, with the effect of environment being greater in the prenatal than the postnatal period.

Sexual dimorphism in tooth size characterizes modern humans and varies between different populations. While some authors found that sexual dimorphism in tooth size is less pronounced in the deciduous than in the permanent dentition (Black, 1978; Lysell and Myrberg, 1982), others showed that sexual dimorphism in deciduous teeth is as great as or even greater than that seen in the permanent teeth (Potter *et al.*, 1981; DeVito and Saunders, 1990). The explanations proposed for crown-size dimorphism between males and females include variation in odontogenetic timing and enamel thickness, comparatively larger bodies in males than in females, the effect of sex chromosomes in promoting tooth growth, and hormonal influence (Garn *et al.*, 1979; Stini, 1985; Kieser, 1990). Dental sexual dimorphism may well reflect some sort of interaction between genetic and environmental factors, the nature of which is not well understood.

Tooth size exhibits a continuous range of variation among individuals and between populations. Because of the lack of odontometric data on the deciduous dentition in Jordanians and the paucity of such data on Arabs in general, the present study was carried out to measure the MD and BL crown diameters of deciduous teeth in Jordanians and to compare the results with data for other population groups.

MATERIALS

Jordan is an Arab state of Southwest Asia (the Middle East) with a population of four million people and a history of some of the oldest settled sites in the world. Jordan has been the home of hunters from the lower Paleolithic and Paleolithic-Mesolithic times. It is bounded on the north by Syria, on the east by Iraq, on the southeast and south by Saudi Arabia, and on the west by West Bank and Israel. Jordan is made up of three major physiographic regions: the Jordan deserts occupying more than four-fifths of its territory, the East Bank uplands, and the Jordan rift valley, a branch of the great African rift valley.

The sample in the present study is comprised of 84 male and female children, who were born of Jordanian parents and grew up in Jordan. All were apparently healthy children who presented for dental treatment needs. The mean age (± standard deviation) for males was 4.9 (±0.7) years and for females, 5.0 (±0.8) years). The range was between 2.9 and 5.8 years. Teeth were selected for measurements only if they were fully erupted, were not noticeably affected by attrition or caries, had not been restored, did not display abnormal crown morphology, and were present in the complete dentition.

METHODS

Alginate impressions were taken in suitable perforated trays for the upper and lower dental arches of every subject. Impressions were cast in dental stone immediately to obviate problems with distortion of the model. The MD and BL crown diameters were registered for each maxillary and mandibular deciduous tooth from the second molar on one side to the corresponding tooth on the contralateral side.

The MD crown diameter of a tooth was obtained by measuring the greatest distance between the approximate surfaces of the crown using an electronic sliding caliper inserted from the buccal or labial aspect and held parallel to the occlusal and vestibular surfaces of the crown (Moorrees et al., 1957; Hunter and Priest, 1960). The BL crown diameter was taken as the greatest distance between the labial or buccal surface and the lingual surface of the tooth crown in a plane perpendicular to the MD crown diameter of the tooth (Margette and Brown, 1978). If a tooth was rotated or malpositioned in relation to the curvature of the dental arch, the MD measurement was taken between the points of the approximate surfaces of the crown where the observer considered that contact with adjacent teeth would normally occur. Measurements were made by two observers (F.N.H and A.S.A-M).

Intra-observer reliability was evaluated by a replicability trial in which nine casts, selected at random, were measured on two occasions. Precision of the measurements was calculated by means of the method error statistic (S), also known as the technical error measurement:

$$S=\sqrt{\Sigma d^2/2n}.$$

In the equation for (S) d is the difference between the repeated measurements and n is the number of double determinations (Dahlberg, 1940). The value of S was small: 0.08 mm or 1.2% of the mean.

Inter-observer error was calculated by differences between the means of two sets of measurements using the paired t-test. The differences were not statistically significant. The average difference was 0.16 mm or 2.1% of the mean measurements.

Descriptive statistics including the mean of the MD and the BL crown size, standard deviation (SD), standard error of the mean (SEM), minimum and maximum values, and coefficient of variation (CV=100 SD/$\bar{x}$) were computed for each individual tooth. The data for males and females were analyzed separately and in combination when appropriate. Pearson's correlation coefficient (r) was used to express the degree of association between right and left measurements of homologous teeth in each dental arch by sex and by sexes pooled. The significant levels of the correlation coefficients were determined and the differences between sets of data were evaluated by the analysis of variance. The Student's t-test was employed to determine the differences in the tooth measurements between boys and girls. Sexual dimorphism in tooth size was quantified by expressing the percent to which the crown diameters of males exceeded those of females for each individual tooth: 100 (male mean / female mean minus 1.00). For comparative evaluation of the differences in tooth crown size between populations, crown area (also called summary tooth size, cross-sectional crown area, or robustness value) was obtained by multiplying the MD diameter by the BL diameter and expressing the value in mm^2. Hereafter, we refer to the MD and BL measurements of a tooth as crown diameters or size. Because most of the teeth except the maxillary first and second molars exhibit a greater anterior-posterior component than a medio-lateral component, the MD diameter denotes crown length and the BL dimension, crown width.

RESULTS

The mean MD diameters, standard deviations (SD), and coefficient of variation (CV) values for males are shown in Table 1 and for females, in Table 2. The corresponding data for the BL dimensions are presented in Tables 3 and 4. Statistical analysis using analysis of variance revealed no significant differences in both sexes between the crown size of teeth on the right and left sides of the dental arch. In absolute terms the differences between the mean crown diameters of homologous teeth were very small and ranged from 0.00 mm to 0.11 mm mesiodistally and 0.00 to 0.13 mm buccolingually, with the greatest differences representing 2.71% of the mean measurements. Some individual right-left differences can be shown by the coefficient of correlation (Table 5). For the MD diameters the r values ranged from 0.72 to 0.90 and for the BL diameters, from 0.76 to 0.94 (sexes pooled). In 14 of the 20 correlations antimeric teeth in males were more correlated than those in females.

Teeth that displayed the highest correlation in the MD dimensions are the maxillary central incisors followed by mandibular second molars, while the maxillary canines showed the greatest correlation buccolingually followed next by the mandibular central incisors. The pattern and magnitude of the coefficient correlations varied at random between MD and BL measurements (Table 5). In all instances the correlations between right and left homologous pairs were highly significant ($P< 0.001$). These findings indicate that right or left measurements could be taken to represent crown size diameters in this population.

The relative variability of crown size indicated by the coefficients of variation are shown in Tables 1 to 4. Only slight differences in the mean variability were found between males and females (6.5% vs 6.2%), as well as between the MD and BL diameters (6.2% vs 6.4%). Notable is the independence of the MD and BL dimensional variations of incisors as opposed to those of molars: variability ranged between 4.7% and 9.7% for incisors versus 3.9% and 6.4% for molars. For both sexes the second molars were the least variable teeth in MD and BL dimensions, except for female maxillary molars in which the MD diameter of central incisors varied comparatively less. In general, the

TABLE 1. Mesiodistal crown diameters (in mm) of the deciduous teeth of Jordanian male subjects.

