*Effect of Prophylaxis and Vitamin Supplementation Upon Periodontal Index in Children**

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THE importance of vitamins to health and disease has been abundantly described. Published data from lower animal studies suggest significant relationships of various vitamin fractions to the oral tissues. Interesting, though sometimes controversial, reports are available regarding the oral structures and some of the vitamin combinations in man. As far as can be determined, there is no published work dealing with the relative merits of prophylaxis and various vitamin supplements in the stomatologic health of a group of presumably healthy children.

METHOD OF INVESTIGATION

Three hundred twenty subjects participated in this experiment (Table 1). Fifty-three of the cases (17 per cent) were incomplete (did not report for the second visit) and are, therefore, not included. Of the remaining 267, 72 (27 per cent) constitute Group I and received a placebo (mannitol). Sixty-nine children (26 per cent) were given vitamin C (Group II). Sixty (22 per cent) received vitamin B complex supplementation and are designated as Group III. Finally, sixty-six subjects (25 per cent) are in Group IV and received a multivitamin supplement.

The sample included children who reported for the first time to the clinic for routine oral examination and dental treatment and those returning on a routine recall basis. To qualify for participation, a child was required to have at least one fully erupted permanent tooth. The age and sex distribution is summarized (Table 2). It will be noted that the sample is almost equally divided by sex (128 males, 47.9 per cent; 139 females, 52.1 per cent). The children were predominantly (49.4 per cent) in the 10 to 14 year age category.

At the initial visit, periodontal health was rated by the method of Russell.[1] The Periodontal Index (PI) was determined by scoring all fully erupted permanent teeth. The original method described by Russell was chosen because of the opportunity it afforded of scoring more teeth per patient. The modified system which includes only the lower six anterior teeth would have given fewer reliable readings for the youngest group studied. The procedure used yielded a result that was felt to be

*This study was conducted on members of a prepaid group dental plan in Los Angeles, California.

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TABLE 1
Project Design

Results	*Number of Patients*	*Percentage of Patients*	*Percentage of Patients Followed to Completion*
Total Patient Load	320	100	
Incompleted Cases	53	17	
Completed Cases	267	83	100
Group I (Placebo)	72		27
Group II (Vitamin C)	69		26
Group III (Vitamin B Complex)	60		22
Group IV (Multivitamin)	66		25

TABLE 2

Age and Sex Distribution

Age Group	Group I Placebo Group Male	Group I Placebo Group Female	Group II Vitamin C Group Male	Group II Vitamin C Group Female	Group III Vitamin B Group Male	Group III Vitamin B Group Female	Group IV Multivitamin Group Male	Group IV Multivitamin Group Female	Total Group
5- 9	15 (10.6%)	12 (8.5%)	11 (7.8%)	16 (11.3%)	9 (6.8%)	12 (9.1%)	16 (11.6%)	11 (8.0%)	102 (38.2%)
10-14	21 (14.9%)	18 (12.8%)	16 (11.3%)	13 (9.2%)	16 (12.1%)	14 (10.6%)	12 (8.7%)	22 (15.9%)	132 (49.4%)
15-19	3 (2.1%)	2 (1.4%)	4 (2.8%)	9 (6.4%)	3 (2.3%)	6 (4.5%)	2 (1.4%)	3 (2.2%)	32 (12.0%)
20-	0 (0.0%)	1 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.4%)
Total	39 (27.7%)	33 (23.4%)	31 (22.0%)	38 (26.9%)	28 (21.2%)	32 (24.2%)	30 (21.7%)	36 (26.1%)	267 (100.0%)
Mean Age	10.6	10.7	10.8	11.1	10.9	11.0	9.9	10.9	10.6
	10.6		11.0		11.0		10.5		

more comparable with the older age groups included in this report. Table 3 shows that 9524 measurements were recorded almost equally divided among the four groups and between the two visits. From the individual scores, the mean PI was derived. Following oral examination, routine prophylaxis was performed on all subjects.

Each subject was then provided with a bottle containing one of the four indistinguishable supplements. In the early stages of the study, each child was instructed to chew one tablet daily (a total of 28 for the experimental period). Later in the program, the dosage was increased to 50 tablets for the twenty-eight day period. On a random basis, 72 subjects (Group I) were provided with the placebo (mannitol, 375 mg. per chewable tablet). The 69 children in Group II were supplied with chewable tablets each containing 75 mg. ascorbic acid. Group III (60 subjects) were given chewable vitamin B complex tablets each containing thiamine 1.2 mg., riboflavin 1.5 mg., niacinamide 15 mg., pyridoxine 1.2 mg., cyanocobalamin 3 mcg., calcium pantothenate 5 mg., and biotin 40 mcg. The remaining 66 participants (Group IV) were supplied with multivitamin chewable tablets each containing vitamin A 4000 U.S.P. units, vitamin D 400 U.S.P. units, thiamine 1.2 mg., riboflavin 1.5 mg., niacinamide 15 mg., pyridoxine 1.2 mg., cyanocobalamin 3 mcg., calcium pantothenate 5 mg., biotin 40 mcg. and ascorbic acid 75 mg. While most of the children adhered to the dosage instructions, there were variations (Table 4). However, it will be noted that the range was of the magnitude of only 0.15 tablets per day (1.41 in Group III to 1.56 in Group I).

