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THE BOTTOM LINE

David C. Sarrett, DMD, MS: *Editor*

Dental Amalgam Separators

Amalgam Collector CE24, Hg5, Hg5 HV, and CatchHg 1000 were the only products that dentists identified in our evaluation survey. As reported by its manufacturer, each unit in our review meets ISO standard No. 11143 for effective removal of amalgam particles (95 percent or better removal efficiency). Our survey of ACE Panel members shows that relatively few practitioners own an amalgam separator or plan to purchase one. Still, as this article will explain, it is important for dentists to start learning about the key issues related to this technology before they purchase an amalgam separator.

Desensitizing Agents

Based on our survey results, more dentists used Gluma Desensitizer and Duraphat than other products (n=120 to 249 versus n=15 to 45). Microprime B, notable for its acceptance among patients, was rated as the best overall product; however, overall, a low number of dentists rated this product. In terms of performance, Vanish 5% NaF was the second highest-rated product.

Surface Disinfectants

According to the Centers for Disease Control and Infection noncritical surfaces visibly contaminated with blood, saliva or other potentially infectious material should be disinfected with an intermediate-level germicide that claims tuberculocidal activity. Ten intermediate-level disinfectants, including a household bleach, were tested. Two of these products failed to meet the performance standard as set by the Environmental Protection Agency for tuberculocidal activity. When shopping for surface disinfectants, be sure to scrutinize their label ingredients to avoid confusion; some products are remarkably similar in packaging, but offer significantly different active ingredients.

DENTAL AMALGAM SEPARATORS

Product Review

In this review, we'll discuss the issues that you should consider when shopping for an amalgam separator. The type of amalgam separator that's right for your practice depends on factors such as the plumbing

continued on next page

AmalgamBOSS, LibertyBOSS
M.A.R.S. Bio-Med Processes, Inc.
(866) 594-3648
www.marsbiomed.com

Amalgam Collector Model CE24
R&D Services, Inc.
(800) 816-4995
www.TheAmalgamCollector.com

Amalgam Separators BU10, BU30, MRU10
Dental Recycling North America, Inc. (DRNA)
(800) 360-1001
www.drna.com

ASDEX System, AS-9
Capsule Technologies
(952) 933-4147
www.captech.biz

CatchHg 1000 (formerly RME 1000)
Rebec Simple Solutions
(800) 569-1088
www.rebecsolutions.com

Guardian Amalgam Collector
Air Techniques, Inc.
(800) 822-2899
www.airtechniques.com

Hg5-Mini, Hg5, Hg5 HV
SolmeteX
(800) 216-5505
www.solometex.com

Purevac Hg
Sultan Healthcare
(800) 637-8582
www.sultanhealthcare.com

Pure Water ECO II
Pure Water Development, LLC
(877) 638-2797
www.ecotwo.com

Serfilco 0.5/1.0
Serfilco, Ltd.
(800) 323-5431
www.serfilco.com

Rasch 890-1000 Wet Pump Outlet System

Rasch 890-1500 In-line System

Rasch 890-4000 Micro-Cleanse Scrubber Upgrade Kit

Rasch 890-6000 Dry Pump Outlet System

Rasch 890-7000 Portable System
AB Dental Trends, Inc.
(800) 817-6704
www.amalgamseparation.com

configuration of the office, the physical space required for installation, monitoring and maintenance issues, legal requirements (if any) for the types of separators required, as well as proper disposal practices for collected amalgam waste.[1] In addition, you'll have to consider costs like the unit purchase price and expenses associated with its installation, maintenance and waste disposal requirements.[1]

Why This Product Category Matters to You

For dentists who place or remove amalgams, the trend requiring them to install amalgam separators continues. Presently, eight states require separators by law or regulation. These are the six New England states, plus New York and Oregon. Similar legislation has been filed or is pending in several other states. Several cities require dentists to install separators—among them, Seattle, Milwaukee and San Francisco. The local wastewater treatment authority in Green Bay, Wisc., has received a $50,000 grant from the state's department of natural resources to reimburse dentists who voluntarily purchase and install separators.[2]

Each unit in this review removes 95 percent or more of amalgam particles (as reported by the product's manufacturer), which meets and/or exceeds the minimum level established by the International Organization for Standardization (ISO).[3] We'll provide you with the pertinent information you'll need to make an informed purchase decision.

