Tooth Size and Position Before Birth

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No uniformity exists in the arrangement of the deciduous anterior teeth before birth. The deciduous incisors achieve a substantial amount of their final mesiodistal width at an early stage. Jaw growth in the anterior region during the last three months before birth appears not to exceed the increase in mesiodistal crown dimensions.

The development of the dentition is characterized by phases of temporary discrepancies between tooth size and jaw growth. Before birth, the deciduous anterior teeth that are forming are overlapped and crowded, but postnatally, they usually erupt in good alignment.

The position and mesiodistal dimensions of the deciduous teeth were studied and compared with the values recorded for arch length to estimate the increase in mesiodistal width of the deciduous incisors, to determine if jaw growth exceeds the increase in tooth width, and to determine the arrangement of the teeth before birth.

Materials and Methods

Intraoral occlusal radiographs were obtained from 42 hemisected fetal heads. In 28 instances, both halves of the head were available. The intact upper and lower jaws of six other whole fetuses were dissected and radiographed. All radiographs were taken in a standardized way at a focus film distance of three feet. The radiographs were measured with the Optocom, which measures and automatically feeds the data into a paper tape and prints it out on a teletypewriter.[1] From all teeth visible, *X* and *Y* coordinate values were recorded for mesiodistal tooth width, cusps, and points on the incisors that were representative of tooth position.

The arch length was determined for each quadrant by adding the segmented distances between the midpoint of the central incisor edge and the cusp of the canine, and the distances between the cusp of the canine and the mesiobuccal cusp of the first molars. Drawings were made from all radiographs to illustrate the location and orientation of the individual teeth. The material was analyzed on the basis of crown-rump length,[2,3] dental development as evaluated on occlusal radiographs, and dental development as estimated on lateral radiocephalograms. The latter approach was the most satisfactory. Nine stages could be distinguished clearly in our sample. These stages were based on the number of incisal edges and cusps and their degrees of calcification. Details of this development evaluation method will be published elsewhere.

Results

About half of the occlusal radiographs of the hemisected specimens did not show the first deciduous molars in either jaw. This was either because the film could not be placed dorsally enough during radiography, or, more frequently, because of insufficient calcification of the pertinent tooth. In most instances in which deciduous molars could be seen, they were arranged in the jaws in the alignment normally seen in the deciduous dentition at later stages.

Specimens smaller than 200 mm crown-rump length generally did not show enough tooth development for meaningful collection of measurements from the occlusal films. The analysis of the data was limited to 42 specimens. When two halves were present, the averages of the corresponding recordings were used in the calculations. To evaluate the position of the teeth, the radiographs of the two sides were studied together. The

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mesiodistal width of the incisors was recorded only when enamel was seen on the mesial and distal surfaces. The mesiodistal width was analyzed for individual and combined incisor widths. Older specimens had wider incisors than younger ones (Table). However, the average width differences for the maxillary and mandibular central incisors were only 1.0 and 0.5 mm, respectively.

The sum of the widths of the incisors of both jaws was compared with the arch length and correlations were estimated. The arch length dimensions and the tooth widths were related closely. The correlation coefficient for the maxilla was 0.78, and for the mandible 0.77. No evidence was found that older specimens have a larger arch length in relation to the mesiodistal width of the deciduous incisors (Table).

The positions of individual teeth varied to such an extent that angular values became impractical for the presentation of the data. Therefore, the teeth of each jaw were classified in four categories of morphologic alignment (Fig 1). No systematic differences were noted in tooth arrangement at different stages of development. Individual variation and asymmetric tooth positioning were evident (Fig 2).

TABLE

Prenatal Mesiodistal Crown Dimensions and Arch Lengths

	Central Incisors (mm)			Sum of Central and Lateral Incisors (mm)			Sum of Segmental Arch Distances (mm)†		
	Mean	SD*	No.	Mean	SD	No.	Mean	SD	No.
Maxilla									
Group 1	5.04	0.46	17	8.88	0.59	14	9.71	0.82	15
Group 2	6.05	0.57	13	11.02	1.06	12	13.18	2.03	12
Mandible									
Group 1	3.58	0.35	15	6.88	0.80	13	8.86	0.61	16
Group 2	4.11	0.47	13	8.65	1.03	13	11.19	1.20	11

Note: Group 1, 17 instances of early developmental stages (stages 5, 6, and 7); group 2, 13 instances of late developmental stages (stages 9, 10, 11, and 12). The differences between group 1 and group 2 were significant ($p < 0.05$) for all values.

