VITAMINS IN DENTISTRY

Paper read before Rochester Dental Dispensary Study Club, January 10, 1940.

by Royal Lee, D.D.S.

The story of vitamin deficiency is a long one, but a few words on that subject is in order before discussing the specific reactions such deficiencies produce that are of interest to the dentist.

Alfred Hess,[1] physician in charge of the Hebrew Infant Asylum in New York, established the fact back before the world war that vitamin deficiency definitely was the all-important cause of such conditions as heart disease of various kinds, susceptibility to pneumonia, grippe, nasal diphtheria, furunculosis, otitis, nephritis, adenitis,[2] as well as the more definite syndromes of deficiency such as scurvy, beri-beri, or rickets. Intestinal troubles such as gastritis and constipation were invariable accompaniments of these deficient conditions.

Heart disease and pneumonia alone, the two major causes of death, are almost invariably the end result of years of deficient nutrition. White bread, other white flour products, corn syrup and glucose, white sugar, cold storage foods of all kinds, are present in all of our diets in such a percentage that it is appalling to think of the abuse to which we are subjecting our bodies.

Dr. Weston A. Price [3] was the first dentist to publish an article asserting that dental caries was primarily a result of vitamin deficiency. This was in 1927. In 1923 I had prepared a paper on the subject of "The Systemic Causes of Dental Caries" and read it to the senior class at Marquette Dental College, subscribing to the same hypothesis. I called attention to the findings of Dr. Pollina that in a survey of six thousand school children, the only ones with sound teeth were those children who had NOT had a history of children's diseases. That showed, I argued at that time, that the real cause for both the incidence of children's disease and the accompanying dental caries was one and the same vitamin deficiency. Dr. Price's findings were completely in accord with that hypothesis.

Dr. Price met with such opposition to his contentions that he decided to take an extended trip around the world and compile such a complete record of the damage wrought by civilized man in his commercial distribution of devitalized foods that his critics would be forever silenced. His book, entitled "Nutrition and Physical Degeneration," shows beyond any possible doubt the real truth of the matter. He found that in all parts of the globe where the native population had changed from their natural foods to the use of commercial products, there began the infiltration of those dreaded diseases, tuberculosis, pneumonia, and influenza, together with a statistical rise in dental pathology that exactly paralleled the increase in the use of those commercial foods. Caries, pyorrhea, deformities of the dental arch, cleft palate and hare lip were all now present where unknown before. It made no difference whether the change took place in a high valley in the Swiss Alps or in an island of the sea in the eastern or western hemisphere. The identically same results followed the introduction of the commercial foods of civilized man.

Vitamin deficiency conditions are not found in uncomplicated syndromes that represent conditions due to the lack of a single vitamin. They are mixtures of conditions in which there are almost invariably several deficiencies operating in conjunction. To catalog these conditions and refer each symptom to a deficiency of some one vitamin has been a difficult matter. We can deprive test animals of one vitamin at a time and observe the reactions, but two things are wrong with that procedure. One is that the different species react somewhat differently to this test, and secondly the action of a partial deficiency over a long period of time is unquestionably of a different nature from the effects of a complete deficiency acting over a short period of time. The reactions to deficiency I shall describe can in many instances be reproduced in test animals, but the actual facts have been determined in most cases by treatment of human patients with vitamin concentrates, and a condition observed to be consistently amenable to such treatment has been accepted as a deficiency result.

The basic reaction to vitamin A deficiency is a change in the epithelial tissues.[4] Mucous membrane becomes sensitive to irritation, and degenerative or metaplastic changes occur. These of course are most rapid where destructive influences require the most rapid repair.

A predisposition to infection of any kind is set up. In the mouth this may mean pyorrhea or Vincent's infection, with a pale color of the mucous surfaces. The pyorrhea due to A deficiency differs from that in C deficiency in that the teeth remain tight, and there is not the characteristic bleeding.

The B complex[5] is necessary to mouth integrity in that an abnormal redness of the tongue and throat is present usually in pellagra with the changes ranging from simple erythema to a gangrenous necrosis such as heretofore known as "noma."

Vitamin C deficiency[6] primarily causes a degeneration of the intercellular substance of teeth and bone. The bone tissues become decalcified, and loose teeth is the result. If teeth become loose individually because of the end result of a pus pocket, that is not scurvy. But where several teeth are loose without evident infection, it is quite certain to be incipient scurvy. Gingivitis is a more early stage, except where due to infection as a consequence of the epithelial changes of A deficiency. It is obvious that the deficiency of vitamin C is favorable to rapid resorption of the alveolar ridge in edentulous mouths. It is also obvious that deficiency of A will increase the irritability of the mucous surfaces and add to the difficulty of getting a newly fitted set of dentures into satisfactory service.

