Food Additives In Dentistry

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INTRODUCTION

The presence of food additives in products used in dental procedures may have serious consequences for many patients. Hyperactivity and learning disabilities as well as buccal, gingival and oral cankers have occurred following the use of diagnostic aids. Furthermore, hyperkinetic patients, whose symptoms have been controlled by withdrawal of all artificial colors and flavors from their diets, have suffered relapses following a dental visit. These problems should be recognized by practitioners because only by the concerted efforts of professionals in the field will disagnostic aids free of artificial color and flavor become available.

THE NATURE OF FOOD ADDITIVES

Our interest in food additives dates back about twenty-five years to the time our research laboratories were concerned with studying the allergic reaction to the flea bite.[1] Very early in our investigations we demonstrated that the allergic response to flea bites is induced by a low molecular weight chemical present in flea saliva. In immunologic terminology this is known as a hapten. By virtue of this observation, our laboratories became involved in studying the behavior of the haptenic mechanism in the immune response.

On the clinical side of our program we undertook to study the adverse reactions to medications or drugs and the adverse reactions to food additives.[2] It must be recognized that except for terminology both categories of compounds, medications and food additives, are identical. They are both low molecular weight compounds. In spite of this identity not one of the thousands of compounds introduced into our food supply as additives has ever been subjected to pharmacological studies as required of compounds licensed for use as drugs. It is true for licensing as an additive, a compound is subjected to toxicologic survey, e.g. carcinogenesis, mutagenesis and blastogenesis, but not the pharmacological behavior of the chemical. For this reason we know very little, if anything, regarding the influence and the participation of these compounds in biochemical mechanisms.

Intentional food additives may be classified into thirteen categories, as listed in Table I, which consists of 2,764 compounds compiled from data gathered by the Food Protection Committee of the National Science Foundation. The actual number currently used in our food supply is not known but approximates 4,000. The absence of precise figures can be attributed to the fragmentation of jurisdiction for licensing among nine governmental agencies which permit secret formulae to be used—which are not known either to other agencies or to the public.

Of the thirteen categories of additives we have focused our interests upon two groups, the artificial colors and flavors. However, this does not imply that the remaining eleven categories of additives do not cause adverse reactions. Actually, they do, for it must be recognized that any compound, either natural or synthetic, has the capacity to induce adverse reactions in an individual with the appropriate genetic profile, i.e. predisposition.

Accordingly, no compound is exempt. Therefore, each compound

continued on next page . . .

Table I

Classification of Intentional Additives*

1.	Preservatives	33
2.	Antioxidants	28
3.	Sequestrants	45
4.	Surface Active Agents	111
5.	Stabilizers, Thickeners	39
6.	Bleaching and Maturing Agents	24
7.	Buffers, Acids, Alkalies	60
8.	Food Colors	34
9.	Non-Nutritive and Special Dietary Sweeteners	4
10.	Nutritive Supplement	117
11.	Flavorings—Synthetic	1610
12.	Flavorings—Natural	502
13.	Miscellaneous: yeast foods, texturizers, firming agents, binders, anticaking agents, enzymes	157
	TOTAL NUMBER OF ADDITIVES	2764

*Compiled from data gathered by the National Science Foundation in 1965

or class of compounds must be evaluated on the basis of benefit compared with risk. In applying this measure to the colors and flavors, we learn that these two categories are the most widely distributed of all the food additives, occurring in about 80 percent of our food supply. Because of this wide distribution, they are the commonest cause of adverse reactions attributed to additives, affecting practically every system of the body. (Table II).

It should be pointed out that the adverse reactions induced in Table II are not allergic in nature, since they do not involve the immune mechanism. The nature of the basic mechanism is as yet unknown. However, it is generally held not to be immunologic and therefore not allergic.

The words "U.S. Certified Color", "Certified Color", or "Food, Drug and Cosmetic" (FD&C) on a label for foods, beverages and medications should be a reassuring phrase to consumers and should imply complete safety of the chemical used for dyeing a product for human consumption. Unfortunately, such descriptions do not guarantee against adverse reactions. As has been indicated, none of these compounds has ever been subjected to pharmacological studies.

The U.S. certified food dyes are, for the most part, derived from coal tar bases, triphenylmethane, azo, xanthene and indigo. These compounds are inherently toxic, i.e. they are carcinogenic, mutagenic and

Table II

Adverse Reactions Induced by Flavors and Colors*

1. Respiratory
   - Rhinitis
   - Nasal Polyps
   - Cough
   - Laryngeal Edema
   - Hoarseness (laryngeal nodes)
   - Asthma
2. Skin
   - Pruritus
   - Dermatographia
   - Localized Skin Lesions
   - Urticaria
   - Angioedema
3. Gastrointestinal
   - Macroglossia
   - Flatulence and Pyrosis
   - Constipation
   - Buccal Cankers
4. Neurological Symptoms
   - Headaches
   - Behavioral Disturbances
5. Skeletal System
   - Arthralgia with Edema

*Feingold, Ben F.: *Introduction to Clinical Allergy*, C.C. Thomas, Springfield, Illinois, 1973.

blastogenic. This inherent toxicity explains the constant deletion and substitution which has been the history of these compounds since their initial licensing in 1906. On the basis of short-term experience, they are approved for use, but following long-term experience, ten to fifteen years, they are recognized as toxic and must be removed from the food supply. Just this year two dyes have suffered such a fate. Amaranth, FD&C red #2, a widely distributed dye, has been banned after sixteen years of controversy. Just recently, in September in 1976, FD&C red #4, used particularly for coloring maraschino cherries, has been banned. This will always be the experience with dyes of coal tar derivation, since they are inherently toxic.

