



Dental Instrument Sterilization

A Pollution Prevention Perspective

In Brief

We conducted a survey of infection control techniques used by dental practices in the San Francisco area. This survey was part of a cooperative project sponsored by CDA, local dental societies, city agencies, and the US Environmental Protection Agency.

Our dental co-researchers who responded to the survey told us:

- About 65% of dental offices use steam or dry heat sterilizer systems. The balance use chemical sterilization. A few offices report using both steam and chemical sterilants.
- Glutaraldehyde is the most common active ingredient in chemical products used for cold sterilization of dental instruments.
- Unexpectedly, a mix of formaldehyde and ethanol is also a frequently used chemical sterilant at the surveyed offices - perhaps due to a number of dentists in the surveyed area still using chemical vapor sterilizers. Some of our peer reviewers have voiced the opinion that formaldehyde sterilants are much less common than our survey results suggest, indicating that this is an area for follow-up research. See Note [1].
- Dental assistants typically sterilize used instruments either daily or more often depending upon the office's instrument inventory, number of patients seen, and how much time is needed to process items through the sterilizer.
- On average the survey respondents use 43 grams per day of chemical sterilant solution per dentist. The highest reported daily amount is 427 grams per dentist.
- These sterilants contain an average of 4.6 grams per day of hazardous ingredients per dentist. The highest reported daily amount is 38 grams of hazardous ingredients per dentist.



These survey responses give us clues on how dental practices can reduce their sterilant use and its hazards. Three primary strategies are:

- Consider steam or dry heat for sterilization of devices and instruments that can withstand this type of processing.
- Evaluate the active ingredients and other chemicals in your sterilizer solution. Choose products that are least toxic yet are still able to accomplish the intended purpose. Be aware of the particular health hazards of formaldehyde, and use appropriate protective measures.
- If you choose to employ a chemical sterilant product then prepare and use it in accordance with manufacturer's directions. In addition, closely monitor the sterilization process to assure that the desired results are being obtained while consuming the least amount of sterilant practicable.

These alternative approaches have the important benefits of decreasing patient and staff exposure to chemical hazards, and also decreasing the environmental impact of dentistry.

The Details

1 What are the most common active ingredients in dental sterilant solutions for processing instruments?

Glutaraldehyde or formaldehyde are used in about 30% of the sterilizer systems reported by our survey sites. These sterilants generally contain more than one active ingredient. See Note [1].

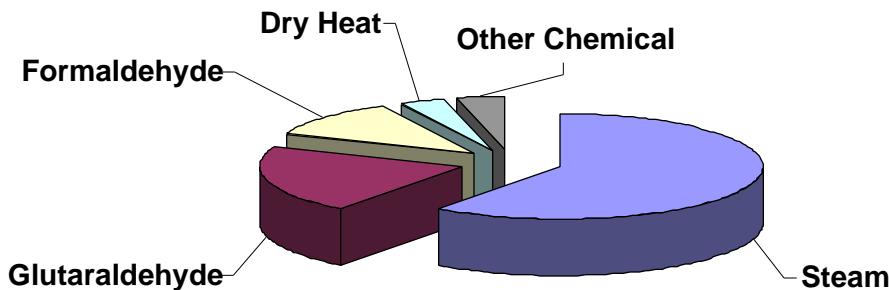
2 What are the potential hazards that chemical sterilants pose to the user, the building and its occupants, and to the environment in general?

The following table shows that there are a number of potential health hazards associated with active ingredients found in dental sterilants.

These agents perform a necessary function in the health care setting. However, the user must be aware of the hazards involved and take appropriate protective measures, such as:

- wear chemical resistant gloves;
- wear eye protection;
- wear respiratory protection; and
- assure that the work area has plenty of fresh air.

Types of Dental Instrument Sterilizing Systems



Source: Survey responses • See note [1]

Ingredients In Chemical Sterilants Used At Survey Sites

Active Ingredient	Practices Using Ingredient	Potential Hazards of Each Ingredient			
		User	Surfaces	Patients	Environment
Glutaraldehyde	19%	Eye & skin burns; Asthmagen	Medium to High	Affects indoor air quality; Asthmagen	Medium to High
Formaldehyde	10%	Carcinogen; Asthmagen; eye & skin burns		Carcinogen; Asthmagen; eye & skin burns	Medium to High
Alcohol	10%	Absorb thru skin, Vapors harmful - CNS effects	Low	Affects indoor air quality	Low to Medium
Glycol Ethers	2%	Absorb thru skin, harmful to blood, liver & kidneys	Low	Low	Low

Source: Product and ingredient MSDSs; Dental Office Surveys; CA Dept. Pesticide Reg.; State of NJ Worker Right-To-Know Factsheets

3 What are appropriate chemical ingredients to use for dental instrument sterilization?

In 2003, the Center for Disease Control (CDC) published its Guideline For Infection Control In The Dental Health Care Setting. Appendix C of this Guideline recommends that a dental practice generally use products that deliver a level of infection control that corresponds to the need.

Three key observations are made from the above CDC Guideline, taken together with the ingredient hazards listed in the prior table.

- 1 Thorough precleaning in an ultrasonic bath is critical to ensuring that the following sterilization can be effective. Precleaning also leads to longer life for the sterilant solution.
- 2 Glutaraldehyde and formaldehyde both pose significant health hazards. New sterilant products as well as wastes should be stored in tightly sealed containers, and in a secure location.
- 3 In addition, spent sterilant with glutaraldehyde or formaldehyde cannot legally be discharged into the sewer unless the waste is deactivated first. Alternatively, it may be disposed of as a hazardous waste.