Vitamin C deficiency is also responsible for a reduction in the germicidal enzymes normally present in the saliva,[7] which adds to the general tendency to infection, not only of pus germs but also of the systemic infective children's diseases. Those same germicidal enzymes protect the teeth against caries, so we have here the reason why Pollina found good teeth only in those children who had never had those children's diseases.

Vitamin D is another factor that co-operates with each of the vitamins so far mentioned, as it supplies the calcium that is essential for the metabolic changes that are regulated and controlled by those vitamins. The germicidal enzymes are inactive in the absence of calcium, and vitamin C cannot maintain the bone integrity without a calcium supply.[8] The specific function of vitamin D is to increase the affinity of the blood serum for calcium, so that a normal assimilation of that element will take place from the alimentary supply. But another factor is required to unload that calcium again when it arrives at its destination, and that factor is termed by one group of investigators the vitamin F complex. It consists of that group of unsaturated fatty acids of which linolenic, linoleic, arachidonic and clupanodonic are known to be of biological activity if present in the proper form. Vitamin F is found normally associated with vitamin D in its natural sources such as butter or cod liver oil.

If vitamin F is not given with vitamin D, as when a purified concentrate is used, toxic effects can easily be produced. Those effects are purely the effect on an excessively high blood calcium. In pregnancy, calcification of the placenta occurs. Nephritis and albuminuria are a common result of reckless administration of vitamin D without its accompanying synergists. I have received reports of cases like this: A nine year old boy, dosed heavily by fond parents with a highly concentrated proprietary form of synthetic vitamin D during the winter months, developed kidney inflammation and a severe albuminuria in the spring. The physician on getting the history of the case, stopped the use of the D and prescribed vitamin F and warned the parents to keep the youngster out of the sun. The parents, distrusting the accuracy of the physician's diagnosis, put the young man out on the beach in a bathing suit the next day to get a "healthy tan." A half hour of this treatment resulted in a collapse, with fatal consequences.

Cold sores and fever blisters are specific signs of low calcium in the tissue fluids. A vitamin F tablet or two with five grains of calcium lactate will pro-

duce a definite recession of the condition in two or three hours. A little vitamin D at this stage will invariably cause a prompt recurrence. It draws the calcium back into the blood stream from the pericellular fluids after the vitamin F has diffused it out. It must be kept in mind that the blood stream does not supply the cells directly. The pericellular fluids must carry the nutritive materials across the gap between the cells and the capillaries. Vitamin D is a "loader-up" of the transportation system of the body, and vitamin F is the unloader.[9] They are directly antagonistic from the viewpoint of the observer who watches only the blood calcium, but to the physiologist who sees the whole picture they are necessarily synergists that act in unison to get calcium to its ultimate destination in the body. It is significant that vitamin F has recently been found in cod liver oil and in butter.

We can see here the logic of trying to obtain a balanced intake of all the vitamins, rather than to overdo the use of any particular one. Systemic diseases such as children's diseases, fevers, and all infectious processes exhaust the reserves of vitamin C,[10] and often rapid degeneration of the dental structures follow such a case history. The requirement of many of the vitamins is subject to great variations, so that an intake that is adequate at one time may be quite insufficient at another. The slow convalescence from fevers, pneumonia, etc., is mainly due to the increased requirement which is inadequately supplied at this time in the great majority of cases. If the requirement happens to be greater than the intake for any reason, the patient declines into some fatal outcome as heart involvement, or a new infection made possible by the low resistance. That is why pneumonia so often recurs several times in one winter in the same patient. It is a tragic fact that no patient is known to die until his reserves of vitamin C are completely exhausted. No vitamin C can be found in any of the tissues of a victim of an infectious disease, while it can always be shown by color tests in other cases. The conclusion is obvious. Vitamin C should be invariably used as a part of the treatment in any such case. The reduction in temperature when vitamin C is used is often amazingly rapid. The spread of infection sometimes seen after the extraction of diseased teeth calls for the immediate use of heavy doses of vitamin C. This vitamin seems to stimulate phagocytosis, and aids in the sequestration of the infected area. Hot applications aid in this result, as phagocytosis is also facilitated by heat. The high temperature in infections is, no doubt, the natural reaction of the body to stimulate phagocytosis by this means, and with the added help of the new supply of vitamin C the temperature becomes unnecessary. It is obvious that here we have the first physiological remedy for fevers. Another interesting fact is that the white blood cell is higher in vitamin C than any other cell of the body, under normal conditions. The phagocyte seems to be the policeman of the body, and the vitamin C his ammunition. Without it his digestive enzymes are ineffective against the new enemy.

Vitamin C is the most important of the vitamins, and is the most difficult to get. It is oxidized so easily that it disappears in storage of citrus fruits and vegetables. Spinach is a good source if fresh, but loses its entire content within a week after it is cut at room temperatures. Potato is one of the good sources, and more reliable than most. In the potato the C is combined with the protein molecule, which accounts for the statement that potato protein is a valuable nutritious principle. Baking the potato destroys the vitamin the least, boiling loses the most.