* Standard deviation.

† The distance between the midpoint of the central incisor edge and the cusp of the canine, and the buccal cusp of the first molar (mesiobuccal cusp in the mandibular molar).

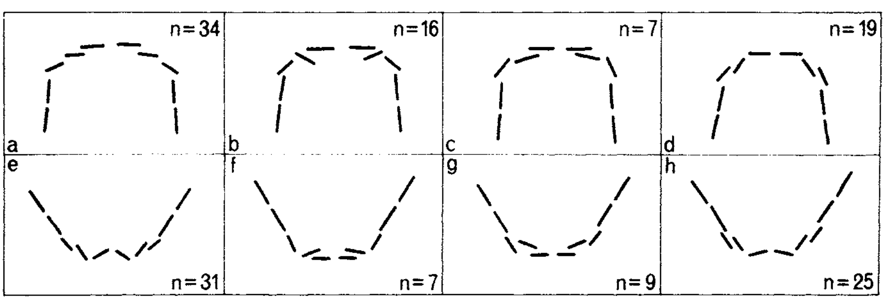

Fig 1.—The four types of deciduous tooth alignment in each jaw before birth. In the maxilla, central incisors are uniformly oriented perpendicularly to the midsagittal plane. *a,* lateral incisors distolingual of and parallel to central incisors; canines distal of lateral incisors at an angle of about 60° to midsagittal plane. *b,* Lateral incisors point dorsally to midsagittal plane. Distal edge is between proximal edges of neighboring teeth. Canines are in 45° position. *c,* lateral incisors point ventrally to midsagittal plane. Mesial edge is located lingually at middle of central incisors. Canines are in 45° to 60° position. *d,* lateral incisors distal of central incisors. They point ventrally to midsagittal plane at about 45°. Canines are distobuccal and generally parallel to lateral incisors. In the mandible, there is uniformity in location of canines in about a 45° position, and variation in orientation of central and lateral incisors. *e,* four incisors in a double v arrangement. Lateral incisors are mesiolingual of canines. *f,* central incisors perpendicular to midsagittal plane. Lateral incisors point dorsally, (with their mesial edges) to midsagittal plane. Distal edge is between neighboring teeth. *g,* Central incisors perpendicular to midsagittal plane. Lateral incisors lingual of central incisors and canines. *h,* four incisors in a w arrangement; lateral incisors located mesiolingual and parallel to canines.

