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What is This?
DENTAL AMALGAM AND MERCURY VAPOR RELEASE

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Abstract—Dental diseases are among the most common ailments, and dentists in the United States spend over 50% of their time in dental practice rebuilding carious, malformed, and traumatically injured teeth. It is logical, therefore, that the majority of the dental school curriculum is devoted to the diagnosis, prevention, and treatment of teeth with anomalies.

Dentists have several choices of materials they can use to accomplish the task of rebuilding teeth. Besides amalgam, they have ceramic materials, resin composites, base-metal and noble casting alloys, and glass-ionomer cements to use to restore the posterior dentition. Each of these restorative materials has advantages and disadvantages, and the clinical judgment as to when a particular material should be used is given a high priority in dental education.

Amalgam is the most widely used of these restorative materials, with 92% of dentists listing it as the material of choice in the posterior of the mouth (Clinical Research Associates, 1990). Dentists have been placing amalgams for over 150 years in the US. They placed 150 million last year, which represents over 75 tons of amalgam alloy. The reasons that dentists use this restorative material so frequently are its durability, ease of manipulation, and low cost. Numerous clinical studies have been conducted on the serviceability of amalgam. Most of these have been on the old, low-copper alloys, and results indicate that they last from 8 to 15 years (Bailit et al., 1979; Osborne et al., 1980; Qvist et al., 1986). In the past 20 years, vast improvements have been made in amalgams with the development of the high-copper systems. Clinical studies initiated in the 1970’s are reporting that the well-placed high-copper amalgam will last over 30 years (Laswell et al., 1989; Letzel et al., 1989; Osborne and Norman, 1990; Osborne et al., 1991). The ease with which amalgam is manipulated has no equal. Placement of amalgam takes only 20-50% of the time it takes to restore a tooth with other materials. For the amalgam, this cost in placement time and the cost to purchase the material are considerably less. The one factor that amalgam does not have in its favor is esthetics. The other restorative materials, frankly, look better.

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Dentists recognize that mercury vapor is released from amalgams. Gay et al. (1979) reported that mercury vapor was detected in the breath of patients who had amalgams in their mouths. The question is not if but how much mercury vapor is released. Vimy and Lorscheider (1985) suggested that from 8 to 29 µg of mercury vapor was released every 24 h, for four to 12 amalgams, respectively. Mackert (1987) recalculated these figures and demonstrated that they were high by a factor of 16. Berglund (1990) reported that 1.7 µg of mercury vapor was released from amalgams in a 24-hour period. A quick calculation shows that it would take over 10,000 years for 12 average-sized amalgams to release all their mercury at this rate of 1.7 µg per day. Actual tracheal measurements of mercury concentrations have been made by Langworth et al. (1988) and have been found to be in the range of 1-6 µg/m³ during inhalation and less than 1 µg/m³ when subjects breathed through their noses.

As was pointed out over 400 years ago, a most critical factor in toxicology is the dose (Paracelsus, 1538). Almost everything can be toxic. Water can be toxic. Ordinary table salt has been used in suicides committed in ancient China. By comparison, the amount of mercury vapor released from amalgams constitutes a minor constituent when compared with the amount found in the environment. Mercury is released into the atmosphere by the earth’s crust, at a rate of 150,000 tons per year. The burning of coal releases approximately 20,000 tons of mercury per year. Mercury has been a part of man’s existence since we first walked on the earth. It is in the air, water, and food we eat. It is estimated that from 10 to 20 µg of mercury is taken up daily by individuals who have no occupational exposure to mercury (Williams, 1981; Vostal, 1972). Fish, for instance, contains relatively high quantities of mercury because of its position on the food chain. An examination of common things we use on a daily basis reveals that many medicines and cosmetics contain mercury. Many ophthalmic solutions, deodorants, and hypo-allergenic cosmetics contain mercury compounds. Additionally, the World Health Organization (WHO) allows from 300 to 500 µg of mercury daily, five days per week, with no side-effects (American Conference of Government Industrial Hygienists, 1985). As has been pointed out by Berglund (1990), this WHO standard for mercury is 100 times greater than the weekly dose from 12 amalgam restorations.

In spite of good scientific evidence that amalgams contribute insignificantly to the total mercury intake, others claim adverse health effects. Eggleston (1984) reported that T lymphocytes were adversely affected in patients with amalgams. These data were presented after the examination of three patients. However, recently, Mackert et al. (1991) examined 37 patients with and without amalgams and found no effect on T cells. Another well-publicized study indicated that sheep suffered a 60% loss of glomerular filtration rate when 12 amalgams were placed.
The profession struggled with the Vimy et al. (1990) data until Malvin (1991), a renal physiologist from the University of Michigan, presented an analysis at the March, 1991, FDA meeting. He reported that the renal data presented by Vimy et al. (1990) showed an improved kidney function and suggested that the reduced filtration rate was due to the sheep not eating and not to the increased mercury levels.

This should in no way suggest that there is no adverse effect of amalgam. There have been several reports of true allergies (Jolly et al., 1986; Hundstrom, 1984; White and Smith, 1984; Catsakis and Sulica, 1978; Duxbury et al., 1982). Whether that allergy be to the mercury, silver, tin, copper, or any metal in the restorative could be speculative, since any one metal could cause the reaction. The frequency of the condition is extremely low (Storrs et al., 1989) but should not be disregarded and should be treated accordingly.

