The Effects of Clefting on Crown-Root Length, Eruption, Height and Weight in Twins Discordant for Cleft of Lip and/or Palate.

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Quite recently, standardized roentgenographic data for 34 pairs of like-sexed twins discordant for cleft of lip and/or palate became available for study. As part of the analysis of this quite unusual sample of matched-pair subjects an investigation was undertaken to examine the effects of clefting on crown-root lengths and on eruption of the buccal teeth in growing children.

While it is generally accepted that children with clefts are shorter and lighter than non-cleft children (*5*, *6*) and may erupt their teeth more slowly, the evidence for the latter is not conclusive. A definitive answer was therefore sought amongst those of the sample whose dentitions were developing.

The data were obtained from left and right 45° cephalograms for 28 pairs of like-sexed twins discordant for cleft of lip and/or palate from the eastern half of the United States. The age range was from 3 years to 15 years. These were selected from the total sample of 34 discordant twin pairs* on the basis of age. The sample is therefore of matched-pair design with respect to age and sex; the genetic component is matched to varying degrees depending principally upon the zygosity of the twins.

The composition of the sample according to sex and zygosity is shown in Table 1.

Method

Crown-root length was measured from the tracings parallel to the long axis of each buccal tooth (Pm_1, Pm_2, M_1 and M_2, both sides) using the mesial cusp tips and mesial root apices as end points.

Eruption was measured as the distance from the mesial cusp to the mandibular border perpendicular to Functional Occlusal Plane expressed as a percentage of the total distance for each position from Functional Occlusal Plane to mandibular border as shown in Figure 1. It may be noted that the percent obtained for each twin by this method could never

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TABLE 1—Composition of sample by sex and zygosity.

mean age	*male n*	*female n*	*totals n*
DZ 9 yrs. 8 mo. ± 3 yrs.	7	7	14
MZ 10 yrs. 5 mo. ± 3 yrs. 3 mo.	10	4	14

be zero. However, the method tends to isolate eruption from size factors. In addition, it is the within-twin differences which are the principle concern of the study. In no instance was the investigator aware of the identity of the cleft twin.

Gross errors were detected from an initial computation of means and variances for each tooth position and were corrected.

Mean values and their associated variances were assembled from the computer output. Non-parametric tests [Wilcoxin, matched-pairs, signed-ranks and the Mann-Whitney U test (7)] were used where appropriate to establish or refute statistical significance of the differences under consideration.

An analysis of replicate measures demonstrated measurement errors to be within an acceptable range and not systematic.

Crown-Root Length. An analysis of within-twin differences by zygosity, for 8 tooth positions (4 Left side, 4 Right side) showed only M_1 for Right Side, DZ twins to have a significant difference ($p = .04$). Nevertheless,

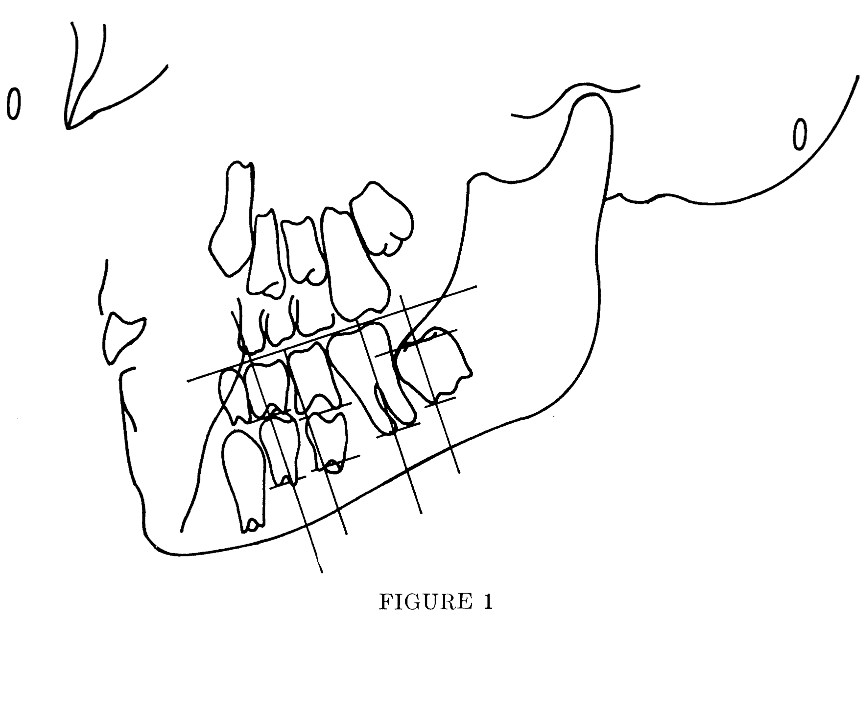

FIGURE 1

TABLE 2. Pooled within-twin differences in crown-root length

	left	*right*	*pooled*
DZ			
n	*48*	*49*	*97*
mean (mm)	0.50	1.13	0.82
S.D. (mm)	2.70	2.74	2.72
Prob	0.09	0.002*	0.002*
MZ			
n	*50*	*55*	*105*
mean (mm)	0.34	0.20	0.27
S.D. (mm)	1.88	1.90	1.88
Prob	0.16	0.14	0.10

* Within twin difference judged significant.

in 12 of the 16 categories studied, the affected twin teeth were shorter on the average than those of unaffected twins.