We also invited three experts to provide product suggestions and recommendations. You can "listen in" on the experts by reading the **Panel Discussion** and learn what these experts had to say on the issues that affect you.

Amalgam Separator Types

There are different types of amalgam separators based on the method of action: sedimentation, filtration, centrifugation, chemical removal by ion exchange or a combination of these methods.

Sedimentation units. These separators reduce the speed of wastewater flow, which allows amalgam particles to settle out of the wastewater.

Filtration units. Depending on the type of filter used, these separators remove not only coarser amalgam particles but also some finer and colloidal amalgam particles.

Centrifuge units. These products use centrifugal force to draw out amalgam particles from the wastewater.

Combination units. These separators use any combination of two or more technologies to remove minute amalgam particles and dissolved mercury particles.

Consider the Issues

Before you install an amalgam separator, you'll need to consider some issues (Box 1).

Box 1. **Amalgam Separator Buyer's Checklist.**

	FACTOR	COMMENTS
Office Considerations	Operatories (number of chairs)	Offices with four or more chairs should consider central, not chairside, units
	Number of amalgam restorations placed or removed per day Office operations (number of days per week)	Offices that perform more than 40 amalgam-related activities per week* may need a unit with a large storage capacity
	Dental practices located in your building Number and type	Consider combining similar flows with other offices if possible to share or reduce costs
	Do you own or lease your space? Would lease stipulations affect installation of a separator? What terms are included for utilities maintenance?	Confirm that plumbing system modifications are consistent with lease provisions
	Do you operate wet/dry cuspidors?	Wet cuspidors should be plumbed to a separate line if possible (and if permissible under applicable law); if not, separator should have a holding or surge tank with sufficient capacity
Building Configuration	Is sufficient space available to the air/water separator drain-line and sewer-line connection?	Certain separators rely on gravity flow and require adequate space from the air/water separator line to connect to the drain system
	Access to electrical power (voltage)	Check the power supply needs for each model under consideration
	Size and material of existing sewer connection	Separator installation should not constrict existing vacuum or drain-line requirements
Vacuum System	Do you operate a wet or dry vacuum system?	Wet-ring vacuum pumps generate additional water flow that will require greater storage capacity
	Will any warranty be affected by third-party installations?	Some warranties may be invalidated if parts of the system are modified by third parties
	Is the vacuum system dedicated to your office?	Group practices that share vacuum systems may want to replumb or split costs associated with amalgam separator
	Location of the vacuum system Basement or office?	Office-level systems may require smaller units. Vacuum systems should be vented to outside air.
	Space available adjacent to vacuum system (height, length and width)	Access to upstream piping is critical for maintenance and inspection of systems
Separator Specifications	Recommended installation location Capacity (in chairs) Maximum flow rate Life-cycle cost	Evaluate model information against the specific conditions for the practice (such as space, plumbing, access, workload, regulatory considerations)
Other Considerations	In your group practice, who is responsible for Equipment servicing and maintenance? Water/sewage/utilities? Amalgam collection/recycling?	Group practices that share vacuum lines may need to discuss how the addition of an amalgam separator will affect allocation of cost and responsibilities, as well as make arrangements for access to the unit

* Source: Kidd K, Cameron M, Peters J. Recommendations for controlling mercury and dental wastes. Tufts University Graduate Program Capstone study conducted for Massachusetts Water Resources Authority, 1998. Adapted from McManus KR, Fan PL. Purchasing, installing and operating dental amalgam separators: practical issues. JADA 2003;134(8):1054-65.

Prepurchase Considerations

Installation Location. Generally, amalgam separators are installed within the vacuum system piping (in-line) at or near individual operatory chairs; in-line at a central location upstream of the vacuum pump; or at the outlet side of the air/water separator.[1] According to manufacturer recommendations, the units listed in Table 1 should be centrally installed, except the Serfilco (Serfilco, Ltd.) and ASDEX System AS-9 (Capsule Technologies) products. The Rasch 6000 and 7000 are compatible with dry systems only. All other units work with both wet or dry vacuum systems.