Tooth	Side	N	x̄	SD	SEM	Range	CV	x̄A
			Maxillary Teeth					
central incisor	right	34	6.54	0.39	0.068	5.81-7.57	5.9	6.55
central incisor	left	32	6.56	0.38	0.068	5.85-7.44		
lateral incisor	right	37	5.48	0.40	0.066	4.86-6.46	7.2	5.45
lateral incisor	left	38	5.42	0.38	0.062	4.55-6.29		
canine	right	39	6.72	0.50	0.079	5.53-7.72	7.1	6.73
canine	left	38	6.74	0.45	0.073	4.47-7.77		
first molar	right	37	7.38	0.47	0.078	6.61-8.78	6.3	7.35
first molar	left	37	7.31	0.46	0.075	6.30-8.35		
second molar	right	36	9.04	0.54	0.090	8.11-10.50	5.8	9.01
second molar	left	36	8.97	0.51	0.086	8.02-10.10		
			Mandibular Teeth					
central incisor	right	35	4.15	0.33	0.055	3.43-4.86	8.2	4.13
central incisor	left	34	4.11	0.35	0.060	3.50-5.05		
lateral incisor	right	37	4.83	0.41	0.068	4.07-5.75	8.6	4.82
lateral incisor	left	37	4.80	0.42	0.069	4.00-5.60		
canine	right	39	5.82	0.39	0.062	4.92-6.63	6.5	5.84
canine	left	40	5.86	0.37	0.058	4.89-6.63		
first molar	right	35	8.07	0.45	0.075	7.10-9.10	5.6	8.03
first molar	left	33	7.98	0.45	0.079	7.30-9.08		
second molar	right	40	9.98	0.47	0.075	9.00-10.75	4.7	9.96
second molar	left	38	9.93	0.47	0.076	9.00-10.80		

N is the number of subjects. x̄ is the mean for N. CV is the coefficient of variation (%). x̄A is the average of the right and left measurements.

TABLE 2. Mesiodistal crown diameters (in mm) of the deciduous teeth of Jordanian female subjects.

Tooth	Side	N	x̄	SD	SEM	Range	CV	x̄A
			Maxillary Teeth					
central incisor	right	40	6.46	0.32	0.051	5.91-7.00	4.7	6.46
central incisor	left	40	6.45	0.29	0.046	5.99-6.96		
lateral incisor	right	41	5.41	0.32	0.049	4.65-5.98	6.3	5.41
lateral incisor	left	41	5.40	0.36	0.057	4.52-6.02		
canine	right	40	6.69	0.38	0.060	5.81-7.50	6.1	6.68
canine	left	41	6.67	0.46	0.071	5.63-7.65		
first molar	right	38	7.20	0.40	0.065	6.33-7.97	5.6	7.19
first molar	left	38	7.18	0.40	0.065	6.44-7.99		
second molar	right	40	9.00	0.49	0.077	6.91-9.77	4.9	9.00
second molar	left	40	9.00	0.39	0.062	8.32-9.71		
			Mandibular Teeth					
central incisor	right	39	4.12	0.35	0.056	3.52-5.58	7.9	4.06
central incisor	left	41	4.01	0.29	0.045	3.50-4.77		
lateral incisor	right	41	4.79	0.30	0.047	4.19-5.50	6.7	4.81
lateral incisor	left	42	4.82	0.34	0.052	4.01-5.50		
canine	right	39	5.92	0.38	0.061	4.83-6.93	5.9	5.93
canine	left	42	5.94	0.32	0.041	5.33-6.49		
first molar	right	35	7.98	0.46	0.078	6.79-9.00	5.9	7.96
first molar	left	36	7.94	0.48	0.080	6.52-9.01		
second molar	right	39	9.97	0.36	0.058	8.96-11.15	3.9	9.94
second molar	left	38	9.90	0.42	0.068	9.81-11.02		

lateral incisors were the most variable in both MD and BL dimensions.

The tooth crown diameters of males were not consistently larger than those of females (Tables 1 to 4). In 13 of the 20 MD and BL diameters (right and left sides pooled) males showed a larger crown size than females with differences ranging between 0.01 mm and 0.16 mm with an average of 0.05 mm. Statistical analysis showed no significant differences between males and females in the crown size of any individual tooth. The patterning and magnitude of gender dimorphism is possibly best investigated by means of the percentage of sexual dimorphism suggested by Garn *et al.* (1967). The percentages of sexual dimorphism of MD and BL diameters are presented in Tables 6 and 7. Overall, the second molars displayed the least dimorphism in crown size (0.49%), while the central incisors (1.37%) and the first molars (1.17%) showed the greatest dimorphism in the dentition. The total average of sexual dimorphism percentage was 0.98% for the MD and 0.71% for the BL diameters with no specific pattern in the expression of sexual dimorphism between MD and BL dimensions.

The cumulative MD diameter was calculated as the sum of crown lengths of individual teeth in each arch up to and including the second molars. In males the cumulative lengths of the maxillary and mandibular teeth were 70.16 and 65.53 mm, respectively. The corresponding lengths in females were 69.46 mm and 65.39 mm.

A valuable measure for comparing the crown size between groups is the sum of crown areas of individual teeth (Lukacs et al., 1983). The total crown area of Jordanians was calculated and compared with those of other populations (Table 7).

A comparison of the MD diameters in the Jordanian sample with those reported for the deciduous dentition of Egyptians (EL-Nofely *et al.*, 1989), North American whites (Black, 1978), and Australian Aboriginals (Margette and Brown, 1978) are presented in Table 6. The BL diameters of Jordanians compared with those of North American whites (Black, 1978), Hindu from western India (Lukacs *et al.*, 1983), and Australian Aboriginals (Margette and Brown, 1978) are shown in Table 7.

DISCUSSION

The paucity of odontometric data on populations in this region is responsible for the difficulty in comparing the present findings with those of others, except for the

MD data of Egyptian children reported by El Nofely *et al.* (1989). The present study of crown size (MD and BL diameters) is based on measurements from dental casts obtained from children born of Jordanian parents.

The present study showed no significant differences between right and left crown measurements in both genders. These findings are consistent with those reported for the deciduous dentition in other populations (Moorrees *et al.*, 1957; Margette and Brown, 1978; Lysell and Myrberg, 1982). According to Garn *et al.* (1979), intra-individual crown-size correlation and similarities between isomeres and antimeres might well derive from specific intrauterine events during odontogenesis and relatively less from genetic effect. Harzer (1987) provides evidence that the right-left differences between homologous teeth are smaller than the differences in tooth size between monozygotic twins, suggesting that the side differences can be attributed to environmental influences. Accumulated evidence indicates that the small amount of dimensional variation between antimeres is due to fluctuating asymmetry with little or no evidence for a genetic basis of bilateral asymmetry (Potter and Nance, 1976; Perzigian, 1977; Fields *et al.*, 1995). The random differences in tooth size between antimeres suggest a relative developmental stability within the dentition.

