Dental Sealant Safety Reconsidered

Last year, a study conducted at the University of Granada in Spain concluded that hormone-mimicking compounds leached into saliva from a plastic resin used to protect pits and fissures on tooth surfaces against cavities. Boston University researchers have now tested the same sealant, together with six others, and found that none releases the main hormonelike compound implicated in the earlier investigation.

According to the Chicago-based American Dental Association (ADA), the new study supports its "strong recommendation that dental sealants be used as appropriate."

However, the Boston team found that two of the sealants released another suspected environmental hormone found in the Spanish tests. Because of substantial differences in the design of the two studies, not everyone is convinced that other sealants might not also pose a risk.

In the earlier research, Nicolás Olea and his colleagues found bisphenol-A (BPA) in the saliva of all 18 young adults treated with a dental sealant (SN: 4/6/96, p. 214). The team had found no BPA in the saliva an hour before treatment.

A building block of polycarbonate plastics and many other materials, BPA triggers estrogenlike activity in laboratory experiments on cells and rodents. This has prompted concerns that exposure to such pseudohormones might alter development (SN: 10/18/97, p. 255) or foster cancer (SN: 7/3/93, p. 10).

"Dental sealants give breast cancer to young girls: To be blunt, that's basically what [the Granada researchers] had been saying," charges Dan Nathanson, a biomaterials specialist who led the Boston study. "Once [their] paper came out," he notes, "I started getting calls from dentists all over the country asking me what to do."

"We took it upon ourselves to verify or counteract [the BPA] claim," he says, "and found there is nothing to it." The Boston group reports its findings in the November JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

Nathanson's team put some of each liquid sealant into a glass dish and chemically cured it into a solid, much as a dentist would harden it on teeth. The researchers then bathed each cured material for 4 minutes in ethanol. Nathanson explains that because BPA dissolves readily in ethanol, "we decided to give it the harshest test. If it's going to come out in anything, it'll come out in ethanol."

Subsequent analyses turned up a number of compounds in the alcohol baths but no BPA. Two sealants did release some BPA dimethacrylate (BPA-DMA), a compound the Granada team had found and shown to mimic estrogen. Nathanson would like to double-check that finding, because if BPA-DMA is an environmental hormone, he says, "those two [sealants] are not to be used."

Some of the ethanol baths also contained uncured residues, identified as bisglycidyl dimethacrylate (BIS-GMA), from one of the sealants. At a meeting earlier this year, Karl-Johan Söderholm of the University of Florida in Gainesville reported that BIS-GMA is weakly estrogenic in mice.

However, Söderholm told SCIENCE NEWS, "the doses we used are far higher than what would be absorbed by digesting [sealant residues]. I have a hard time believing this could really be a health threat, though we should take a closer look."

Olea says that even if he and Nathanson found different chemicals leaching from dental sealants—perhaps because of manufacturing or formulation differences between U.S. and European products—the primary concern should be whether the sealants deliver any compounds that mimic estrogen. His team will soon report on about a dozen such compounds. Moreover, Olea was disturbed that the Boston group performed no tests of hormone activity.

That is being done in several other trials, observes Chris Martin of the ADA. One ADA-sponsored study at the University of Nebraska is testing for estrogen activity in the saliva of people treated with dental sealants. In a Georgia trial, scientists are adding leached materials to test tubes containing cells that respond to estrogen.

Finally, the National Institute of Dental Research (NIDR) in Bethesda, Md., is a week away from beginning a pilot study of 30 to 50 Navy recruits to monitor leaching of five suspect compounds from dental sealants. If leaching is detected, says Lawrence J. Furman of NIDR, it could prompt a larger trial. —*J. Raloff*

Material may help batteries hold a recharge

Of what do electronics-laden consumers dream? A cheap, compact battery that lasts a long time, holds up well even after repeated rechargings, and is environmentally friendly.

Now, researchers from the University of Texas at Austin have come up with a substance that may serve as a cathode for a battery that fills the bill. The new material, called a manganese oxyiodide, may solve a variety of problems that plague rechargeable batteries, the scientists report in the Nov. 20 NATURE.

Lithium-ion batteries, packing lots of power in a little space and offering long operational lifetimes, are the current choice for rechargeable power sources in portable electronics. A major drawback of these batteries is that the cathodes contain cobalt, an element that is both toxic and expensive. They also tend to lose their ability to hold a charge after repeated rechargings.

Many researchers have tried various manganese oxides as cathode materials, because they are cheaper and less toxic than cobalt, but have found that changes in the crystalline structures of these substances often cause problems, says Arumugam Manthiram, a materials scientist at the university. Each cycle of discharging and recharging alters the volume of a cathode, distorting its crystal structure and interfering with its ability to hold a charge.

Manthiram's manganese oxyiodide, however, has a nearly amorphous structure that's less susceptible to the stresses of charging. Tests show that the substance can be recharged fully, even after 40 cycles of charging and discharging. Indeed, the material shows a slight increase in its ability to hold a charge after repeated rechargings. Manthiram says the amorphous nature of manganese oxyiodide may allow atoms to rearrange themselves each time the battery is recharged.

The amorphous structure of manganese oxyiodide results in large part from the presence of iodine atoms, which are larger than the other atoms in the material. The large atoms create spaces that the small lithium ions can move through as the battery discharges and recharges, says Manthiram.

Manganese oxyiodide is made in a low-temperature, solution-based process that offers advantages over the high-temperature processes used to produce other cathode materials, Manthiram asserts.

"This material seems to solve some of the structural instability problems associated with manganese oxide electrodes, and it provides an unusually high recharge capacity at low current rates," says Michael Thackeray of Argonne (Ill.) National Laboratory. However, the wide voltage range of the lithium cell, which falls from 4.3 to 1.5 during discharge, may be a limitation in commercial applications, he adds. —*S. Perkins*