Reader Tip: Install the amalgam separator as near as possible to the vacuum pump to minimize the effect on vacuum pressure. The addition of a hose to an existing vacuum piping system generally means more bends or angles in the length of that hose, which can compromise vacuum. Also, the addition of more than four feet of new hose can weaken vacuum performance.

Building and Office Configuration. If your office building has a basement level, consider putting your amalgam separator there. It's likely where you've installed the vacuum systems and air/water separators, anyway. The basement location not only will conserve valuable office space, but also will provide enough space upstream of the vacuum system to collect flow. Alternatively, if you don't have a basement, space upstream will be limited if your existing systems are installed behind a closet and/or cabinet doors or in utility spaces. As a result, you may have to install chairside amalgam separators.

Monitoring, Ease of Maintenance and Associated Costs

It can happen—you're in the middle of a dental procedure and suddenly the vacuum s-l-o-w-l-y loses power because the canister in the basement has become full. To avoid practice interruptions like this from happening, understand the maintenance requirements and schedules of your separator *before you buy any unit.*

Collected amalgam has to be removed from every unit; but what varies is how and when. Some separators will need to be decanted daily; others will require that you replace or recycle the entire unit or canister every three to 18 months, depending on your practice volume. The needs, capacities and constraints of your practice will determine the separator that's right for you.

Reader Tip: Before you purchase any unit, determine who will be responsible for monitoring and maintaining your amalgam separator—you, someone from your office, or a vendor technician. Well-meaning practitioners often will assume the tasks of monitoring and maintaining the unit to avoid paying for the services of an outside technician. But in some cases, this arrangement can become problematic and, in the long run, cost you money instead. To aid monitoring, some units have an audio alarm to signal when the container should be replaced or recycled, as well as to indicate operation malfunction. Other units have transparent collector housing units to aid visual identification.

The expert panel (see **Panel Discussion**) agreed that the right package for you should include a thorough understanding of monitoring and maintenance services, whether your office staff or a vendor technician performs them.

There's More on PPR Online

For a detailed look at survey responses about these products, visit PPR online at "www.ada.org/goto/ppr".

Clean Your System Regularly

Keep an eye out (and ear, too) for warning signs such as loss of suction power or increased mechanical noise from the vacuum pump; either may suggest that clogs have developed in the line, which can occur over time with use.

Limiting the biological growth within the system will keep things humming along nicely. Your vendor's recommendations will depend on the amount of biological material introduced into the system, the length of vacuum lines, and the type of separator.

Reader Tip: Do not use bleach or other chlorine-containing solutions to clean the lines. They can remobilize bound mercury and release it into the waste stream, thereby compromising the efficacy of your separator.

Remember to consider the cost of replacement parts when budgeting for your system. Ask your vendor about how often you'll have to replace the unit. Again, this will partly depend on your patient load and the number of amalgam restorations performed. The vendor can estimate these figures, but your practice has its own particular set of factors that should be considered when predicting the cost of a system. With some units, especially with sedimentation separators, the entire product is replaced instead of any cartridge. Check with your supplier to determine replacement costs for your separator.

Warning Signal Feature. Remember that dreaded scenario, losing vacuum power because the container has reached maximum capacity? To minimize that prospect, consider a product with an early warning signal feature that indicates when its container needs to be changed or the unit is malfunctioning. Ask the manufacturer if the warning feature is visual, audible, or both, and where it is located so it can be easily detected. Also, find out when the alarm will activate in advance of the unit actually becoming full. Our panel experts suggest an appropriate lead time of about three to four days, which should allow routine maintenance that won't interrupt your practice.

Regulatory Issues

The effort to reduce amalgam waste discharge from the dental office often is the result of increasing pressure facing local wastewater treatment plants to reduce the concentration of mercury in effluent from their plants and the concentration of mercury in sludge. Although there is no national regulation requiring the installation of amalgam separators in U.S. dental offices, state and local requirements exist in some areas. Currently, eight states and a number of localities lawfully require dentists to install amalgam separators. Where mandatory controls do exist, the requirement generally applies to dentists who place or remove amalgams. Check with your state or local dental society to see if any requirements exist in your area.

To ensure proper disposal of amalgam waste, you should contract with a vendor-sponsored program or make disposal arrangements with an independent recycler.