To express the magnitude of inequalities between antimeric teeth, correlation coefficients were used. The results showed that the r values between homologous teeth of Jordanians (Table 5) are consistently lower than those reported for North American whites (Moorrees and Reed, 1964) but comparable to those Lysell and Myrberg (1982) published for a Swedish sample. Although no significant right-left differences could be demonstrated, the magnitude of bilateral asymmetry appears to be a characteristic for ethnic groups. Perzigian (1977) indicated that within the morphological classes of the permanent dentition the comparatively more distal teeth are more asymmetrical than their mesial neighbors. Such a trend was not prominent in our sample (Table 5) or those reported by others on deciduous teeth (Moorrees and Reed, 1964; Lysell and Myrberg, 1982).

The relative variability in the crown size of the present sample showed that the lateral incisors, genders pooled, were the most variable teeth (CV=7.5%), while the second molars were the most stable teeth in the dentition (CV=4.7%). Similar observations were reported for other populations (Foster *et al.*, 1969; Black, 1978; Margette and Brown, 1978; Lysell and Myrberg, 1982; DeVito *et al.*, 1990), but varied from those of Moorrees *et al.* (1957) who found that the first molars were the least variable (CV=5.1%). DeVito *et al.* (1990) reported that the

TABLE 3. Buccolingual crown diameters (in mm) of the deciduous teeth of Jordanian male subjects.

Tooth	Side	N	$\bar{x}$	SD	SEM	Range	CV	$\bar{x}$A
Maxillary Teeth								
central incisor	right	43	4.95	0.33	0.050	4.00-5.90	6.9	4.95
central incisor	left	41	4.95	0.35	0.057	4.07-5.90		
lateral incisor	right	43	4.60	0.40	0.061	3.85-5.44	8.3	4.62
lateral incisor	left	41	4.64	0.37	0.057	3.92-5.32		
canine	right	43	5.94	0.42	0.064	5.12-6.92	6.9	5.92
canine	left	43	5.90	0.40	0.062	5.01-7.05		
first molar	right	44	8.28	0.42	0.063	7.21-9.53	4.9	8.32
first molar	left	44	8.35	0.40	0.060	6.60-9.52		
second molar	right	44	9.51	0.45	0.069	8.50-10.92	4.6	9.52
second molar	left	44	9.53	0.43	0.065	8.65-10.90		
Mandibular Teeth								
central incisor	right	41	3.79	0.29	0.045	3.19-4.60	8.1	3.79
central incisor	left	39	3.78	0.32	0.050	3.23-4.64		
lateral incisor	right	42	4.26	0.29	0.044	3.55-5.20	6.1	4.24
lateral incisor	left	42	4.22	0.23	0.036	3.69-4.95		
canine	right	44	5.58	0.39	0.058	4.43-6.62	7.7	5.55
canine	left	44	5.52	0.46	0.070	3.96-6.71		
first molar	right	44	7.27	0.43	0.064	6.44-8.11	5.9	7.23
first molar	left	44	7.18	0.42	0.063	6.28-8.23		
second molar	right	44	9.02	0.38	0.058	8.06-9.87	4.4	8.99
second molar	left	44	8.95	0.41	0.062	8.12-9.92		

Abbreviations are the same as those in Table 1.

TABLE 4. Buccolingual crown diameters (in mm) of the deciduous teeth of Jordanian female subjects.

Tooth	Side	N	$\bar{x}$	SD	SEM	Range	CV	$\bar{x}$A
Maxillary Teeth								
central incisor	right	31	4.87	0.27	0.048	4.36-5.31	5.8	4.86
central incisor	left	31	4.85	0.29	0.053	4.16-5.38		
lateral incisor	right	30	4.64	0.48	0.088	3.57-5.91	9.7	4.61
lateral incisor	left	30	4.57	0.41	0.073	3.54-5.37		
canine	right	31	5.93	0.47	0.085	5.11-6.65	8.3	5.94
canine	left	31	5.94	0.51	0.091	5.09-6.78		
first molar	right	31	8.33	0.34	0.060	7.48-9.08	4.2	8.38
first molar	left	31	8.42	0.36	0.065	7.63-9.28		
second molar	right	30	9.54	0.44	0.081	8.57-10.70	5.3	9.55
second molar	left	30	9.55	0.58	0.106	8.26-10.90		
Mandibular Teeth								
central incisor	right	32	3.83	0.28	0.050	3.43-4.68	7.2	3.81
central incisor	left	32	3.78	0.27	0.048	3.38-4.54		
lateral incisor	right	32	4.30	0.29	0.051	3.81-4.92	7.2	4.28
lateral incisor	left	32	4.25	0.33	0.058	3.73-5.40		
canine	right	32	5.54	0.35	0.062	4.79-6.42	6.4	5.55
canine	left	32	5.55	0.36	0.065	4.94-6.61		
first molar	right	32	7.35	0.46	0.082	6.21-8.42	6.4	7.29
first molar	left	32	7.22	0.47	0.083	6.35-8.32		
second molar	right	32	8.87	0.41	0.074	7.84-9.71	4.1	8.87
second molar	left	32	8.87	0.31	0.055	8.08-9.47		

Abbreviations are the same as those in Table 1.

TABLE 5.Correlation coefficients (r) for crown size diameters between the antimeres of the total sample (sexes pooled).

	Mesiodistal			Buccolingual		
Tooth	N	r	Rank	N	r	Ran
Maxillary Teeth						
Ri1-Li1	71	0.9	1	74	0.85	6
Ri2-Li2	79	0.8	5	73	0.86	5
Rc-Lc	80	0.7	7	74	0.94	1
Rm1-LM1	73	0.8	3	76	0.82	9
Rm2-Lm2	75	0.7	9	76	0.88	4
Mandibular Teeth						
R1-L1	75	0.8	6	71	0.89	3
R2-L2	78	0.7	10	74	0.84	7
Rc-Lc	79	0.7	8	76	0.84	8
Rm1-Lm1	69	0.8	4	75	0.91	2
Rm2-Lm2	77	0.8	2	76	0.76	10

dimensions of deciduous teeth in Canadian Caucasians were comparatively more variable in the females for all of the teeth except the canines. Margette and Brown (1978) discovered neither differences in tooth size variability nor differences between MD and BL variability in Australian Aboriginals. We found that MD dimensions were comparatively more variable in the males for all teeth except the mandibular first molars, whereas variabilities in BL diameters showed a similar pattern in both genders (Tables 1 to 4).