There are many ways in which a dentist may affect the exposure to mercury vapors to himself, his staff, and patients. The profession is aware that the careless handling of mercury can result in spills that are difficult to contain and clean up. Most dentists use pre-capsulated amalgam to eliminate this problem. Mercury has a high vapor pressure, and if an office is not well-ventilated and elemental mercury is left uncovered, the patients and office personnel could be exposed to a higher than normal level of mercury. Engle et al. (1991) showed that mercury vapor was released during placement and polishing of amalgams. He also showed that the highest release of vapor was during the removal of amalgam restorations. A spike of mercury in the blood of patients has been demonstrated after the removal of amalgams. Precautions are taken in offices to minimize mercury vapor uptake during removal by the use of the rubber dam, copious amounts of water, and high-volume evacuation.

Since it has been noted that the removal of amalgams causes a slight increase in mercury levels in patients (Snapp et al., 1989), the “overnight” cure should be placed in a different perspective. If the patient has a reduction in symptoms shortly after amalgam removal, could the increased mercury level in fact be a cure? This is no more relevant than suggesting that mercury caused the original problem.

Because they work continually with amalgams, dentists have a higher level of mercury than the general population. Interestingly, the level of mercury in urine and blood rises from the time when dental students first work with amalgams and lasts throughout their dental school experience. Since dentists are exposed to more mercury vapor than the general population, they serve as the “canaries”, and any problems with mercury exposure should show up in them. An examination of the health, mortality, and morbidity rates of dentists shows some very interesting results. When compared with the white male population, dentists are healthier and live 2-1/2 years longer. In fact, they are healthier and live longer than their physician colleagues. Dentists do not get cancer at a higher rate, and do not suffer from more multiple sclerosis, arthritis, heart attacks, or any other diseases (Putman and Madden, 1972; Zwemer and Williams, 1987; Galgainitis and Gift, 1980; Howkins, 1935; Bernstein and Balk, 1953; Austin and Kruger, 1947; Bureau of Economic Research and Statistics, 1963, 1975; Orner and Mumma, 1976; Orner, 1978; Simpson et al., 1983; Milham, 1972; Glass, 1966; Blachly et al., 1953; Black et al., 1990; Enwonwu, 1987; Eccles and Powell, 1967). The pregnancy outcome of dentists’ wives and dental assistants with high and low mercury exposure shows no difference in birth defects and spontaneous abortion (Brodsky et al., 1985). If this were one or two reports, we might question it, but I have reviewed 18 articles from several sources.

On March 15, 1991, the FDA held hearings regarding the use of dental amalgam. The findings were that there was no evidence that the amount of mercury vapor released from amalgams caused harm to patients. They also concluded that more research should be conducted to alleviate patients’ fears. One of the questions that has not been answered is, at what level, above what we now observe, does mercury vapor cause a functional problem in the central nervous system, or the kidneys? This is a question our physician colleagues will have to answer.

**DISEASES WITH UNKNOWN ETIOLOGY**

The last area I would like to address is, why do patients seek unusual therapies? Dentists are continually faced with patients who have incurable diseases with no known cause. Many times they are presented with a patient attitude of “I’ll try anything”, or “I want the fillings out!”. Many of us may not understand why unusual therapies are sought by patients. Psychologist Thomas Gilovich, in the Wilson Quarterly (1991), published an article entitled, “The ‘Hot Hand’ and Other Illusions of Everyday Life” which may help us to understand this phenomenon. The ‘Hot Hand’ refers to the gambler or sports star who is on a hot streak. Dr. Gilovich points out that where it may appear as a ‘Hot Hand’, in fact it is not, and we all have illusions that are erroneous. For instance, it seems to be an article of faith that infertile couples who adopt children will later conceive. Wash your car, and it will rain. Accidents occur in three’s. Policemen swear that “weirdos” come out during the full moon, and pediatric nurses say that deliveries are highest also during a full moon. All these illusions are erroneous. But I believe that when I get into a grocery checkout line, it will be the slowest. It applies to collections at toll roads as well. Again wrong. The article points out that most of these erroneous beliefs are harmless, and that they are the product of the human mind’s ceaseless quest to find order and meaning in our lives when, in many cases, there is no order or meaning. He points out that professionals and laypersons alike have these illusions, and that they are not due to irrationality but rather to flawed rationality. They are often cases of a failure to perceive the world accurately. But, in the case of wrongly perceived threats to health, these “illusions” can cause panic and possibly inappropriate therapy. We have all heard of effective therapy not being given to a patient or of a patient electing “quackery” because of “illusions”. As Dr. Gilovich writes, can there be anything more pitiful than a disastrous health-care result in the service of some unsound belief? It is hoped that one of the areas that can be pursued in future research is how to help both health care provider and patient to
understand and cope with desperate health conditions that can lead to unusual therapies, such as the unwarranted removal of amalgams. Remember that the basis for dental practice is both legal and ethical, and the triad that is used in the prescription of therapy is (1) dental school training, (2) current scientific knowledge, and (3) the standards of the community. Providing treatment outside these bounds may constitute malpractice.

REFERENCES