Many amalgam separator manufacturers offer recycling programs as part of their sales package, which generally allows spent or full cartridges/separators to be shipped to recycling facilities for a service fee or as part of a lease. Ask your vendor about the available recycling services in your area (Box 2).

Table 1. **Summary Comparison of Product Features and Cost**

Brand Name and Manufacturer	Unit Cost/ Maintenance Cost	Chairs Served	Intervention Warning	Maintenance
AmalgamBOSS LibertyBOSS M.A.R.S. Bio-Med Processes, Inc.	$899	1-10	Alarm - container	Technician
	$1549	4-20	Alarm - container	Technician
Amalgam Collector, CE24* R&D Services, Inc.	$1245 for manual $1620 for automatic recycle container $150	1-12	Visual - container	Reusable canisters Manual - daily
Amalgam Separator BU10 Dental Recycling North America (DRNA)	$750	1-6	No	Technician
Amalgam Separator BU30 DRNA	$1395	7-12	No	Technician
Amalgam Separator MRU10 DRNA	$1500	1-6	No	Technician
ASDEX System, AS-9 Capsule Technologies	$229 $79 filter	1	Yes	Replace filter
ECO II Pure Water Pure Water Development, LLC METASYS GROUP	$335	1-6	Yes	Replace when full
Guardian Amalgam Collector Air Techniques, Inc.	$1725 - $3615 $850 collector replacement kit	1-7	No	Evac cleaning, replace collection container
Hg5-Mini SolmeteX	$750 $170 filter	1-4	Visual	Change cartridge
Hg5‡ SolmeteX	$750 $170 filter	1-10	Visual	Change cartridge
Hg5 HV§ SolmeteX	$2500 $170 filter Filter cartridge with recycle kit $285	1-20	Visual	Change cartridge
Purevac Hg Sultan Healthcare	$1080	1-6	No	Recycle, daily line cleaning
Rasch 890-1000 Wet Pump AB Dental Trends, Inc.	$1190 replace canister $596	1-12, 24 with upgrade kit	Alarm - optional	Replace canister, flush daily
Rasch 890-1500 Inline System AB Dental Trends, Inc.	$695, replace canister $596	1-12, 24 with upgrade kit	Alarm - optional	Replace canister, flush daily
Rasch 890-4000, Micro-Cleanse Scrubber Upgrade Kit (not a total system) AB Dental Trends, Inc.	$718, upgrades the 890-1000 or 890-1500, which must be purchased separately $596, replace scrubber canister every 144 doctor months	24 when used as an upgrade kit	See 890-1000, 890-1500 product information	Flush daily
Rasch 890-6000 Dry Pump AB Dental Trends, Inc.	$666, replace canister $597	12-256	Alarm - optional	Replace canister, flush daily
Rasch 890-7000 Dry Pump AB Dental Trends, Inc.	$1076 replace canister $596	1-2	Visual	Replace canister, flush daily
CatchHG 1000 (formerly RME 1000‖) Rebec Simple Solutions	$1665 replace container $445	1-10	No	Return container for processing
Serfilco 0.5/1.0 SERFILCO, Ltd	$354 filters $1.78-$2.26	1	Visual	Replace filter

* Rated by 20 PPR dentists
‡ Rated by 10 PPR dentists
§ Rated by 71 PPR dentists
‖ Rated by 18 PPR dentists

Amalgam Collection/Recycling: Best Management Practices.

It is sometimes difficult to categorize whether state or local legislative/regulatory action concerning installation of separators or adherence to Best Management Practices (BMPs) is mandatory or voluntary. Note that in a few areas, best management practices include amalgam separators. The ADA's BMPs and many other BMPs do not include amalgam separators. The ADA strongly urges dentists to follow BMPs.

Dental Waste Amalgam Online Information Resources

For more information on amalgam waste issues, including the ADA's Best Management Practices, visit http://www.ada.org/prof/resources/topics/amalgam_bmp.asp#amalgam.

For more information on amalgam waste issues, visit http://www.ada.org/prof/resources/topics/amalgam.asp

For more information on local requirements that may exist in your area, visit your state or local dental society at http://www.ada.org/ada/organizations/index.asp

Should your office assume the responsibility of the amalgam collection/recycling process, this means you will have to perform one or more of the following collection and recycling tasks:

- disposal of the collected amalgam waste;
- disposal of the used canisters or used filter cartridges;
- disposal of the used filter cartridge and/or resin cartridge, along with the collected waste.