Our results on sexual dimorphism in crown size revealed that the MD and BL diameters of males did not significantly differ from those of females in all tooth types. These findings are in contrast with those of other populations in which male means were significantly larger than those of females for all teeth (Lysell and Myrberg, 1982; DeVito *et al.*, 1990; Ooshima *et al.*, 1996), for all of the teeth except the BL diameter of the mandibular central incisors (Lukacs *et al.*, 1983), in six of ten MD dimensions (Moorrees *et al.*, 1957), in eleven of 20 MD and BL diameters (Foster *et al.*, 1969; Farmer and Townsend, 1993), and in five out of 20 MD and BL diameters (Margette and Brown, 1978).

A useful method for quantifying gender differences in tooth size is the percentage by which the mean diameter of males exceeds that of females (Tables 4 and 5). No distinct differences in the total average of gender dimorphism percentages between MD and BL dimensions were observed (0.98% vs 0.71%). No specific pattern of sexual dimorphism existed between the MD and BL diameters within the same sample and between populations (Tables 6 and 7). The magnitude of the total average of the percentage of sexual dimorphism (MD and BL combined) of Jordanians (0.85%) was remarkably lower than that of North Americans (1.54%), South Australian Caucasians (1.99%), Australian Aboriginals (3.08%), and Hindu (3.68%). The highest percentages of sexual dimorphism in crown size were found in British children aged 2½ to 3 years: an overall average of 5.24% (computed from figures published by Foster *et al.*, 1969). In their study the anterior teeth displayed greater gender dimorphism than posterior teeth, a finding which was not confirmed by the present study (Tables 6 and 7) and in other population groups (Black, 1978; Margette and Brown, 1978; El Nofely *et al.*, 1989; Farmer and Townsend, 1993).

These findings clearly indicate inter-population differences in gender dimorphism of the deciduous dentition. Such an observation was also reported for the permanent dentition (Haeussler *et al.*, 1989; Hattab *et al.*, 1996). The sexual dimorphism of the deciduous dentition in the present sample (0.98%) was considerably less pronounced than that of the permanent dentition of the same population (3.60%) (Hattab *et al.*, 1996). This low level of gender dimorphism may reflect the relatively smaller sex differences in the timing of the developmental processes in the deciduous dentition which develops over a shorter period of time than the permanent dentition. While canines were the most dimorphic teeth in the permanent dentition, they displayed a lower percentage of dimorphism than the central incisors and first molars in the deciduous dentition (Table 6).

Comparison of MD and BL diameters of the deciduous dentition in Jordanians and other populations are presented in Tables 6 and 7, respectively. Statistical analysis using the t-test showed that the MD dimensions of all teeth in Jordanians were significantly larger than those of Egyptians to a level of $p<0.001$ with absolute differences ranging from 0.27 mm for the central incisors to 0.47 mm for the first molars. Jordanians had larger MD diameters than those of North Americans, except for the maxillary canines in males and central incisors in females. The differences were significant for the maxillary first molars and mandibular second molars. The MD dimensions of Jordanians were close to those of Japanese children (Ooshima *et al.*, 1996) both in pattern and in magnitude. In BL dimensions Jordanians possess significantly smaller maxillary central incisors and first molars than Americans. British children exhibit larger MD and BL dimensions than Jordanians in 15 out of 20 comparisons with differences that were highly significant for canines and central incisors, except for the MD diameter of the maxillary central incisors. In all instances the crown sizes of Jordanians were significantly smaller than those of Australian Aboriginals ($P<0.001$).

TABLE 6. Mesiodistal crown diameters (in mm), sexual dimorphism (%), and the rank order of sexual dimorphism of the deciduous teeth in Jordanians compared with other population groups.

	Jordanians				Egyptians				North American Whites				Australian Aboriginals			
Tooth	M	F	%	Rank	M	F	%	Rank	M	F	%	Rank	M	F	%	Rank
							Maxillary Teeth									
central incisor	6.55	6.46	1.39	4	6.13	6.16	-0.48	10	6.40	6.52	-1.84	3	7.35	7.20	1.97	8
lateral incisor	5.45	5.41	0.74	7	4.96	4.93	0.61	9	5.24	5.33	-1.69	6	6.00	5.93	1.11	10
canine	6.73	6.68	0.75	6	6.46	6.33	2.05	2	6.78	6.66	1.80	4	7.41	7.21	2.75	3
first molar	7.35	7.19	2.23	1	6.86	6.72	2.08	1	6.69	6.59	1.52	7	7.55	7.28	3.71	2
second molar	9.01	9.00	0.11	10	8.67	8.55	1.40	6	8.84	8.79	0.57	9	9.65	9.42	2.44	5
							Mandibular Teeth									
central incisor	4.13	4.06	1.72	2	3.94	3.89	1.29	7	4.03	4.10	-1.71	5	4.51	4.34	3.94	1
lateral incisor	4.82	4.81	0.21	8	4.51	4.44	1.58	4	4.58	4.72	-2.97	1	5.01	4.91	2.01	7
canine	5.84	5.93	-1.52	3	5.36	5.32	0.75	8	5.83	5.81	0.34	10	6.31	6.16	2.53	4
first molar	8.03	7.96	0.88	5	7.59	7.48	1.47	5	7.85	7.74	1.42	8	8.25	8.12	1.55	9
second molar	9.96	9.94	0.20	9	9.58	9.41	1.81	3	9.88	9.69	1.96	2	10.89	10.64	2.37	6
$\bar{x}$D			0.98				1.35				1.58				2.44	

$\bar{x}$D is the total average of the percent of sexual dimorphism.

TABLE 7. Buccolingual crown diameters (in mm), sexual dimorphism (%), and the rank order of sexual dimorphism of the deciduous teeth in Jordanians compared with other population groups.

	Jordanians				North American whites				Hindu (western India)				Australian Aboriginals			
Tooth	M	F	%	Rank	M	F	%	Rank	M	F	%	Rank	M	F	%	Rank
							Maxillary Teeth									
central incisor	4.95	4.86	1.85	1	5.13	5.19	-1.16	6	5.25	5.04	4.17	4	5.47	5.30	3.34	7
lateral incisor	4.62	4.61	0.22	9	4.71	4.64	1.51	5	4.94	4.71	4.88	2	5.24	5.01	4.59	2
canine	5.92	5.94	-0.34	7	6.11	5.97	2.34	2	6.19	5.96	3.86	6	6.61	6.34	4.23	3
first molar	8.32	8.38	-0.72	5	8.83	8.56	3.15	1	9.07	8.76	3.54	7	9.07	8.77	3.37	6
second molar	9.52	9.55	-0.31	8	9.54	9.36	1.92	4	10.15	9.75	4.10	5	10.65	10.27	3.74	4
A^2 (mm^2)	243.28				239.58				257.67				282.96			
							Mandibular Teeth									
central incisor	3.79	3.81	-0.52	6	3.86	3.84	0.52	9	3.88	3.87	0.26	10	4.33	4.19	3.20	8
lateral incisor	4.24	4.28	-0.93	3	4.37	4.35	0.46	10	4.35	4.21	3.33	8	4.75	4.65	2.04	10
canine	5.55	5.55	0.00	10	5.60	5.55	0.90	7	5.64	5.38	4.83	3	6.05	5.84	3.74	5
first molar	7.23	7.29	-0.82	4	7.37	7.31	0.82	8	7.51	7.27	3.30	9	7.92	7.49	5.81	1
second molar	8.99	8.87	1.35	2	8.90	8.70	2.30	3	9.32	8.87	5.07	1	9.87	9.57	3.05	9
$\bar{x}$D			0.71				1.51				3.74				3.71	
A^2 (mm^2)	215.61				212.28				218.71				246.94			
ΣA^2 (mm^2)	458.89				451.86				476.38				529.90			

$\bar{x}$D is the total average of the percent of sexual dimorphism. A^2 (mm^2) is the crown area. ΣA^2 (mm^2) is the total crown area.

