

BIOLOGY OF THE ORTHODONTIC PATIENT:  
III. RELATIONSHIP OF CHRONOLOGIC AND  
DENTAL AGE IN TERMS OF  
VITAMIN C STATE

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# Biology of the Orthodontic Patient:

## III. Relationship of Chronologic and Dental Age in Terms of Vitamin C State

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### INTRODUCTION

Orthodontics includes the study of the growth and development of the dento-facial complex particularly, and the growth and development of the body generally. . . . Hereditary, functional, environmental, sexual, *nutritional* [italics added], and metabolic factors influence normal growth and development greatly. The proportional effects of each of the factors are not easily determined, but nevertheless, orthodontists should attempt to evaluate each patient in relation to these influences.

This citation<sup>1</sup> reflects the awareness of the multifactorial nature of growth and development and points out the fact that nutrition plays a role. Additionally, it is evident from this quote that the difficulty in isolating the variables still exists.

The purpose of this report is to analyze the relationship between chronologic and dental age in terms of the vitamin C state of the body. Specifically, an attempt will be made to add light to the following questions:

1. What is the relationship of chronologic and dental age in a routine sample of orthodontic patients?
2. What is the vitamin C state of this population?
3. Is the relationship of chronologic and dental age in any way a function of vitamin C state?
4. Of what significance are these findings?

### METHOD OF INVESTIGATION

Dental age [DA] was determined

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from four periapical radiographs of the subject's left side distributed as follows: maxillary and mandibular left posterior segments and maxillary and mandibular left anterior segments. The age was recorded in months. Dental age [DA] was assessed by the method of Nolla.<sup>2</sup> Chronologic age, in months, was also recorded. The results for 141 children [orthodontic patients] are summarized in Table I. Additionally, vitamin C state was determined in the same population.<sup>3,4</sup> The plasma ascorbic acid scores are listed in Table II; the lingual vitamin C test times are portrayed in Table III.

Table I  
distribution of chronologic ages [CA]  
and dental ages [DA]

ages [months]	chronologic age number and percentage of subjects	dental age number and percentage of subjects
<100	0 [ 0.0%]	2 [ 1.4%]
100-119	16 [ 11.3%]	28 [ 19.9%]
120-139	28 [ 19.9%]	24 [ 17.0%]
140-159	36 [ 25.5%]	38 [ 27.0%]
160-179	38 [ 27.0%]	27 [ 19.1%]
180-199	18 [ 12.8%]	16 [ 11.3%]
200-219	5 [ 3.5%]	6 [ 4.3%]
total	141 [100.0%]	141 [100.0%]
means	153	147
S.D.	25	28
t		4.406
P		<0.001*
minimum	108	97
maximum	212	216
range	104	119

\*statistically significant difference of the means.

Table II  
plasma ascorbic acid frequency distribution

plasma ascorbic acid groups [mg. per cent]	number and percentage of subjects
0.00-0.19	24 [ 17.3%]
0.20-0.39	29 [ 20.9%]
0.40-0.59	21 [ 15.1%]
0.60-0.79	23 [ 16.5%]
0.80-0.99	28 [ 20.1%]
1.00+	14 [ 10.1%]
total	139 [100.0%]

### RESULTS

*Question One:* Table I summarizes the chronologic age [CA] and the dental age [DA] for the entire group. Three points are evident. First, the spread is slightly greater for dental age than chronologic age [119 versus 104 months]. Second, there is a statistically significant difference [ $t = 4.406$ ,  $P < 0.001$ ] between the mean ages. Third, on the average, dental age lags approximately six months behind chronologic age.

A more detailed analysis of the differences is pictured in Table IV. Dental age was less than chronologic age [CA - DA] in 88 of the 141 subjects [62.4 per cent]; equal [CA = DA] in 5 [3.5 per cent]; dental age was higher

Table III  
lingual vitamin C test scores distribution

lingual vitamin C scores [seconds]	number and percentage of subjects
10-14	5 [ 3.6%]
15-19	34 [ 24.5%]
20-24	25 [ 18.0%]
25-29	32 [ 23.0%]
30-34	15 [ 10.8%]
35-39	12 [ 9.8%]
40-44	7 [ 5.0%]
45-49	2 [ 1.4%]
40-60	7 [ 5.0%]
total	139 [100.0%]*

\*approximate

Table IV  
number of months difference between chronologic age [CA] and dental age [DA]

	differ-ence [months]	number of subjects	percentage of subjects
DA < CA	51-60	1	0.7
	41-50	2	1.4
	31-40	4	2.8
	21-30	16	11.3
	11-20	27	19.1
	1-10	38	27.0
DA = CA	0	5	3.5
DA > CA	1-10	28	19.9
	11-20	14	9.9
	21-30	5	3.5
	31-40	0	0.0
	41-50	1	0.7
total		141	100.0

than chronologic age in 48 subjects [34.0 per cent]. Hence, the majority of children showed delayed dental eruption and some considerable retardation [as high as 60 months].

Finally, notwithstanding these differences, it is clear, in answer to the first question, that there is a statistically significant positive correlation [ $r = +0.833$ ,  $P < 0.01$ ] between chronologic and dental age [Fig. 1].