Or, you can contact a vendor to handle these procedures. Alternatively, the manufacturer of your amalgam separator may offer amalgam waste handling/recycling services as part of the unit's purchase or lease cost. *Before you buy*, ask the manufacturer exactly what types of recycling services are included in the cost (Box 2). For a directory of amalgam recyclers, visit ADA.org at http://www.ada.org/prof/resources/topics/topics_amalrecyclers.pdf.

Reader Tip: For specific information about amalgam collection recycling services for these products, visit PPR online at "www.ada.org/goto/ppr".

Box 2. **Questions to Ask About Amalgam Recycling.*** †

- What kind of amalgam waste do you accept?
- Do your services include pickup of amalgam waste from dental offices? If not, can amalgam waste be shipped to you?
- Do you provide packaging for storage, pickup or shipping of amalgam waste?
- If packaging is not provided, how should the waste be packaged?
- What types of waste can be packaged together?
- Do you accept whole filters from the vacuum pump for recycling?
- Is disinfection required for amalgam waste?
- How much do your services cost?
- Do you pay for clean non-contact amalgam (scrap)?
- Do you accept extracted teeth with amalgam restorations?
- Does your company have an EPA or applicable state license?
- Does the company use the proper forms required by the EPA and state agencies?
- Do your procedures comply with ANSI/ADA Specification 109: Procedures for Storing Dental Amalgam Waste and Requirements for Amalgam Waste Storage/Shipment containers?‡

* Source: American Dental Association. ADA best management practices for amalgam waste. Available at: "www.ada.org/prof/prac/issues/topics/amalgam.html#BMP".
† Because the generator of the waste is responsible for proper disposal, dentists should obtain replies to these questions in writing from their recyclers.
‡ American Dental Association Council on Scientific Affairs. American National Standard/American Dental Association Specification No. 109. Procedures for storing dental amalgam waste and requirements for amalgam waste storage/shipment containers, 2006

For the Practitioner Input and Web-based survey, visit the PPR online at "www.ada.org/goto/ppr".

References
1 McManus KR, Fan PL. Purchasing, installing and operating dental amalgam separators. JADA 2003; 134:1054-1065.
2 American Dental Association, Department of State Government Affairs.
3 International Organization for Standardization. ISO No. 11143–1999(E). Dental equipment–amalgam separators. Geneva, Switzerland: ISO.

DENTISTS, INDUSTRY EXPERTS DISCUSS AMALGAM SEPARATORS

Moderator: **Frederick Eichmiller, DDS**
Vice President and Dental Director
Delta Dental of Wisconsin
Mosinee, WI

Participants: **Kevin McManus, MA, MBA**
Senior Program Director
EBI Consulting
Boston, MA

Tim Tuominen, BS
Chemist
Western Lake Superior Sanitary District
Duluth, MN

Connie Verhagen, DDS
Pediatric Dentist
Muskegon, MI

Eichmiller: **What do you see as the chief complaints/problems encountered with today's separator technologies or instruments?**

McManus: The thing that I hear a lot is the difference in performance in the field than what was either promised or represented by the vendors, and I think the reason for that is that installation in clinical situations is always going to be very site specific. For example, there are often times when people will say, "I thought this cartridge was supposed to last for 6 months or 9 months or a year, and I've had to swap it out three times already, what's going on there?" And I think it's still early to say whether or not it's common to all these, but I think it has to do with the fact that offices may be collecting a lot of other material, which is degrading the performance and longevity of the units, particularly the cartridge type units.

Eichmiller: Well, that's a capacity issue, really. Things like prophy paste will load up a separator very quickly, so a lot of times, you're

right, it's installation specific. So if you have an office that has hygiene chairs connected in with the restorative chairs, they're going to fill up a separator much more rapidly than if they're isolated just to the units that are doing the amalgam work.