Pooled data are shown in Table 2. Only the DZ right side twins showed the teeth of affected twins to be significantly smaller than those of unaffected twins. However, initial tests (for this group of 4 positions) of all possible combinations of Pm_1, Pm_2, M_1 and M_2 revealed a statistically significant difference between data for positions M_1 and M_2 (prob. .04). Hence, the pooling of these data may be questioned.

Examination of Table 2 reveals that in addition to a trend for the buccal teeth of affected twins to be shorter than those of unaffected twins, these differences are also smaller in the MZ twins than in the DZ twins. The difference is not significant for left side pooled values but is significant at the .01 level of probability for right side values. Again pooling of the data may be questioned.

A further analysis of 12 pairs of left side DZ completed M_1 root-crown lengths and 16 pairs left side MZ completed root-crown lengths showed those of affected DZ twins to be shorter by .19 mm. on the average and those of affected MZ twins to be shorter by .03 mm. Neither were statistically significant. Again, the trend for affected twins to have shorter crown-root lengths is substantiated.

Hence, although the teeth of affected twins tend to be shorter than those of their unaffected twins, one must conclude that the effect of clefting on crown-root length is indeed slight.

Eruption. The within-twin differences for eruption are summarized in Table 3. Within-twin differences for the first permanent molars were not examined since only 12 of the possible 56 first permanent molars in the sample were not fully erupted or missing. For the other tooth positions such measures were deleted when the teeth of both twins were fully erupted.

No within-twin individual tooth position means were statistically different at the .05 level of probability. The large variances associated with the mean differences suggest the reason for lack of statistical significance.

TABLE 3. Pooled, average within-twin differences in eruption

	left	*right*	*pooled*
DZ			
n	*29*	*29*	*58*
mean (%)	0.84	2.24	1.54
S.D. (%)	10.8	10.1	10.38
Prob.	0.23	0.38	0.25
MZ			
n	*28*	*29*	*57*
mean (%)	−0.41	0.10	−0.15
S.D. (%)	3.0	6.2	4.85
Prob.	0.11	0.48	0.20

Table 3 illustrates the same trend as seen for crown-root length. That is, the within-twin DZ differences tend to be greater than the within-twin MZ differences. However, the zygosity differences are not statistically significant for eruption as they were for right side crown-root values.

Height and Weight. Average values for within-twin differences for height and weight according to zygosity are shown in Table 4. Although the within-twin differences tend to be larger for DZ twins than for MZ, they are not significantly so.

Type of Cleft. Table 5 and Figure 2 provide a summary of the sample according to type of cleft (*6*). No bilateral clefts were in the sample. The within-twin differences were examined according to type of cleft with MZ and DZ twins pooled as shown in Table 6.

For crown-root length for cleft of lip and/or alveolus only, the differences were not significant. The pooled differences for right side were however, significant for both cleft of soft and/or hard palate and for cleft of lip and palate. Tests for differences between individual tooth positions

TABLE 4. Pooled, average within-twin differences in height and weight

	height	*weight*
DZ		
n	*14*	*14*
mean	1.83 cms.	3.58 kilos
S.D.	5.36 cms.	6.07 kilos
Prob.	.14	.03*
MZ		
n	*14*	*14*
mean	1.25 cms.	3.31 kilos
S.D.	2.77 cms.	5.10 kilos
Prob.	.02*	.01*

* Within twin differences significant.

TABLE 5. The sample according to type of cleft

mean age	males			females			total
	CLP	*CL*	*CP*	*CLP*	*CL*	*CP*	
DZ 9 yrs. 8 mo. ± 3 yrs. 0 mo.	5	1	1	0	2	5	14
MZ 10 yrs. 5 mo. ± 3 yrs. 3 mo.	5	5	0	0	2	2	14

for these data were not significant, so that the pooled differences would appear to be valid statistically.

Hence, with respect to crown-root length, the impact of cleft of the palate and cleft of lip and palate, may be seen as slightly greater than that of cleft of the lip only. The data appear to support the thesis that the environmental impact of cleft of the palate is more deleterious than that of lip only.

Table 6 also contains the summary of pooled within-twin differences for eruption. None of the within-twin differences are significantly different from zero. However, for Right Side values, those for CL and CP are significantly different from one another. Hence, CP *may* have a greater retarding effect on eruption than either CL or CL and P.