*Question Two:* In order to ascertain the frequency of suboptimal vitamin C state, plasma ascorbic acid and lingual vitamin C test times were determined. According to the recommendations by the Interdepartmental Committee on Nutrition for National Defense,<sup>5</sup> plasma ascorbic acid levels  $< 0.1$  mg per cent are frankly deficient and 0.2 mg per cent are low. Utilizing these criteria, it must be concluded that 17.3 per cent display suboptimal vitamin C state. Other authorities contend that 0.6 mg per cent is the delineation between satisfactory and unsatisfactory state.<sup>6</sup> On this basis more than half [53.3 per cent] of the group demonstrates suboptimal ascorbic acid levels.

According to the best available evidence,<sup>7</sup> the physiologic range for the lingual vitamin C test is approximately 15 to 25 seconds. On this basis about

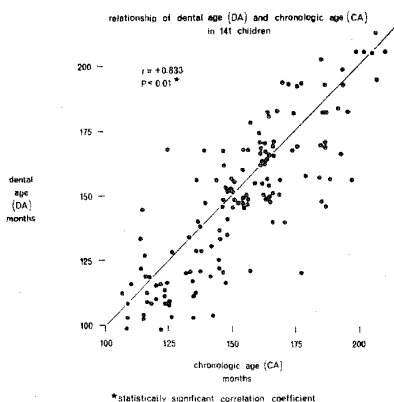


Fig. 1 The relationship of chronologic age [CA] and dental age [DA] in 141 routine orthodontic patients. There is a statistically significant positive correlation [ $r = +0.833$ ,  $P < 0.01$ ]. However there are considerable variations in individual subjects.

55 per cent of the subjects display marginal to poor vitamin C state.

The precise frequency of poor vitamin C state in this sample may be based on any of these criteria. However, in answer to the second question, apparently a significant segment of the group shows suboptimal ascorbic acid state with any one of these standards.

*Question Three:* In the light of the differences between chronologic and dental age in a large percentage of the group and the fact that suboptimal vitamin C state exists, it follows that one should try to determine whether the chronologic-dental age discrepancies may be, in part, a function of vitamin C metabolism. Accordingly, the relationship of these two growth and development parameters were examined in the light of ascorbic acid state as measured by the lingual vitamin C test time (Fig. 2). It is noteworthy that, as the lingual time increases suggesting poorer vitamin C state, the correlation between chronologic and dental age diminishes. This is even more dramatically shown in Figure 3.

## DISCUSSION

It has long been recognized that there is a significant positive correlation between chronologic and dental age. In general, the imperfect correlation has been ascribed to the fact that tables for dental age are not perfect. There is limited evidence to suggest that discrepancies between chronologic and dental age may be associated with various endocrine and metabolic diseases.<sup>5</sup>

As far as can be determined, there is no published report relating chronologic-dental age parallelisms in terms of nutrient status. This, the first such report, suggests that subjects with *optimal* vitamin C state show the *highest* correlations between chronologic and dental age.

## SUMMARY

A study of the chronologic and dental ages of 141 routine orthodontic patients reveals a statistically significant, positive correlation [ $r = +0.833$ ,  $P < 0.01$ ] between these two barometers of growth and development. A more detailed examination of this parallelism suggests that there is greater harmony [ $r = +0.878$ ,  $P < 0.01$ ] when the vitamin C state is optimal.

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relationship of chronologic age [CA] and dental age [DA] in terms of vitamin C state lingual test time scores

lingual test time groups	sample size [n]	r	P
< 20	38	+0.878	< 0.01*
20-29	58	+0.837	< 0.01*
30-39	26	+0.772	< 0.01*
40+	15	+0.702	< 0.01*

\*statistically significant correlation coefficient

Fig. 2 The relationship of chronologic age [CA] and dental age [DA] in terms of vitamin C state as judged by the lingual ascorbic acid test. The shorter the lingual time [ $<20$  seconds], meaning the more optimal the vitamin C state, the higher the correlation [ $r = +0.878$ ,  $P < 0.01$ ]. Conversely, the longer the lingual time [ $40+$  seconds], suggesting the poorer the vitamin C state, the lower the relationship [ $r = +0.702$ ,  $P < 0.01$ ].

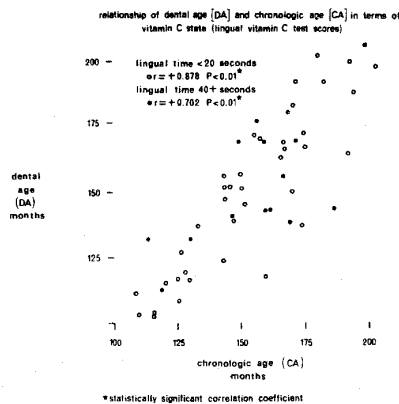


Fig. 3 A pictorial portrayal of the relationship of chronologic age [CA] and dental age [DA] in terms of vitamin C state. The higher correlation [ $r = +0.878$ ,  $P < 0.01$ ] is found in the group characterized by the shorter lingual time [open circles] representing the most optimal vitamin C state. The lower correlation [ $r = +0.702$ ,  $P < 0.01$ ] is noted in the group with the longer lingual time [dark circles] signifying the poorer vitamin C state.

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