Verhagen: When you start talking to dentists about putting in an amalgam separator, you get a lot of questions: How big is this unit going to be? Will it fit in my office? What will it cost? Who's going to install it? Are there plumbing codes involved with the installation? As far as maintenance, someone has to either physically operate or simply visually inspect the separator, sometimes daily, sometimes weekly and sometimes monthly. It is not something that you can just put in place and then forget about it. You want to make sure it is working properly. The separator is another maintenance item that affects your equipment performance. You could be in the middle of an operative procedure when suddenly the vacuum goes out, and then you remember that you have an amalgam separator that you have to take care of.

McManus: So lack of a warning signal or something to let you know that it's reaching capacity?

Verhagen: Right. And when it reaches capacity, *everybody* stops working. Everything just comes to a halt.

Eichmiller: **Do you think the solution is a better warning system?**

Verhagen: Absolutely, we can not just rely on visual inspection.

Eichmiller: Because that is something that was brought up at the ISO level, more than once. The warning systems we have now are mainly visual, and so you have to have someone checking that level all the time, and there really aren't many with audible alarms connected to them. Also those warning systems might be off in the back room somewhere, rather than in the treatment setting or in a place where you normally would see it.

McManus: One additional comment that is not strictly technology, but deals with the total package provided to a dental office is that typically maintenance falls to the hygienist or an assistant – to order the cartridges, swap them out and understand enough about them. I get a lot of calls from people asking us to provide routine maintenance. It seems to me that an important enhancement would be to provide a total package that really takes the right people through regular maintenance in a way that makes sure that services aren't interrupted. I find that sometimes this information doesn't get effectively communicated to the person who is responsible for maintaining the units.

Verhagen: Another important feature is to provide an easy way to dispose of the collected amalgam. Many companies that provide a canister system also provide an easy way to swap canisters and a mailing container for sending the full canister in for recycling.

Tuominen: I think they'll work with you, not all of them do it themselves, but they'll work with you to have a place to send it.

McManus: A couple units still require you to decant the material off, and that is less preferable, I would guess, for most offices. Most newer units swap out the entire unit and I think those have some real desirable features if, again, people understand when and how to swap the units out.

Eichmiller: **What do you think is the largest obstacle to the acceptance and use of separators today?**

Tuominen: I've dealt with every dentist here in Duluth, and I think the biggest thing that happened with us is that a few dentists tried them and said, "I can run my practice with this and it's not causing any problems." The fear of the unknown was the biggest obstacle. Dentists were worried about whether they could still practice with these things.

Eichmiller: **Do you feel the same was true on the maintenance side?**

Tuominen: I worked with a group of dentists that acted as a leadership group. When we were getting down to where we had one or two dentists to go they said, "Give us their phone numbers and we'll visit with them and tell them it's no big deal." And that's how we worked

For the full discussion, visit the PPR online at "www.ada.org/goto/ppr."

DESENSITIZING AGENTS

Product Review

For this review, we surveyed dentists about 12 desensitizing agents: D/Sense Crystal Desensitizer (Centrix), Duraflor Sodium Fluoride Varnish (MEDICOM), Duraphat (Colgate Oral Pharmaceuticals), Gel-Kam DentinBloc (Colgate Oral Pharmaceuticals), Gluma Comfort Bond (Heraeus Kulzer), Gluma Desensitizer (Heraeus Kulzer), Hemaseal & Cide Desensitizer (Advantage Dental Products), HurriSeal Dentin Desensitizer (Beutlich LP, Pharmaceuticals), Microprime B Desensitizer (Danville Materials), Pain-Free Desensitizer (Parkell), PROTECT Desensitizing Solution (Sunstar Americas, Inc.), Vanish 5% NaF White Varnish (OMNI Preventive Care).