Comparisons of the crown areas of Jordanians with those of other populations are presented in Table 7. Summed crown areas of individual teeth showed that Jordanians, sexes pooled, exhibited a larger total crown area than Americans (458.89 mm^2 vs 451.86 mm^2), but smaller than Hindu (476.48 mm^2), and much less than Australian Aboriginals (529.0 mm^2). This last ethnic group is thought to have the largest teeth in the contemporary populations.

SUMMARY

In summary, the present study of MD and BL diameters of deciduous teeth in Jordanian males and females showed the following: 1) In both genders a bilateral symmetry in crown size of homologous teeth was evident by highly significant correlation coefficients. 2) The lateral incisors were the most variable teeth in both MD and BL dimensions, while the second molars were the most stable teeth. 3) No significant differences in crown diameters, either mesiodistally or buccolingually, were found between males and females. 4) Noticeable inter-population differences in crown diameters with respect to the pattern and degree of sexual dimorphism, dimensional variability, and right-left side correlations suggest a complex interaction of genetic and environmental factors in determining tooth crown dimensions. Hopefully, the present data on Jordanians will provide a useful reference for future studies on populations in this poorly examined region.

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A BRIEF COMMENT ON AN INTENTIONALLY MODIFIED TOOTH FROM THE RIO TALGUA REGION, NORTHEASTERN HONDURAS

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ABSTRACT A single tooth from an ossuary cave in eastern Honduras was examined for the evidence of intentional modification. Using various microscopic methods, the authors did not observe linear striations associated with filing. However, characteristics consistent with normal masticatory processes were documented.

INTRODUCTION

Dental mutilation, also known as intentional dental modification, is an interesting cultural practice that has enjoyed a long and diverse history in many populations around the globe. Many explanations have been suggested for groups to artificially alter the morphology of their teeth. For instance, some researchers believe dental modifications are indicative of beautification (Rubín de la Borbolla, 1940; Romero, 1958; Fastlicht, 1976), ethnic markers, or tribal identification (van Reenen, 1978a,b, 1986; Handler, 1994), and social status (Fastlicht, 1948, 1976). For those interested, Milner and Larsen (1991) offer a detailed discussion of this practice.

Aside from these reasons for engaging in this interesting behavior, a fundamental question exists when considering intentional dental modification: What is the longevity of filing signature marks on modified teeth under masticatory function? Several authors have examined various methods for filing teeth (van Rippen, 1917; Havill, *et al.*, 1997). In a gross macroscopic example, van Rippen (1917) states that blades manufactured from obsidian were used to file or cut the incisal and mesial and/or distal margins of teeth in some prehistoric Mesoamerican populations. Havill and co-workers (1997) utilize scanning electron microscopy (SEM) to examine the signature marks left on intentionally modified teeth. Their study suggests that striations on the incisal borders of teeth are indicative of intentional filing.

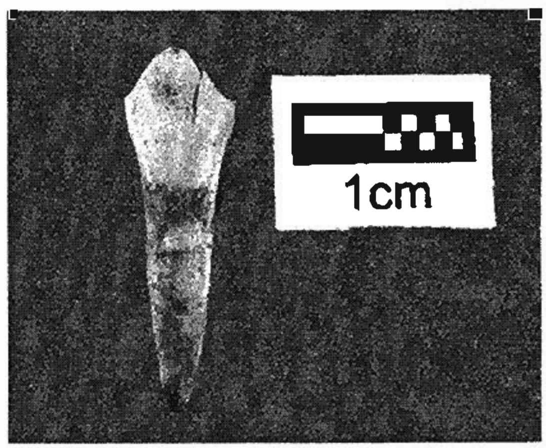

Fig. 1. Modified tooth from Cueva de las Arañas.

MATERIALS AND METHODS

In this study, we examined a modified mandibular incisor found in the vestibule of Cueva de las Arañas (Cave of the Spiders), an ossuary cave located in the Olancho Valley of northeastern Honduras near Catacamas. The cave is situated a few hundred meters from Cueva del Rio Talgua (Cave of the Glowing Skulls), an important ossuary cave discovered and investigated in 1994 and 1996 by Dr. James E. Brady of California State University-Los Angeles.

Extensive investigations in the cave included survey and mapping, excavation of the cave entrance, documentation of the black and red cave paintings, and *in situ* analysis of the calcite-veneered human remains. No radiocarbon dates are available from the entrance of the cave where the modified tooth was recovered. Besides the modified tooth, excavations in the vestibule recovered additional human remains, numerous Classic period (300-900 AD) pottery sherds, worked shell, stone beads, hematite objects, obsidian blades, faunal remains, and a fragment of a corncob.

We documented the modified tooth from a gross morphological perspective as well as by using microscopic methods. Several photomicrographs of the tooth surface and the incisal margin were produced with a Cambridge Stereoscan 360 Scanning Electron Microscope. The enamel surface was examined in an attempt to identify evidence of intentional modification (such as striations) or signatures of functional wear (such as pitting and linear scratches). Dr. Charles Brooks and Mr. Gregory Jones of the Department of Material Science and Engineering of the University of Tennessee Knoxville provided access to the SEM as well as several hours of technical assistance in sample preparation and image production.

All specimens examined were sputter coated with gold by a Hummer I Technics sputter coater within a nitrogen plasma field. Specimen surfaces were scanned at 20Kv with varying probe currents in an effort to maximize image quality. Finally, black and white Polaroid images of select features and surfaces were taken.

In order to examine the potential microscopic modifications within the architecture of the tooth, three 1.2mm sections were cut from the embedded crown fragment using the techniques outlined by Marks and co-workers (1996). Dr. Murray Marks of the Department of Anthropology at the University of Tennessee Knoxville provided access to the Mineralized Tissue Laboratory where the tooth was imbedded and thin sections were cut.

