# Agenesis and Tooth Size in the Permanent Dentition

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Many dental traits have been studied including comparative tooth size in various populations.[1,2] This report describes the relationship of tooth size with agenesis in a sample of individuals (ages 6-24 years), physically and mentally normal. The experimental group (33 males, 71 females) had radiographically proven agenesis of one or more permanent teeth. They were compared to two control populations. One, seen by us, (35 males, 66 females) had full complements of thirty-two teeth. The second group is from a sample reported by Moorrees in 1957.[3] All were from northeastern United States and were of European ancestry.

TABLE 1
FREQUENCY OF MISSING TEETH PER PATIENT
(not including third molars)

| *MALES* | | *FEMALES* | |
|---|---|---|---|
| Number Teeth Missing | Frequency | Number Teeth Missing | Frequency |
| 8 | 1 | 6 | 3 |
| 7 | 1 | 5 | 1 |
| 6 | 2 | 4 | 4 |
| 5 | 1 | 3 | 8 |
| 4 | 3 | 2 | 28 |
| 3 | 4 | 1 | 27 |
| 2 | 9 | | |
| 1 | 12 | | |
| *Range*: | 1-8 | | 1-6 |
| *Median*: | 2.06 | | 1.82 |
| *Mode*: | 1 | | 2 |

## METHODS

Measurements were made on plaster casts of the dentition, using a ground tip micrometer caliper calibrated to 0.05 mm readout. Our mesiodistal widths were obtained after the method of Moorrees.[4] Buccolingual diameters were obtained by measuring between points representing the maximum convexity on the erupted tooth. If eruption was not complete, the tooth was eliminated from consideration.

Resultant measurements were categorized by sex, arch (maxilla or mandible), and type of tooth. Since there is no systematic difference in size between teeth on right and left sides,[5] combining of left and right was fully justified. Therefore, we had seven tooth types per arch, eliminating third molars because of the abnormal patterns.

Modes, medians, and frequencies of the various congenitally missing teeth were noted (Table 1). Other calculations made included $\bar{x}$, $S^2$, S for each tooth type and a student's "t" for testing size difference between normals and experimentals (Table 2), as well as F tests for homogeneity of variance between these samples.

## RESULTS

We have found that in a mesiodistal direction eighteen of the twenty-eight tooth types showed significant decreases in size ($p<.05$). Six more types had p levels $<.1$. The results of analysis of buccolingual data were not as statistically significant. Only four of the twenty-eight tooth types exhibited differences significant to a p level of $<.05$. Three others had p levels $<.1$.

In addition to the general decrease in mesiodistal size, the agenesis group also presented another consistent finding. This was the significant deviation from normal size demonstrated by maxillary and mandibular canines in both buccolingual and mesiodistal dimensions. This

TABLE 2

COMPARISON OF CONTROL AND EXPERIMENTAL GROUPS

BY t-TEST FOR INDEPENDENT SAMPLES

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Mesio-Distal | | | | Bucco-Lingual | | | | |
| | Female | | Male | | Female | | Male | | |
| | t-score | df | t-score | df | t-score | df | t-score | df | |
| $I_1$ | 1.744* | 216 | 4.996** | 142 | 0.173 | 222 | 0.592 | 105 | MAXILLA |
| $I_2$ | 3.745** | 144 | 1.053 | 103 | 0.663 | 118 | 1.081+ | 54 | |
| C | 0.354 | 119 | 5.692** | 92 | 2.391* | 79 | 0.240 | 10 | |
| $P_1$ | 2.905** | 143 | 3.278** | 108 | 1.306 | 124 | 2.039* | 51 | |
| $P_2$ | 2.001$^+$ | 105 | 5.959** | 100 | 1.848$^+$ | 87 | 0.780 | 40 | |
| $M_1$ | 10.847** | 205 | 8.862** | 138 | 0.527 | 252 | 0.334 | 126 | |
| $M_2$ | 1.822 | 55 | 5.258* | 66 | 0.629 | 48 | 0.412 | 9 | |
| $I_1$ | 1.040$^+$ | 205 | 2.909** | 132 | 0.508 | 127 | 0.432 | 114 | MANDIBLE |
| $I_2$ | 4.770** | 207 | 3.271** | 134 | 0.660 | 228 | 1.393 | 102 | |
| C | 7.991** | 158 | 5.063** | 96 | 4.956** | 117 | 1.873$^+$ | 25 | |
| $P_1$ | 1.912$^+$ | 147 | 2.045$^+$ | 104 | 0.685 | 126 | 0.467 | 46 | |
| $P_2$ | 0.554 | 100 | 2.583* | 91 | 1.111 | 77 | 0.047 | 28 | |
| $M_1$ | 2.933** | 193 | 8.437** | 130 | 0.746 | 238 | 0.900 | 127 | |
| $M_2$ | 2.322** | 60 | 2.684$^+$ | 54 | 2.216* | 58 | 1.761 | 8 | |

**$p < .01$
* $p < .05$
+ $p < .1$

would seemingly be in contradiction to previously reported hypotheses of lower genetic variability in canines.[6]

The frequency of third molar agenesis and agenesis of other teeth was also studied by means of a Chi-Square test. The two groups compared within the agenesis population included first, all patients with erupting or developing third molars and second, patients with complete third molar agenesis. The $\chi^2$ value obtained, 0.0009, is highly insignificant. This may be interpreted as meaning that the mechanism causing the congenital absence of a tooth is likely to be similar for third molars and all other teeth. It should be pointed out that while $\chi^2$ is usually used for data with independent samples, and these data are not independent, the result is so overwhelming that this fact would not account for any change in interpretation. The possibility of sex as a factor was significant, since a $\chi^2$ performed on the frequency of presence and absence of third molars in males and females showed no difference.

## Summary

The above data indicate that:

1. A direct relationship exists between agenesis and decreased tooth size especially in a mesiodistal direction.

2. While previous authors have found canines to be genetically stable, we have found a significant amount of variation in their size, both mesiodistally and buccolingually.

3. The factors controlling third molar agenesis and agenesis of other teeth appear here to be the same.

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## References

1. Garn, S. M., Cohen, M. M., and Geciauskas, M. A.: Increased Crown-Size Asymmetry in Trisomy G. *J. Dent. Res.*, 49:465, 1970.
2. Cohen, M. M., Garn, S. M., and Geciauskas, M. A.: Crown-Size Profile Pattern in Trisomy G. *J. Dent. Res.*, 49:460, 1970.
3. Moorrees, C. F. A., Thomsen, S. Ø., Jensen, E., and Yen, P. K.: Mesiodistal Crown Diameters of the Deciduous and Permanent Teeth in Individuals. *J. Dent. Res.*, 36:39, 1957.
4. Ibid., p. 39.
5. Garn, S. M., Lewis, A. B., Walenga, A. J.: Maximum Confidence Values for Permanent Tooth Size. *Arch. Oral Biol.*, 13:841, 1968.
6. Osborne, R. H., Horowitz, S. L., DeGeorge, F. V.: Genetic Variation in Tooth Dimensions. A Twin Study of the Permanent Anterior Teeth. *Am. J. Human Genetics*, 10:350, 1958.