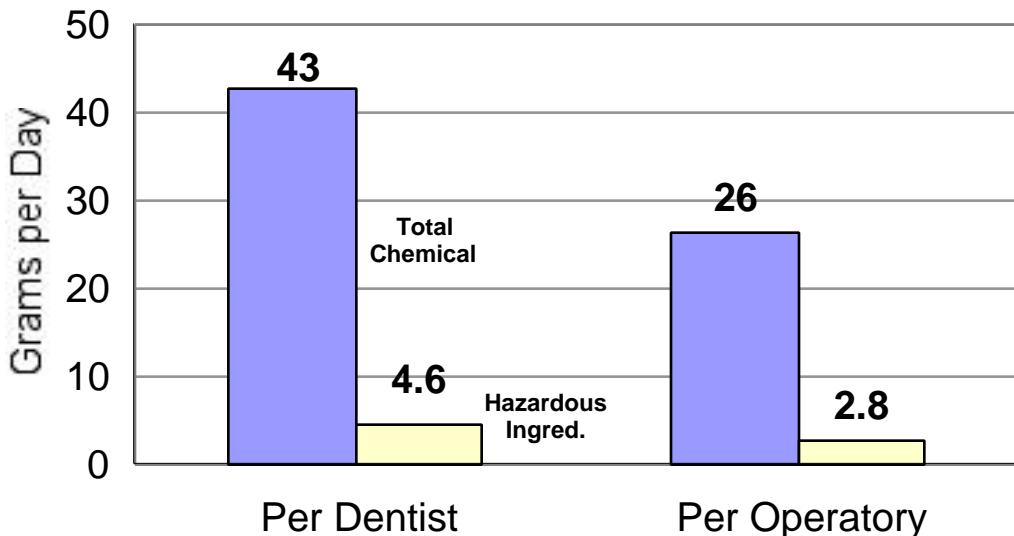
4 What amounts of chemical sterilants do dental practices typically use?

The following chart shows the daily amounts of product and hazardous ingredients that our survey respondents report using per dentist and per active operatory.

The survey participants indicate that they use an average of about 43 grams of sterilant per dentist, which for these particular offices is equivalent to 26 grams per operatory each day.

Hazardous ingredients include both the "active" ingredient cited when the sterilant was registered with US EPA, and other chemicals in the product that pose a health or environmental risks. These ingredients average about 4.6 grams per dentist per day, or 2.8 grams per operatory.

Average Daily Use Of Chemical Sterilant Products



Source: Survey Responses

What You Can Do

Take a quick inventory of your chemical sterilant use, and estimate the average amounts of each product that you use daily.

You may discover old, outdated products in your storage area. Dispose of these properly (e.g., unused glutaraldehyde solution is a hazardous waste). In the future buy just the amount that you can use before the shelf life expires.

Results to expect: You can reduce your chemical sterilant use by up to perhaps 5%, depending upon the details of how your practice has been ordering supplies.

If you use significantly more than the amounts of sterilant that we found to be typical (i.e., 43 grams per dentist each day), then audit your protocols.

- First check that you are following the mixing and use directions from the manufacturer.

- Also check that your ultrasonic bath is effectively pre-cleaning the instruments.
- If you are consuming more than manufacturer guidelines, then examine how often you change the product. Of course, take care not to go so far that worker and patient protection is compromised.

Results to expect: The outcome of adopting these changes will vary with the specifics of your situation, but you may see an overall product reduction of perhaps 10%. This estimate is based upon the fairly wide range in amounts of sterilant being used per dentist at the survey sites (i.e., the highest daily amount reported was 427 grams per dentist, which is far above the average of 43 grams).

The Center for Disease Control and the American Dental Association have published guidelines for dental office infection control that will assist you in researching active ingredients. For details, refer to the first three websites cited below.

Where To Get More Information

Dental supply vendors and manufacturers usually have MSDSs and other product literature available for downloading on their websites.

Health, safety, and environmental issues related to specific ingredients of dental disinfectants may be researched via the following websites:

<http://www.cdc.gov/mmwr/PDF/rr/rr5217.pdf>
<http://www.cdc.gov/mmwr/PDF/rr/rr5210.pdf>
<http://www.apic.org/pdf/gddisinf.pdf>
<http://www.osap.org/>
<http://atsdr1.atsdr.cdc.gov/toxfaq.html>
<http://toxnet.nlm.nih.gov/>
<http://ehp.niehs.nih.gov/docs/montharch.html>
<http://www.state.nj.us/health/eoh/rtkweb/rtkhsfs.htm>
<http://www.osha-slc.gov/SLTC/dentistry/index.html>

Notes

- [1] Our survey results tell us that a mix of formaldehyde and ethanol is used as a chemical sterilant at 10% of the responding dental practices. Some of our peer reviewers believe that formaldehyde sterilants are actually much less commonly encountered than these results suggest. We invite interested parties to conduct and share with the project the additional research that would improve this estimate.

About The Project

The Dental P2 Project team worked under a grant from Region IX of the US Environmental Protection Agency. Co-researchers included staff from the California Dental Association; Cities of San Francisco, Palo Alto, and Richmond; Mid-Peninsula Dental Society; San Francisco Dental Society; Union Sanitary District; and the University of Nevada - Reno.

The project goals are to identify, characterize, and quantify chemicals used by dental professionals for radiography, infection control, and restorative work.

In 2004 and 2005 the project team mailed, FAXed, and hand-delivered a 2-page survey about dental infection control to 450 dental offices in the San Francisco Bay Area. Over 50 dental practices chose to participate in this part of the project, for a response rate of about 12%.

We invite your comments. <http://www.westp2net.org/studies.cfm>

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