D/Sense Crystal Desensitizer
Centrix
(800) 235-5862
www.centrixdental.com

Duraflor Sodium Fluoride Varnish
MEDICOM
(800) 361-2862
www.medicom.com

Duraphat
Colgate Oral Pharmaceuticals
(800) 226-5428
www.colgateprofessional.com

Gel-Kam DentinBloc
Colgate Oral Pharmaceuticals
(800) 226-5428
www.colgateprofessional.com

Gluma Comfort Bond
Heraeus Kulzer
(800) 431-1785
www.heraeus-kulzer-us.com

Gluma Desensitizer
Heraeus Kulzer
(800) 431-1785
www.heraeus-kulzer-us.com

Hemaseal & Cide Desensitizer
Advantage Dental Products
(800) 388-6319
www.advantagedentalinc.com

HurriSeal Dentin Desensitizer
Beutlich LP, Pharmaceuticals
(800) 238-8542
www.beutlich.com

Microprime B Desensitizer
Danville Materials
(800) 827-7940
www.danvillematerials.com

Pain-Free Desensitizer
Parkell
(800) 243-7446
www.parkell.com

PROTECT Desensitizing Solution
Sunstar Americas, Inc.
(800) 527-8537
www.sunstar.com

Vanish 5% NaF White Varnish
OMNI Preventive Care
(800) 445-3386
www.omnipreventivecare.com

Some of these desensitizing agents also can be used for other indications beyond treating hypersensitivity (Table 1). For example, many can be applied as a liner beneath restoratives to help prevent post-operative sensitivity. All the featured products have shelf lives of two to three years beyond their manufacture date and can be stored at room temperature, although you may want to refrigerate the product if you're not going to be using it for long periods (see the instructions for storage requirements).

Of the 844 dentists who responded to our Web-based survey on these products, 91 percent reported using desensitizing agents. From that group, we collected 698 survey responses from dentists who use the products featured in this report. We also hosted an Expert Panel discussion, bringing together researchers from the Medical College of Georgia to talk about the science behind professionally applied desensitizing agents (p. 10).

Table 1. **Desensitizing Agent Features, According to the Manufacturer.**

Product Manufacturer	**Active Ingredient**	**Shelf Life (yrs.)***	**Indications Beyond Hypersensitivity**	**Price†**
D/Sense Crystal Desensitizer Centrix	Potassium binoxalate Nitric acid	2	Liner Before and after tooth bleaching	$45.99 (6 – 1 ml syringes and 24 tips)
Duraflor Medicom	5% Sodium fluoride	2	Topical fluoride†	$26.95 (32 – 0.25 ml unit dose applicator or 1 - 10 ml tube)
Duraphat Colgate Oral Pharmaceuticals	5% Sodium fluoride	2	Topical fluoride†	$30.99 (1 – 10 ml tube, 10 brushes and 1 dispensing pad
Gel-Kam DentinBloc Colgate Oral Pharmaceuticals	1.09% Sodium fluoride 0.4% Stannous fluoride 0.14% Hydrogen fluoride (equivalent to 0.717% fluoride)	2		$37.49 (50 – 0.75 g unit dose applicators)
Gluma Comfort Bond§ Heraeus Kulzer	4-META‖ HEMA**	3	Bonding of restoratives	$239 (3 – 4 ml bottles)
Gluma Desensitizer Heraeus Kulzer	Glutaraldehyde HEMA	3	Liner	$70.75 (40 – 0.075 ml unit dose applicators)
Hemaseal & Cide Desensitizer Advantage Dental Products	35% HEMA 4% Chlorhexidine	3	Liner	$83.50 (1 – 10 ml tube)
HurriSeal Dentin Desensitizer Beutlich LP, Pharmaceuticals	HEMA Sodium fluoride	3	Wetting agent in bonding procedures	$42.95 (1 – 12ml bottle)
Microprime B Desensitizer Danville Materials	HEMA Benzathonium chloride	3	Antimicrobial	$45.99 (1 – 10 ml bottle)
Pain-Free Desensitizer Parkell	Colloidal mixture of polymethyl methacrylate co-parastyrene-sulfonic acid in water	3		$104.99 (2 bottle system: 1 – 5 ml bottle of each)
PROTECT Desensitizing Solution Sunstar Americas, Inc.	Polymerized methacrylates Potassium fluoride	2		$60.79 (1 bottle, 45 applicator brushes and mixing pad)
Vanish 5% NaF White Varnish OMNI Preventive Care	5% Sodium fluoride Resin	1.5	Liner Topical fluoride†	$97.50 (50 – 0.5 ml unit dose blister packs)