The labial portion of the crown separated from the root as the tooth dried during decompression in the SEM chamber. Therefore, examination of the entire enamel and dentine structure was possible without embedding the complete tooth or the lingual half of the modified crown. The thin sections were examined by transmitted light microscopy (TLM) and closely scrutinized for the presence of dead tracts. We specifically focused on the mesial plateau section because it was adjacent to the most heavily modified portion of the crown and would have been directly impacted by filing.

RESULTS AND DISCUSSION

The tooth is a mandibular left lateral incisor that exhibits characteristics consistent with intentional filing of the incisal, mesial, and distal margins (Fig. 1). The type of modification corresponds to Romero's (1958) C-6 category. As a result of the modification, a band of dentine is exposed across the incisal margin of the tooth. In addition, a small area of fractured enamel is evident at the labial apex of the crown. This defect suggests that the tooth functioned normally after modification.

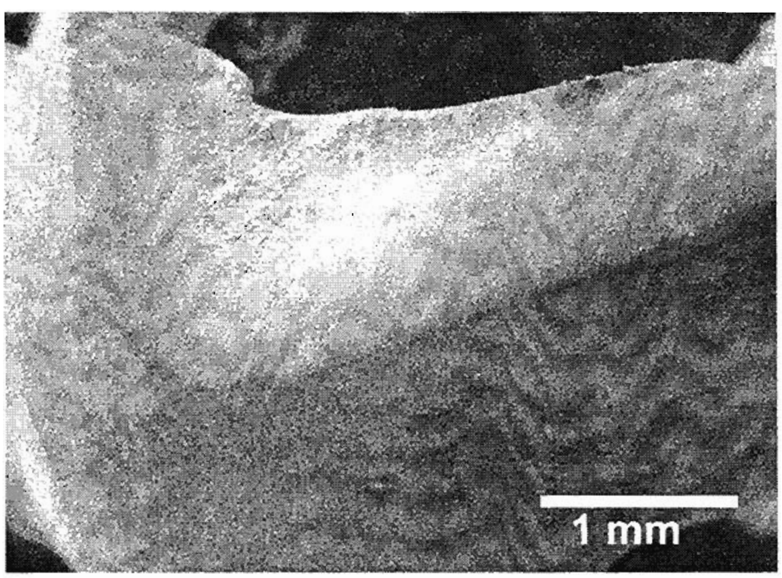

Fig. 2. SEM photomicrograph of the mesiolabial occlusal surface.

Along the labial and incisal surfaces of the tooth, no filing marks similar to the type reported by Havill and co-workers (1997) were present (Figs. 2, 3, and 4). However, most surface features evident were consistent with normal attritional processes (see Teaford, 1991; Teaford and Lytle, 1996). Scratches and pits were observed on the mesial and distal plateaus. Several scratches were also present along the incisal margin. Attritional processes appear to have obliterated filing marks. The tooth does show evidence of trauma at the labial incisal margin where a small area of enamel has fractured (Fig. 2). Although not visible in these figures, a distally oriented wear facet is present on the lingual aspect of the incisal margin, possibly suggesting that the upper incisors were also modified.

Using gross macroscopic and SEM methods of investigation, we did not find evidence of filing as defined by Havill and co-workers (1997). Based on this, we assume that the tooth was modified and normal masticatory processes resumed after filing. Attritional wear is evident on all surfaces of this tooth. No dead tracts were observed in any section of the crown including the heavily modified mesial plateau (Marks, Personal Communication, 1998).

The lack of dead tracts within the dentine below the modified areas suggests that attrition quickly erased the signatures of artificial alteration. However, we found no reference specifically outlining the time required for the development of dead tracts. Therefore, we are unable to provide an estimate of time since modification.

A bias in the archaeological record may occur because natural tooth wear in older individuals might destroy evidence of intentional modification on teeth (Milner and Larsen, 1991). That is, through the natural process of tooth wear consistent with a gritty diet (see Teaford and Lytle, 1997), individuals who possess dental modifications as young adults may actually wear the modification away. Had the individual from Cueva de las Arañas lived longer, the altered crown would have been gradually reduced. Thus, as time passes the teeth may not reveal intentional modification, even though those teeth may have been modified.

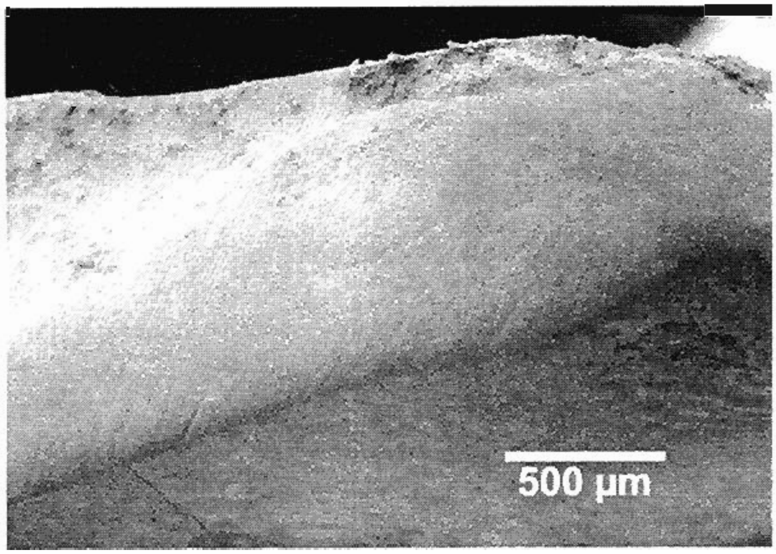

Fig. 3. SEM photomicrograph of the labial-incisal margin with a small enamel fracture at the apex.

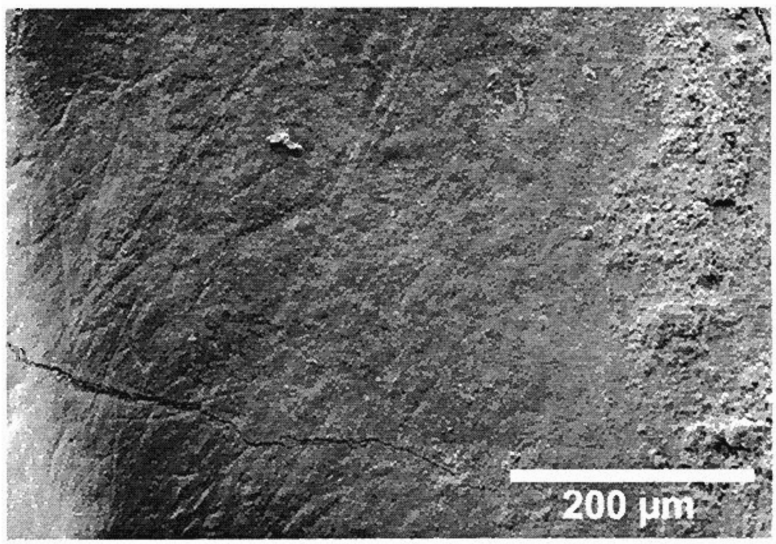

Fig. 4. SEM photomicrograph of the mesial plateau with scratches.

