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# Demonstrating an anthropological application of the Economides orthodontic collection: deciduous and permanent tooth size in European and Hispanic Americans

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## Abstract

Radiographs, intra-oral photographs, and patient records in the J.K. Economides orthodontic patient record collection are now on line and freely available for research. This database contains records and over 400,000 images for 5,650 individuals representing the diversity of Albuquerque, New Mexico 1972-1999, including African, Asian, European, Hispanic, and Native Americans. There are records for 600 related sets of individuals in the collections. Additionally, associated dental models are available for research at the Maxwell Museum of Anthropology.

The anthropological research potential for this database is enormous, including studies of growth and development and cranial, dental, and soft tissue studies. This potential is indicated by the present study, an intra-individual comparison of deciduous and permanent occlusal linear measures and areas of molars in European (EA; n=123) and Hispanic Americans (HA; n=77). Two alternate hypotheses were considered for the relationship between correlations in HA compared to EA. First, higher overall tooth size correlations might indicate developmental stability in a admixed group (HA). Second, lower overall correlations might indicate developmental instability related to lower socioeconomic status. Correlations range from 0.00 (HA um1/UP3) to 0.72 (EA um2/UM1). Overall, differences between EA and HA are not statistically significant, indicating that neither admixture nor socioeconomic status is affecting tooth size in this sample of HA.

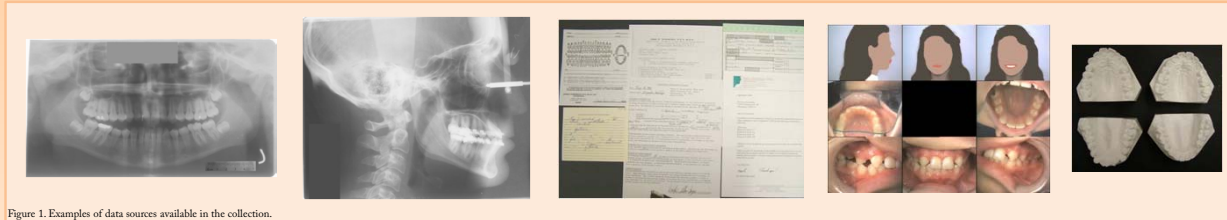


Figure 1. Examples of data sources available in the collection.

<http://hsc.unm.edu/programs/ocfs>

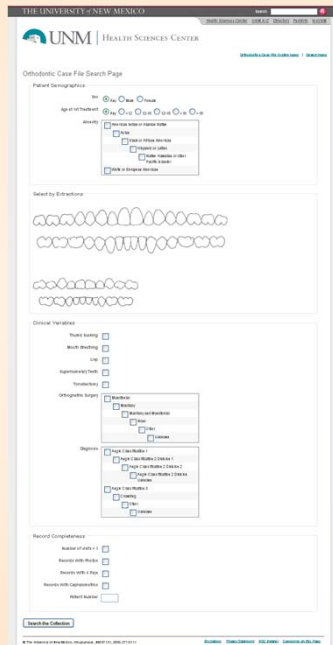


Figure 2. The on-line database query form.

## Results

Correlations ranged from -0.222 (EA mandibular m2/P4) to 0.718 (EA maxillary m2/M1). Three of the 36 correlations calculated were negative, and one of these was essentially zero. In general, correlations were higher for molar/molar comparisons than for molar/premolar comparisons.

Significant differences in tooth size correlations between the two groups were seen in five of 18 comparisons. All five significant results were in mandibular teeth. Three were in area measures, which is not surprising as area multiples differences in correlation from MD and BL. In all five significant cases the higher correlations were seen in HA.

## Conclusions

Most correlations of deciduous and permanent molar size compared between European American and Hispanic Americans are not significantly different (13 of 18  $p > 0.05$ ). However, all five of the correlation comparisons that are significant are cases where the correlation is higher in Hispanic Americans. This observation supports hypothesis 2, that the hybrid nature of the Hispanic population is associated with greater developmental stability as compared to European Americans. Of course, this conclusion only pertains to these population samples, which reflect Albuquerque NM 1972-1999.

This study also provides a glimpse of the potential research applications that can be developed using the on line search engine and images and physical materials in the Economides orthodontic collection. The physical materials and on-line images are of very high quality. Perhaps the greatest strength of the collection is its diversity. These resources are now available free of charge, and the on line collection is accessible to anyone at any time.

## Acknowledgements

The developers of this collection would like to thank the following individuals for their efforts and expertise: Summers Kalishman, Charles Tatlock, Frank Peacock, Randy Stewart, Anna Rautman, Lara Noldner, Stephanie Finke, Corey Ragsdale, Kelly Gilbert, UNM HSLIC TECHS, and the orthodontic faculty and students of U. Tennessee HSC. This work was supported by NLM grant #5308LM009381.