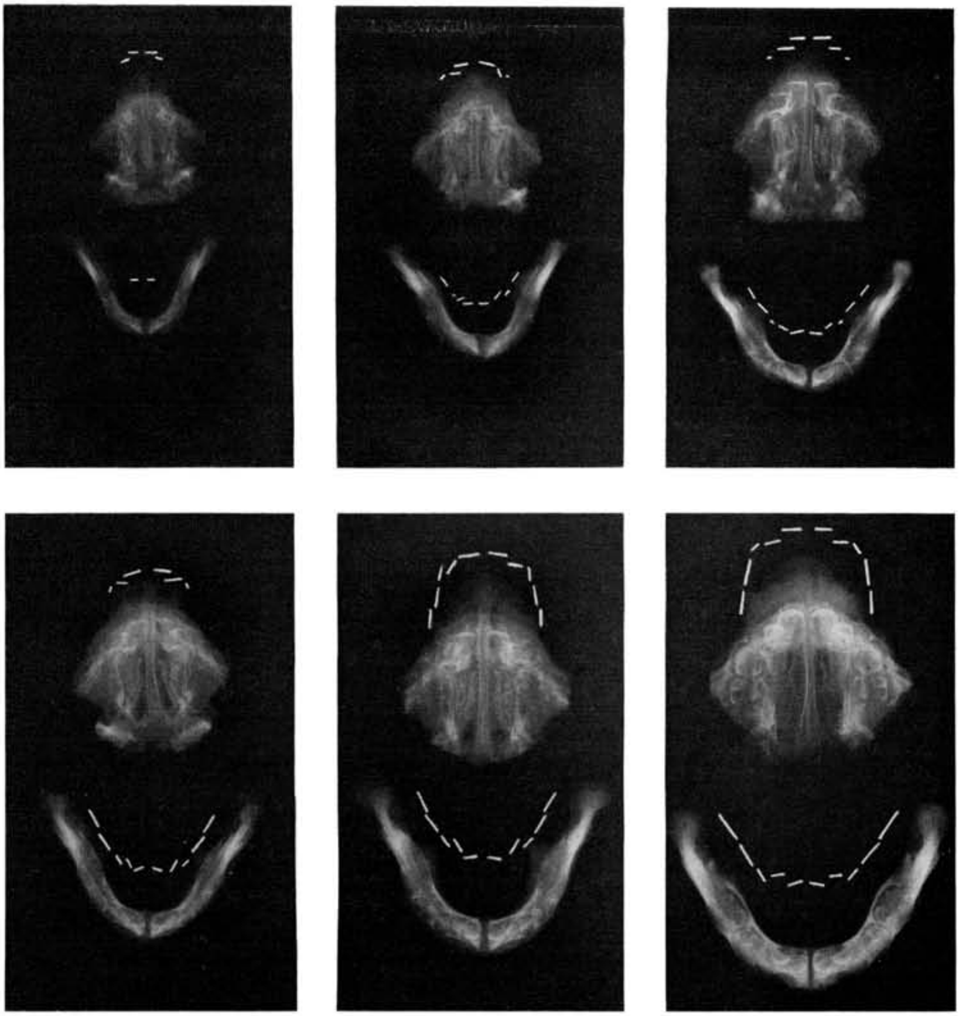

FIG 2.—Individual variation and asymmetrical tooth positioning.

Discussion

The method used here did not supply adequate information on size of the deciduous molars and canines. Kraus and Jordan[4] presented dimensions of the molars obtained by alizarin staining and direct measurements of tooth buds. Our data was combined with that of Kraus and Jordan[4] for the analysis of differences in increase in mesiodistal crown dimension of the anterior teeth and molars (Fig 3). Incisors attained a substantial part of their mesiodistal crown dimensions at an early developmental stage, in contrast to the molars, which continued intercuspal increase when the cusps were partly calcified.[4]

Molars seem to increase in width in accordance with jaw growth, whereas the anterior teeth are in a crowded position and in different patterns. Our data on arch length and tooth size before birth indicate that prenatal jaw growth does not exceed the increase in combined tooth width. Because in most instances adequate arch length is present when the deciduous teeth erupt later, postnatal jaw growth is primarily responsible for supplying the space needed to align the deciduous teeth before eruption.

The position of the teeth before birth that was shown by Friel[5] and illustrated in Figures 1, *d* and *e*, was found in only a few specimens. The remaining specimens exhib-

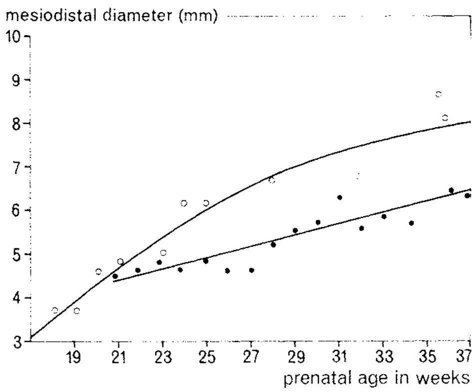

FIG 3.—Differences in increase of mesiodistal crown dimension of anterior teeth and molars. *Solid circles,* maxillary central deciduous incisor; *clear circles,* mandibular first deciduous molar.

ited other arrangements; in several specimens, asymmetry in tooth position was present.

Crown-rump length varies widely in relation to the physiological age rating determined by the development of the dentition. When estimating the age of an embryo by means of the crown-rump length, variations in size cause difficulty. An age rating based on developmental characteristics may be more accurate (eg, Streeter's developmental horizons[6]). The development of the dentition, particularly when it is determined by lateral cephalograms, may be the most accurate way to determine developmental age.

Our data indicated that the mesiodistal width of the deciduous incisors varies considerably in the same developmental age. The limitations outlined for the use of crown-rump length to estimate the developmental stage of fetuses apply to the use of tooth sizes as a guide.

Conclusions

The size and position of the deciduous teeth were studied in 48 normal human fetuses that ranged in age from 20 weeks to full term. Much variation was found in the arrangement of the teeth; four types of morphologic alignment of the teeth were distinguished in each jaw. The incisors reached a substantial amount of their final mesiodistal width at a relatively early developmental stage. There were no indications that jaw growth before birth exceeds the increase in mesiodistal crown dimensions of the deciduous teeth, or that teeth are less crowded in later prenatal stages.

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