SUMMARY

In this study we examined a lateral mandibular incisor from Honduras to see if evidence of filing on the distal and mesial borders of the incisal surface is present. Based on our investigation, the pits and striations evident under SEM are consistent with marks made by normal masticatory function. Any signature filing "marks" have either worn away or were not present initially after the filing episode. The longevity of filing signature marks is potentially short due to high attrition in most maize-dependent Mesoamerican populations.

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Book Review

HUMAN DENTAL DEVELOPMENT, MORPHOLOGY AND PATHOLOGY: A TRIBUTE TO ALBERT A. DAHLBERG. Edited by John R. Lukacs. Eugene: University of Oregon Anthropological Papers 54. 447 pp. ISBN 0-87114-060-8 (paper) 1998

"For I would have thee to know, Sancho, that a mouth without grinders is like a mill without a millstone, and every tooth in a man's head is more valuable than a diamond." Thus said Don Quixote to his faithful squire while recovering from a fall off his mount, Rozinante, during his assault upon the innocent sheep which he mistook for an army of enchanted Moors (Miguel de Cervantes, 1605, *The History and Adventures of the Renowned Don Quixote* Part 1, Book 3, Chapter 4). Cervantes could not have imagined that four centuries after the publication of his satire of medieval chivalry a generation would arise which shared his hero's enthusiasm for the dentition, but because teeth are also important as sources of scientific data for documenting the biological diversity, evolution and phylogenetic affinities of ancient and modern human populations. In this august company of twentieth century dental anthropologists Albert A. Dahlberg (1908-1993) pioneered research for over seven decades, a career celebrated in a *Festschrift* published by the editors of *Ossa* in 1979 (25 contributors) and in the *Dental Anthropology Newsletter* in 1992 (31 contributors).

To these tributes John R. Lukacs, Professor of Anthropology at the University of Oregon, has edited a volume of 20 chapters by 35 authors of whom the majority presented papers at the Albert A. Dahlberg Memorial Symposium on Dental Anthropology and Evolution held at the annual meeting of the American Association of Physical Anthropologists in Oakland, California, in 1995, an event co-sponsored by the Dental Anthropology Association.

The volume is organized into five parts: 1. Dental Development and Genetics (3 chapters); 2. Morphological Variations (8 chapters); 3. Odontometric Variation and Dental Asymmetry (5 chapters); 4. Dental Pathology and Wear (3 chapters); and 5. History of Dental Anthropology (1 chapter). Preceding these chapters is a Dedication by G. Richard Scott. Reference citations appear at the end of each chapter. The volume concludes with an author - subject Index. It is amply illustrated with black and white photographs, line drawings and tables. The editor, a distinguished dental anthropologist with a quarter century of research in dental anthropology, has written a Preface. He is to be complimented for his careful attention to proofing and formatting this collection of papers, and for his organization of the 1995 Symposium while President of the Dental Anthropology Association. The name of Hennie T. Groeneveld as co-author with Julius A. Kieser of Chapter 14 is omitted from the Table of Contents where Kieser's first name is given not as "Julius" but as "Jules" at the heading of the chapter with Groeneveld.

The contributors discuss current issues of dental anthropology using samples from geographically widespread populations of Bronze Age Bactria (Chapter 5: Brian E. Hemphill, Alexander F. Christiansen, and S.I. Mustafakulov), Mesolithic Ukraine (Chapter 6: A.M. Haeussler), post-Paleolithic Nubia (Chapter 8: Joel Irish), Archaic Florida (Chapter 18: Andrea Cucina and M. Yasar Iscan), and prehistoric St. Thomas in the United States Virgin Islands (Chapter 19: Clark Spencer Larsen, Mark F. Teaford, and Mary K. Sandford). Among studies of historic populations are those from Maharashtra, India (Chapter 7: John R. Lukacs, Brian E. Hemphill, and S.R. Walimbe), native populations of the Northwest Coast (Chapter 11: Guy L. Tasa), South America (Chapter 17: Phillip

L. Walker, Larry Sugiyama, and Richard Chacon), and southern Australia (Chapter 20: Tasman Brown). These and other chapters address specific issues in odontometrics (Chapter 2: Simon Hillson; Chapter 3: John T. Mayhall, Lassi Alvesalo, and Grant Townsend; Chapter 9: Tsunehiko Hanihara; Chapter 16: Donald H. Morris), tooth growth and development (Chapter 15: Edward F. Harris), discrete morphological traits (Chapter 4: Christy G. Turner II and Diane E. Hawkey), root variations of molar teeth (Chapter 10: Verner Alexandersen and Ole Carlsen; Chapter 11: Guy L. Tasa), asymmetry and co-variation of the deciduous dentition (Chapter 12: Grant Townsend and Victoria Farmer; Chapter 13: Yuji Mizoguchi; Chapter 14: Julius A. Kieser and Hennie T. Groeneveld), and the role played by odontology in primate systematics (Chapter 1: Robert S. Corruccini). Other issues including irregularities of dental enamel formation, cultural practices, pathology and trauma are discussed in several of the chapters.

Lukacs provides instructors of college-level courses on dental anthropology a number of "required reading" assignments in this state-of-the art collection of papers by present-day leaders in this field. Particular attention in this review is directed to the contributions by Turner and Hawkey which discusses the unreliability of Carabelli's trait as a population marker since they have encountered it in 15 geocentric regions in their sample, not primarily among European and European-derived populations. In his study of primate taxonomy, Corruccini infers that relationships of true higher-level sister-group species may be correctly indicated by the morphology of the dentinoenamel junction in mandibular molars, as well as by variations of crown morphology. Evaluation of dental asymmetry as an indicator of environmental stress is discussed by Kieser and Groeneveld in the context of prenatal exposure to tobacco smoke of children between the ages of ten and 16 years. Older mothers who smoke have offspring with higher rates of dental asymmetry than do children of younger mothers who smoke. Brown's historical study of dental anthropology in South Australia contains photographs of anthropologists and physicians who contributed to the advancement of this area of investigation beginning with the appointment of Frederick Wood Jones to Adelaide University in 1919. This is a fitting final chapter to the volume in providing the reader with an awareness of the international scope of past and present-day research orientations in dental anthropology and the legacy left by Albert A. Dahlberg.

This reviewer enjoyed friendship and scholarly collaboration with Albert from the time of my graduate student years at the University of California at Berkeley. My mentor, Theodore D. McCown, summoned me to his office one April morning in 1960, introduced me to his distinguished visitor from the University of Chicago, and informed me that I should assist Dr. Dahlberg for the following three days in locating skeletal specimens housed in the Lowie Museum collections in the basement of the women's gymnasium. I was delighted with this assignment, spending many profitable hours with Albert who, on the final day of his visit, was my host for lunch at Berkeley's elite Black Sheep Restaurant, a heady experience for a graduate student! Albert's kindness, gentle manner, and erudition were among his many gifts to anthropology and to his friends and associates.