In 2005, the Maxwell Museum of Anthropology received a donation of patient records from James K. Economides, an Albuquerque, NM orthodontist. The donation consisted of complete records of all of Economides' patients (<5,650) who entered treatment between 1972-1999. Thanks to a grant from the National Library of Medicine, NIH, the collection is now available for research. A subset of the collection is available in an on-line database free of charge for research and teaching, including patient and treatment histories, diagnoses, demographics, intra-oral photographs (~400,000), and x-rays (~20,000). The physical collection, available for research at the Maxwell Museum includes additional resources, such as full facial and profile photographs and patient names. The development of this database received approval from the University of New Mexico's Human Research Review Committee (protocol #05-410).

There are a number of avenues of anthropological research for which this database and collection could provide data, including:

- ❖ Population variation
- ❖ Growth and development
- ❖ Geometric morphometrics
- ❖ Secular change
- ❖ Forensic identification
- ❖ Dental anthropology
- ❖ Health disparities

In order to demonstrate just one of the myriad applications of this collection, we conducted comparing linear and area measurements of intra-individual deciduous and permanent teeth in two samples, European Americans (EA) and Hispanic Americans (HA). Because subjects who underwent treatment had several dental models made, deciduous molars in one model can be compared to permanent molars in a later model. We developed two alternate hypotheses:

- 1) Correlations between deciduous and permanent measures are higher in European Americans than in Hispanic Americans. If European Americans are significantly economically privileged, they should be more developmentally stable and their deciduous tooth size should better predict permanent tooth size than Hispanic Americans.
- 2) Correlations between deciduous and permanent measures are higher in Hispanic Americans than in European Americans. If a hybridized population is significantly developmentally more stable than a less hybridized one, Hispanic American deciduous tooth size should better predict permanent tooth size than European Americans.

## Materials and Methods

Two samples were drawn at random from subject records matching two criteria: 1) being either European American or Hispanic American, and 2) having dental models that included deciduous molars, permanent premolars, and permanent 1<sup>st</sup> molars. One author (M.H.) made all measurements on 123 EA and 77 HA. Each measure was repeated 2-4 times until no individual measure was more than 10% different than the mean of measures. Means of left and right measures were averaged, and these data were used in further analyses. Correlations were calculated for mesiodistal (MD), buccolingual (BL), and occlusal surface (MD x BL) measurements using Excel. The teeth compared were maxillary and mandibular m2/M1, m2/P4, and m1/P3, for a total of 18 size correlations calculated per group. Correlations were compared with Fisher's Z transformation using SISA ([www.quantitativeskills.com](http://www.quantitativeskills.com)).

measure	tooth	Deciduous		Permanent		Correlation		Z	p	
		EA mean	HA mean	EA mean	HA mean	EA	HA			
BL	um2	9.494	9.795	UM1	11.061	11.247	0.718	0.681	0.491	0.688
MD	um2	8.942	9.237	UM1	10.626	10.834	0.540	0.542	-0.19	0.492
area	um2	66.766	71.221	UM1	92.622	96.004	0.690	0.622	0.068	0.791
BL	um2	9.494	9.795	UP4	9.219	9.392	0.614	0.268	2.981	0.998
MD	um2	8.942	9.237	UP4	6.528	6.692	0.341	0.483	-1.161	0.123
area	um2	66.766	71.221	UP4	47.371	49.464	0.562	0.489	0.683	0.753
BL	um1	8.098	8.201	UP3	9.080	9.319	0.179	-0.001	1.231	0.891
MD	um1	6.745	7.048	UP3	6.730	7.103	0.406	0.302	0.806	0.79
area	um1	42.911	45.559	UP3	48.062	51.928	0.459	0.229	1.779	0.962
BL	lm2	8.674	9.000	LM1	10.225	10.492	0.621	0.660	-0.448	0.327
MD	lm2	9.521	9.950	LM1	10.682	11.119	0.453	0.588	-1.259	0.104
area	lm2	55.577	70.468	LM1	86.006	91.912	-0.062	0.659	-5.772	0
BL	lm2	8.674	9.000	LP4	8.190	8.670	0.118	0.459	-0.2554	0.005
MD	lm2	9.521	9.950	LP4	6.986	7.574	0.437	0.240	1.514	0.935
area	lm2	55.577	70.468	LP4	45.146	52.218	-0.222	0.289	-3.54	0
BL	lm1	6.726	6.801	LP3	7.643	7.820	0.330	0.411	-0.636	0.262
MD	lm1	7.526	7.744	LP3	6.888	7.172	0.248	0.562	-2.588	0.005
area	lm1	39.859	41.480	LP3	35.529	44.135	0.273	0.499	-1.812	0.035

Table 2. Correlations between measures of deciduous and permanent tooth measures for European and Hispanic Americans. Significant differences are shaded in orange.



Figure 3. Query results for one subject.