Fresh meats contain valuable amounts of vitamin C, but in cold storage it is completely oxidized. Milk is a good source unless pasteurized. Irradiation also destroys the vitamin C in milk.

A combined deficiency of Vitamins C, F, and calcium in growing children can result in the condition of chalky teeth. The use of these vitamins with calcium lactate will normalize these teeth in a few weeks. Sometimes there is a phosphorus deficiency too, as characterized by nervous temperament, unruly disposition and restlessness at night while sleeping. This can be corrected by the use of phosphoric acid, glycerophosphates or lecithin.

Calcium phosphate is so insoluble as to be a poor source of that element. The lactate is quite soluble, but as it carries no phosphorus, it can aggravate a deficiency of that element.

Raw milk is, no doubt, the best source of calcium as it carries three times as much as is required by a growing child if used at a quart a day. But pasteurized milk again has lost its calcium and fails to supply enough for maintaining the growth of the infant. Certified raw milk is the only safe form of milk from a nutritional standpoint, because of its higher vitamin C content and higher calcium content.

Back in 1926, McCann wrote a chapter entitled "Iron Men" in his book—The Science of Keeping Young.[11] The iron men he referred to were the natives of Finland, which he said was one of the last civilized areas to resist the influx of commercial foodstuffs. He pointed out how in the Olympic games, the Finns were able to perform feats of endurance that astounded the world. They walked off with a hundred times the number of prizes that they would have won if their chances had been even in competition with such greater numbers. We are witnessing today the result of such physical superiority in their phenomenal defense of their country against the Russian invasion. What is the basic diet of the Finnish people? It is whole rye bread, high in vitamins B, E, F, and G and smoked fish, high in vitamins A, D, F, and G. Plenty of fruit is available. A war correspondent writes back in January that fresh peaches are served commonly in the public restaurants, a great mystery to him, but evidently from cold storage sources.

There we have the secret of their diet. They get ALL the required vitamins naturally in their normal and unprocessed state. Compared to us, they are really supermen. Finns arriving in this country are noted for their perfect teeth. Here, however, they are usually unable to retain them. Our terrible food soon sends them to the dentist, who continues to find more and more repairs necessary as time passes. Dr. Price records many instances where caries became inhibited in persons who returned to their native habits, after much damage had been done by devitalized foods. The necrotic progress immediately stopped, and the cavities remained static thenceforth without developing further, showing the evidence of the renewed production of the protective germicidal enzymes.

1. Hess, Alfred Fabian, Collected Writings, 2 Volumes Charles C. Thomas, 1936.
2. Hess, Alfred Fabian, Infantile Scurvy. V. A Study of Its Pathogenesis, Am. Jr. Dis. Child., November, 1917.
3. Price, Weston A. Nutrition and Physical Degeneration, Paul B. Hoeber, Inc., New York, 1939.
4. British Medical Research Council, Vitamins: A Survey of Present Knowledge, 1932.
5. Sebrell, W. H., Vitamins in Relations to the Prevention and Treatment of Pellagra, J. A. M. A., 110, 20:1665-1672, May 14, 1938.
Sydenstricker, Geeslin, Templeton and Weaver, Riboflavin Deficiency in Human Subjects, J. A. M. A., 113, 19:1697-1700 November 4, 1939.
6. Bastedo, Walter Arthur, Materia Medica, Pharmacology, Therapeutics and Prescription Writing, Fourth Edition, Reset, W. B. Saunders Co., Philadelphia, 1938.
Dalldorf, G. The Pathology of Vitamin C Deficiency, J. A. M. A., 111, 15:1376-1379, October 8, 1938.
7. Editorial. Salivary Immunity, J. A. M. A., 108, 15:1264-1265, April 10 1937.
Cheyne, Virgil D., Effects of Selective Salivary Gland Extirpation upon Experimental Dental Caries in the Rat, Proc. Soc. Exper. Biol. Med., 42, 2:587-590, Nov., 1939.
Pickerill, H. P., The Prevention of Dental Caries and Oral Sepsis, Second Edition, Bailliere Tindall & Cox, 1914.
8. Aub, J. C., The Use of Calcium and the Choice of a Calcium Salt, J. A. M. A., 109:1276, October 16, 1937.
9. Mirvish, Biochemical Journal, 24:233-238, 1930.
10. Abt, A. F. and Farmer C. J., Vitamin C: Pharmacology and Therapeutics, J. A. M. A., 111, 17:1555-1565, October 22, 1938.
Martin, G. J. and Heise, F. H., Vitamin C Nutrition in Pulmonary Tuberculosis, Am. J. Dig. Dis. and Nut. 4:368-374, 1937.
11. McCann, Alfred W., The Science of Keeping Young, George H. Doran Co., New York, 1926.

Reprint No. 30-B

Printed in U. S. A.

LEE FOUNDATION FOR NUTRITIONAL RESEARCH
Milwaukee, Wisconsin 53201