Correlates of Permanent Tooth Development in Prenatal Time

ALPHONSE R. BURDI, STANLEY M. GARN, and JERRY SUPERSTINE

Department of Anatomy and Center for Human Growth, University of Michigan, Ann Arbor, Michigan 48104, USA

Although calcification of the permanent teeth is not radiologically discernible until the first month after birth (GARN, LEWIS, and POLACHECK, *J Dent Res* 38: 135, 1959) developmental stages of I1, I2, M1, and often C may be demonstrated in histological sections of jaws well before the 39- to 41-week age horizon. It is of interest, therefore, to determine whether intra-uterine development of these permanent teeth is simply and linearly related to the conventional measures of fetal size, namely, crown-rump length (CRL) and weight. It is also interesting to ascertain whether the correlation between fetal size and the overall measure of permanent tooth development obtained by summing individual tooth stages is sufficient to make dental development a reference parameter in prenatal studies.

To do this, we have related the stage of development of I1, I2, and M1 in the maxilla and mandible separately to (1) crown-rump length, (2) weight, and (3) the base-10 logarithm of body weight in 34 grossly and histologically normal human fetuses. We have used a simple system of "staging" as previously described by us (GARN and BURDI, *J Dent Res* 50: 1407, 1971; BURDI, GARN, and BABLER, *Arch Oral Biol* 19: in press, 1974). Data on permanent canines were excluded because the small number of fetuses providing definitive developmental information was insufficient to compute valid correlations involving C. Linearity of relationship, after pooling separate sex-specific values of r, was tested before computing final product-moment correlations (r).

As shown in the table, correlations between the stage of development of three maxillary and three mandibular teeth and the measures of fetal size were moderate to high. Individual tooth stage vs body-size correlations ranged from 0.691 to 0.933 with a weighted mean value of r approximating 0.85. Throughout, correlations involving maxillary teeth were higher than those involving corresponding mandibular teeth, a trend that was statistically significant by chi-square test.

With the summed tooth measure (ΣT) correlations involving length, weight, and the base-10 logarithm of weight were consistently higher than correlations involving single teeth. Correlations between summed tooth stage of I1, I2, and M1 and CRL, body weight, and $\log_{10}$ body weight ranged from 0.867 to 0.972. The highest correlation (0.972) was between summed maxillary tooth stage and CRL.

While it is not surprising that permanent tooth development and size are significantly correlated in human fetuses between 75 and 378 mm in CRL, both the linearity of the relationships and the magnitudes of the correlations should be noted. Since correlations involving ΣT and fetal size range up to 0.972, ΣT may provide a useful measure of "dental age" in fetal studies, appropriate as a reference standard in the analysis of prenatal craniofacial development. Finally, dental development may provide a useful, independent reference parameter in embryological research.

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PERMANENT TOOTH DEVELOPMENT AND FETAL SIZE

Tooth	Crown-Rump Length	Crown-Rump Length N	Crown-Rump Length r	Body-Weight N	Body-Weight r	Log Body-Weight N	Log Body-Weight r
Maxillary							
I1	110–378	24	0.890	26	0.854	26	0.782
I2	170–350	18	0.890	18	0.930	18	0.900
M1	75–350	22	0.915	21	0.786	21	0.933
Summed	75–343	20	0.972	18	0.910	18	0.939
Mandibular							
I1	110–378	24	0.790	21	0.797	21	0.701
I2	170–378	22	0.811	20	0.843	20	0.824
M1	75–378	27	0.831	27	0.691	27	0.903
Summed	75–378	19	0.925	21	0.867	21	0.933

Correlations involve the stage of development of individual teeth or the summed values (ΣT) for I1, I2, and M1 where applicable.