Approximately 28 days later, each subject was recalled. The PI was again recorded. All observations were made by one examiner with no reference to the earlier records. Neither the examiner nor the patient was aware of the nature of the supplement until all measurements were completed.

TABLE 3
Distribution of Examined Gingival Areas

	First Visit	*Second Visit*	*Total*
Group I (Placebo)	1279 (13.4%)	1310 (13.8%)	2589 (27.2%)
Group II (Vitamin C)	1254 (13.2%)	1264 (13.3%)	2518 (26.4%)
Group III (Vitamin B Complex)	1064 (11.2%)	1079 (11.3%)	2143 (22.5%)
Group IV (Multivitamin)	1124 (11.8%)	1150 (12.1%)	2274 (23.9%)
Total	4721 (49.6%)	4803 (50.4%)	9524 (100.0%)

TABLE 4
Dosage Distribution

Tablets per Day	*Group I Placebo*	*Group II Vitamin C*	*Group III Vitamin B*	*Group IV Multivitamin*
0.3	0 (0.0%)	0 (0.0%)	1 (1.7%)	0 (0.0%)
0.4	0 (0.0%)	1 (1.4%)	0 (0.0%)	0 (0.0%)
0.5	0 (0.0%)	1 (1.4%)	0 (0.0%)	0 (0.0%)
0.6	1 (1.4%)	1 (1.4%)	0 (0.0%)	0 (0.0%)
0.7	2 (2.8%)	2 (2.9%)	1 (1.7%)	1 (1.5%)
0.8	0 (0.0%)	1 (1.4%)	2 (3.3%)	3 (4.5%)
0.9	4 (5.6%)	7 (10.1%)	5 (8.3%)	5 (7.6%)
1.0	15 (20.8%)	12 (17.4%)	7 (11.7%)	9 (13.6%)
1.1	1 (1.4%)	2 (2.9%)	4 (6.7%)	2 (3.0%)
1.2	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
1.3	1 (1.4%)	0 (0.0%)	1 (1.7%)	2 (3.0%)
1.4	1 (1.4%)	4 (5.8%)	1 (1.7%)	2 (3.0%)
1.5	0 (0.0%)	1 (1.4%)	3 (5.0%)	4 (6.1%)
1.6	6 (8.3%)	4 (5.8%)	2 (3.3%)	3 (4.5%)
1.7	5 (6.9%)	8 (11.6%)	10 (16.7%)	5 (7.6%)
1.8	36 (50.0%)	21 (30.4%)	22 (36.7%)	29 (43.9%)
1.9	0 (0.0%)	3 (4.3%)	1 (1.7%)	1 (1.5%)
2.0	0 (0.0%)	1 (1.4%)	0 (0.0%)	0 (0.0%)
Total	72 (100.0%)	69 (100.0%)*	60 (100.0%)*	66 (100.0%)
Mean	1.56	1.49	1.41	1.54

*Approximate

TABLE 5
Percentage Frequency Distribution in Periodontal Index with Placebo Versus Vitamin Supplementation

Group	*Supplement*	*Clinical Course* *PI Improvement*	*No PI Improvement*	*Total*
I	Placebo	35 (49%)	37 (51%)	72 (100%)
II	Vitamin C	41 (59%)	28 (41%)	69 (100%)
III	Vitamin B	38 (63%)	22 (37%)	60 (100%)
IV	Multivitamin	44 (67%)	22 (33%)	66 (100%)

TABLE 6
Chi-Square Analyses

Groups	II Vitamin C	III Vitamin B	IV Multi-vitamin
I Placebo	1.6567	2.8696	*4.5866**
II Vitamin C	..	0.2070	0.7596
III Vitamin B	..	..	0.1537

*Italics signifies statistical significance.

RESULTS

Table 5 attempts to summarize the clinical changes in PI following prophylaxis alone (Group I) and with the three different vitamin supplements (Groups II to IV). It is noteworthy that approximately one half of the subjects showed lower final PI scores following nothing more than prophylaxis (Group I). This decrease in gingival pathosis, the result of prophylaxis alone, is consistent with the clinical observations of other investigators. Further study of Table 5 reveals that the addition of vitamin C added 10 per cent improvement on a mean percentage basis, vitamin B complex added 14 per cent and multivitamins added 18 per cent. However chi-square analyses[2] (Table 6) disclose that there is a statistically significant difference only between Group I (placebo plus prophylaxis) and Group IV (multivitamins plus prophylaxis).

A larger sample in each group would provide a sufficient number of subjects to enable application of statistical methods that might demonstrate quantitative improvement in the PI rather than the simple "improved" or "not improved" categories herein applied. This broad generalization does provide, however, adequate data to demonstrate a trend useful in one statistical method of proof of cause and effect. This method, chi-square analysis, does show the significance described above.