The identification of a specific problem-compound among the flavors is even more complex because of the mutiplicity of compounds in each flavor. One of the simplest, artificial pineapple is constituted of seventeen separate chemicals. (Table III) At the other extreme, coffee flavor may be constituted from as many as 30 to 40 thousand compounds. This indicates the complexity of the problem encountered in identifying the specific compound involved in adverse reactions to flavors.

ADVERSE REACTIONS

The adverse reactions to colors and flavors listed in Table II are documented in the medical literature. In spite of their potential importance as a cause of pathology in and about the mouth,[1,2,4] very little if any attention has been directed toward their role in clinical dentistry.

Table III

Artificial Pineapple Flavor

	Pure Compounds	%
1.	Allyl caproate	5.0
2.	Isopentyl acetate	3.0
3.	Isopentyl isovalerate	3.0
4.	Ethyl acetate	15.0
5.	Ethyl butyrate	22.0
6.	Terpinyl propionate	2.5
7.	Ethyl crotonate	5.0
8.	Caproic acid	8.0
9.	Butyric acid	12.0
10.	Acetic acid	5.0
	Essential oils, etc.	**%**
11.	Oil of sweet birch	1.0
12.	Oil of spruce	2.0
13.	Balsam Peru	4.0
14.	Volatile mustard oil	1.5
15.	Oil cognac	5.0
16.	Concentrated orange oil	4.0
17.	Distilled oil of lime	2.0

The recognition that the adverse reactions induced by synthetic food colors and flavors can cause buccal, gingival or oral cankers presents an important area for preventative as well as therapeutic dentistry.[1] A persistent lesion that constantly recurs and fails to respond to usual therapeutic procedures must arouse suspicion that food additives, specifically the artificial colors and flavors, may be at fault.

Since there are no tests, either clinical or laboratory, to identify the offending compounds, the diagnosis depends upon awareness and a high degree of suspicion. After elimination of other possible causes, e.g. lues or malignancy, a carefully recorded diet diary can be helpful. The diary should record and carefully describe each food and beverage item for every meal and snack. In addition, all medications, which are very commonly dyed, should be listed as well as all dentifrices, mouthwashes and identifying dyes.

Food additive surveillance requires knowledge regarding the occurrence of chemicals in our food supply. The list of ingredients on the package label can be helpful to a degree, but often the colors and flavors are not disclosed. This is true particularly of dairy products, which are covered by a regulation known as the "Standards of Identity". This regulation requires no disclosure, but the product must adhere to the list of ingredients listed for the product in the Federal Registry. In some cases inquiry of the product's manufacturer may be necessary. If in doubt, it is usually safer to omit the item arbitrarily.

Frequently the elimination of artificial food colors and flavors for the management of oral buccal cankers may correct a longstanding refractory complaint experienced by the patient for many years. These include rhinitis, nasal polyps, skin conditions and even asthma.

Hyperactivity and learning disabilities in children have recently been linked to the ingestion of artificial food colors and flavors. The disturbances occur more frequently in boys than girls, a ratio ranging from 5 or 9 to 1, boys over girls. Management of these children with a diet eliminating all artificial food colors and flavors in about 30 to 50 percent of cases, depending upon age and the sample, can effect a complete transformation of the behavior pattern followed by rapid improvement in scholastic achievement. Success depends upon absolute compliance. The slightest infraction can induce a recurrence of symptoms within two to four hours which persist for 36 hours to four days.

It is of extreme importance for the dentist to recognize this relationship in the management of children with dental problems. It is not unusual for a child who has been under control for a behavioral disturbance to experience a recurrence of symptoms following the use of dyes for detection of caries.[5]

Plate 1

Logo representing complete absence of artificial food colors and flavors in the product.

A more serious practice relates to the multivitamins and fluoride products used in clinical dentistry. Practically every one of the vitamins and fluoride products currently on the market are rich sources of artificial food colors and flavors. The persistent use of these products in a susceptible child can be a cause of behavioral disturbances followed by failure in school.

SOLUTIONS

If the dentist feels a need for the administration of vitamins or fluoride, it is mandatory that the products be entirely free of artificial colors and flavors. In such cases the elimination of the colors and flavors can serve a therapeutic as well as a preventive role.

In some situations, obtaining vitamins and fluoride products free of color and flavor additives presents a problem, since their availability varies with different regions.

In order to assist the consumer, a logo or symbol has been developed to appear on all packages of foods and beverages to indicate the complete absence of artificial food colors and flavors in the product (Plate I). The symbol has been registered in the US Patent Office by the Feingold Association of the United States (FAUS), 759 National Press Building, Washington, DC, 20045. The symbol has been certified for interstate traffic.

Licensing is free but requires assurance that the designated product does not contain artificial food colors and flavors.

The appearance of the symbol will expedite shopping by the consumer. Through identification with the symbol, it will not be necessary to read the table of ingredients which is at times not fully legible or even may fail to disclose the presence of unwanted chemicals.

SUMMARY

The increased demand created by clinicians who recognize their need will soon provide a ready supply of desirable pharmaceutical products with no hazard to the patient. The natural laws of the market place will operate if the clinicians and public create the demand.

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