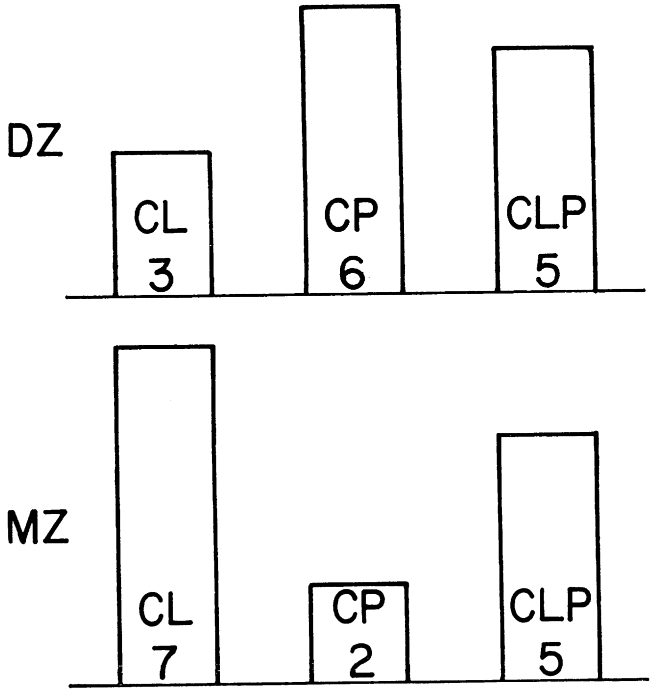

FIGURE 2

TABLE 6. Pooled within-twin differences by category of cleft**

	root-crown length		*eruption*		*height*	*weight*
	l	*r*	*l*	*r*		
CL						
n	*35*	*39*	*24*	*24*	*10*	*10*
mean	.41 mm.	.43 mm.	.66%	−.88%	.61 cms.	2.13 kilos
S.D.	2.21 mm.	1.90 mm.	5.71%	5.16%	2.59 cms.	2.27 kilos
Prob.	.10	.14	.44	.23	.14	.01*
CP						
n	*26*	*29*	*15*	*18*	*8*	*8*
mean	.27 mm.	1.02 mm.	1.37%	5.58%	2.03 cms.	5.81 kilos
S.D.	3.78 mm.	3.40 mm.	13.12%	12.08%	6.35 cms.	7.28 kilos
Prob.	.56	.05*	.20	.07	.18	.10
CLP						
n	*46*	*36*	*17*	*16*	*10*	*10*
mean	.42 mm.	.56 mm.	−1.36%	−.70%	2.08 cms.	2.90 kilos
S.D.	1.71 mm.	1.77 mm.	6.42%	5.22%	3.61 cms.	6.11 kilos
Prob.	.09	.05*	.18	.26	.05*	.14

* Within-twin differences significant.

** CL means cleft lip or cleft lip and alveolus; CP means cleft soft palate or cleft soft and hard palate; CLP means complete cleft of lip and palate.

A similar pattern is seen for weight (Table 6) but not for height. Only the within-twin differences for CL weight are significant statistically and none of the "between-type" differences are statistically significant for height or weight. The height and weight data then support the observation made for crown-root length and eruption that CP with or without CL has a more deleterious effect than CL.

Conclusions

The fact that MZ twins can be discordant for cleft of the lip and/or palate documents an environmental component in the etiology of clefting (*1*, *5*, *6*). Post-natal developmental components studied here show on the average, the expected pattern of greater similarity between MZ twins than between DZ twins. The documented trend for the CP component to have a more deleterious effect than the CL component probably enhances the DZ differences in this sample since 11 of the DZ twin pairs had a CP component as opposed to 7 of the MZ twin pairs.

In other studies of within-twin tooth size differences (*2*, *3*, *4*) the standard deviations did not exceed 0.65 mm. for mesio-distal tooth diameters. Since the average values for crown-root lengths are approximately double those for mesio-distal crown dimensions, one might expect slightly larger within-twin standard deviations for crown-root length. However, they are on the order of 2.00 mm., or at least double the anticipated amount. Since similarly large variances are found for percent eruption and for height and weight, the observation is deemed accurate. It is therefore hypothesized that for this sample of twins discordant for clefts, great differences in the quality of post-natal care were encountered. Thus, of the 14 MZ twin pairs, two with clefts were reported as taller than their non-cleft twin and three as heavier. Furthermore, stature differences for the MZ twins ranged from zero to eight cms. and weight differences as great as 14 kilos were found.

Hence, for this sample of twins discordant for clefts, environmental influences appear to have affected dental development of the buccal teeth and height and weight far more than genetic components of the phenomenon.

Summary

Within-twin differences for crown-root length and eruption of the mandibular buccal teeth were examined for 14 DZ and 14 MZ like-sexed twins discordant for cleft of lip and/or palate. The differences were found to be greater between DZ twins than between MZ and seldom statistically significant. Relatively large variances associated with the differences are attributed to widely varying levels of postnatal care for this sample.

The within-twin differences were also analyzed according to type of cleft. Cleft of lip only was found to have a lesser effect on root-crown length and percent eruption differences than cleft of palate (or cleft of lip and palate) although again not a statistically significant difference.

Height and weight were found to follow a similar pattern including large variances associated with the within-twin differences.

It is therefore concluded that a dysmorphogenic effect of clefting on crown-root length, eruption, height and weight cannot be demonstrated in this sample because of large associated variances due in turn to varying levels of post-natal health care and multiple other aspects of the syndrome.

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