DISCUSSION

It is difficult to compare the findings in this report with available publications for several reasons. First of all, in contrast with this study of human subjects, most of the published information based upon similar study design is derived from work with lower animals. Secondly, unlike this double-blind investigation, most of the available human data consist of review articles or case reports. Thirdly, in the human controlled studies, the emphasis has been almost exclusively on the adult rather than on the child as in the age groups represented in this report. Finally, as far as can be determined, the available reports deal with one or a few vitamin fractions and not with a relatively complete multivitamin supplement. For these reasons it is felt that this report may serve as a contribution to the fields of stomatology and vitaminology.

From the time at which vitamin C determinations as plasma ascorbic acid became available,[3,4] the relationship between the vitamin and periodontal health was discussed. Some investigators concluded that there was little or no correlation between vitamin C and a variety of measurements of periodontal health while other authors claimed a positive relationship between these two factors.[5-32] The varied methods of treating the question led to varied conclusions. However, in general, older subjects seemed more uniformly to show a more positive correlation. The deficiencies of vitamin B complex and some of the fractions of the complex have been related similarly to periodontal health although less extensively represented in the literature.[9,15,20,25,33-36] Only isolated reports upon multivitamin administration have been published suggestive of a possible linkage with periodontal disease.[37-47]

While the uniqueness of this investigation makes it impossible to compare with other experiments, there are two points which are worthy of brief mention. Though there is little doubt that the American public is *quantitatively* well fed, there is considerable question as to whether the quality of the diet is adequate. Among

the many authorities who have expressed themselves in this regard one makes the following statement:[48]

> The papers summarized in this report indicate that variable but substantial proportions of the subgroups of our population consume diets which fell short of the Recommended Dietary Allowances for *vitamin A, thiamine, riboflavin* and *ascorbic acid,* the vitamins routinely studied in nutrition survey work. Wherever body fluid levels were determined, like proportions of the population were found to have levels of these vitamins below accepted normal values.
>
> For different groups of persons and for the different vitamins, the proportions consuming less than two-thirds of the Recommended Dietary Allowances ranges from *less than five to more than 70 per cent.*
>
> While the studies discussed here do not represent a valid cross section of the population of the United States, we believe that they, in conjunction with those in our first report on "How Well Nourished are Americans?" (National Vitamin Foundation, 1960 Annual Report) provide incontrovertible proof that a *great many Americans of all ages and socio-economic brackets are subsisting on diets which fall substantially short of the Recommended Dietary Allowances* in respect to one or more essential nutrient (italics added).

This representative quote underlines the fact that a significant segment of the American public is not consuming adequate amounts of the vitamins. This comment also suggests that the deficiency states are likely to be multiple. The standard textbooks are replete with illustrations and accounts of various clinical syndromes associated with specific vitamin deficits. Thus there are to be found classical descriptions of scurvy, pellagra and beri-beri. While it is generally conceded that these classical expressions of disease are exciting and dramatic, it must be granted that they are also very rare. This point is emphasized in the following statement.[49]

> Perhaps the most important point to realize in a consideration of the naturally occurring deficiency diseases in man is that these diseases result from a lack of *multiple* nutrients rather than the deficit of a single essential. More and more attention is being given to the multiple nature concept of most deficiency disease syndromes; this should help to clarify our understanding of them and allow us to investigate them more intelligently (italics added).

The other point which should be underlined is that almost every nutrient which has been investigated can and does influence one or more other nutrients. In other words, even in controlled studies employing a single vitamin deficit, there is evidence that the end results may be influenced by disturbances associated with other than the vitamin which has been deprived. This is clearly summarized in the following statement:[50]

> In the last issue of this book a comprehensive review of relevant literature to 1953 included well over 200 references on the various facets of the problem of dietary interrelationships. Perhaps the most striking impression received from evaluation of that literature is that hardly any study undertaken with any pair of nutrients has failed to show a significant interaction in terms of some nutritional or biochemical criterion. This is not surprising, though, since each step of the chain of reactions through which a nutrient goes as it follows an appropriate metabolic pathway is mediated by at least one enzyme system, and the function of every enzyme system calls for the combined action of an apoenzyme (made up for the most part of amino acids) and a coenzyme (which usually includes a vitamin and/or a mineral element).

The fact that many people are not consuming adequate amounts of the vitamins

and that the vitamins are interdependent in part seems to explain the significance of the results obtained here with multivitamin-prophylaxis versus placebo-prophylaxis therapy.

SUMMARY

1. A double-blind study is reported of 267 presumably healthy children treated with prophylaxis plus placebo versus vitamin C, vitamin B complex and multivitamin supplementation for a 28 day period.

2. Vitamin C and vitamin B complex were not shown to have statistical significance as administered, with the method selected (chi-square) although trends toward improvement over placebo were noted.

3. A statistically significant difference in reduction of the Periodontal Index was noted between the children given prophylaxis plus placebo and those given prophylaxis and multivitamin supplement.

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