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DENTAL ANTHROPOLOGY AT THE HEBREW UNIVERSITY – JERUSALEM, ISRAEL

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Research in the biological anthropology and ancient DNA laboratory headed by Pat Smith at the Hebrew University, Jerusalem, is very active and diverse. The lab comprises specialists in anthropology, evolution, and molecular genetics who are unified by an interest in human evolution. The current research projects carried out by members of the lab fall under three major themes: 1) Human origins; 2) Dental evolution and patterns of growth; and 3) The interaction between genetic and environmental factors on the composition of past populations in the Southern Levant, South Africa, Australia, and recently in America.

In addition to traditional methods based on morphometric analyses these topics are now being investigated through exciting techniques such as ancient DNA analysis, Ct-scans and confocal laser scanning microscopy (CLSM). The laboratory places great emphasis on links with other research fields including human population biology, molecular genetics and developmental biology.

Pat Smith in collaboration with Leo Joskowicz (Hebrew University) is focusing her research to test current concepts on the ontogeny and phylogeny of the hominid dentition. They have developed a three-dimensional model for the study of growth patterns in fossil and modern teeth. The results of this study show an association between duration of tooth development, tooth size, and crown pattern.

Marina Faerman is continuing her research on diverse issues using ancient DNA. Some of these include 1) The origins of modern humans and microevolutionary trends in Near Eastern populations; 2) The genetics of past populations; and 3) Infectious diseases in the past; 4) Forensic and archaeological applications of ADNA.

Rebeca Haydenblit is examining evolutionary trends in human tooth development using confocal laser scanning microscopy. This study shows the feasibility of using confocal microscopy to examine enamel prism organization and growth patterns of tooth development from modern and fossil hominid teeth.

Almut Nebel, a Ph.D. student, is working on past and present populations in Israel studied by DNA analysis.

Tzipi Kahana recently received her Ph.D. degree on age-related changes in trabecular architecture of the long bones and its forensic implications. She is currently working as a forensic anthropologist in the Israel Police Force in Criminal Investigation.

Uri Zilberman in collaboration with Lassi Alvesalo (University of Oulu, Finland) is finishing his Ph.D. on the extent to which chromosomal defects differentially affect the different components of tooth size and form. His results suggest an inverse correlation between the duration of crown formation and size reduction.

Gilah Kahila Bar-Gal is continuing her Ph.D. research on the genetic change in Capra species of the Southern Levant over the past 12,500 years shown by ancient DNA analysis.

Anda Rozen is focusing her master's thesis research on the relationship between enamel thickness and tooth size in native populations of Tierra del Fuego and Australia and Danny Brener is working for his master's degree on sex differences in dental formation.

Finally, a new Ph.D. student, Issa Sarie, is examining the Neolithic populations of Ein Ghazal and comparing dental genetics and disease patterns in them to that of other Neolithic populations in the region.

The bio-anthropology research group has available to it the facilities of a new laboratory designed for skeletal analyses, with image analyzer, X-ray unit, microcomputer, and mainframe facilities. In addition we have a unique collection of skeletal and dental specimens from the Middle East as well as a large radiographic collection of teeth and skulls. These provide the essential resources for the research carried out.

11th International Symposium on Dental Morphology in Oulu, Finland

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Dr. Lassi Alvesalo (University of Oulu), president of the organizing committee, welcomes participants to an oral session.

International Symposia on Dental Morphology have been held every three years for the past three decades. While steadfastly unorganized (no elected officials, no constitution or bylaws, no dues, no official membership), many of the leading names in dental research predictably participate in these triennial meetings. Actually, "dental morphology" is an inadequate phrase to characterize the diversity of topics dealt with in the Symposia, but no one has come up with a better term than that to encompass the range of research: embryology, tissue interactions, taxonomy, phylogeny, contemporary primate and human variation, odontometrics, imaging technology, and several others.

From August 26 to 30 last summer the 11th International Symposium on Dental Morphology was held in the beautiful northern Finnish seaside town of Oulu. Lassi Alvesalo was president of the organizing committee. Along with a hard-working staff, Lassi hosted five days of science- and fun-filled events.

Eighty-four papers were delivered at the meeting, which was hosted at the dental institute at the University of Oulu, with over 100 participants. Every continent (and some large islands) was represented. By my unofficial count, about half of the presenters were from Europe (45%), followed by North America (15%), Great Britain (12%), Japan (11%), Africa (9%), Australia and New Zealand (5%), and India (2%). The topics were just as diverse as the countries of the participants. Yet the organizers did a superb job of clustering oral presentations and posters into six categories: dental anthropology, ontogeny, dental genetics, morphological integration of the dental and craniofacial complexes, dental evolution, and dental technology.

Dr. Percy M. Butler (University of London), one of the founders of the Symposia on Dental Morphology, glances at the camera, while F.J. van Reenen (University of the Witwatersrand) listens attentively to the speaker.

The organizers politely cajoled the presenters to supply copies of their papers while at the meeting (or with a few weeks leeway for revision) These hard workers are expected to have the proceedings published this spring by the University of Oulu Press. The Symposia have an envied record in that most of the meetings have wound up in book form. These low-volume publications are soon out of print, though, and the importance of the research and the diversity of the books' contents soon turn them into collector's items.

Any report of this meeting has to make an attempt to capture the high-level of collegiality developed by this single-session meeting. All were on an equal footing to chat with other researchers, make new friends, and rekindle old acquaintances. The diversity of research interests makes this unique meeting so intellectually profitable; it brings fresh, novel perspectives together in one session often with productive interactions.

This valuable interactive aspect was more than redoubled by the organizing committee's unflagging effort to make our visit memorable. The evenings were filled with receptions (including an elegant get together at the town hall), folk dances, a tar-flavored cordial unique to Oulu, entertainment by a tuxedoed men's choir, distinctive Finnish food, and much more. After the meeting participants had opportunities for touring, including a visit to Lapland above the Arctic Circle. In all no one should have left without a warm feeling for the organizers, the city, and Finnish culture and hospitality. Judging from the consistent, high-quality of the presentations, the forthcoming volume is a "gotta have" for all researchers dealing with ontogeny, phylogeny, genetics, and/or variation of the dentition. While few papers will focus on any one topic, we'll all benefit from knowing more about related areas.

Just as with Symposia volumes before this one, the forthcoming book also will be a valuable starting point for teaching and for graduate student research. For a decidedly egalitarian and "unorganized" group of scientists, the loose membership of the Symposia produces considerable leading research on the dentition. Contrasted with some professional organizations with annual meetings attended by thousands of participants, there's an obvious message here about "small is beautiful" when it comes to learning.

Well over 100 scientists participated in the five-day symposium, with most of them shown in this group photograph taken near the end of the meeting.

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