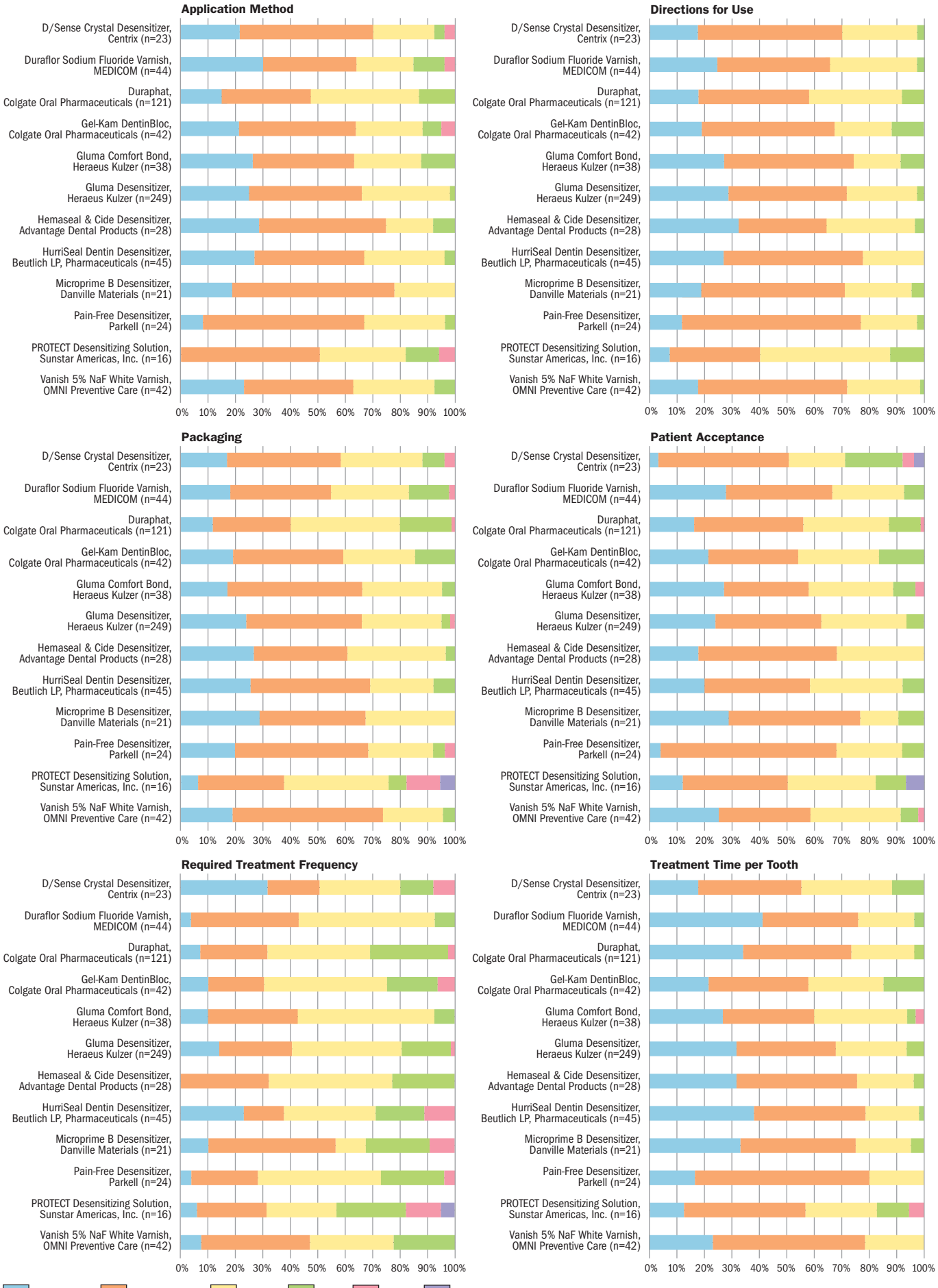
* From date of manufacture.
† Catalog prices. Actual retail price may vary depending on vendor and quantity ordered.
‡ Off-label use.
§ This product requires light curing; all others are self curing.
‖ 4-MethacryloxyEthyl trimellitate anhydride
** Hydroxyethyl methacrylate.

Practioner Input

Through a Web-based survey, we received 698 responses about dentists' experiences with the desensitizing agents featured in this review. Survey participants were drawn from a random sample of ADA members as well as members of the ADA Clinical Evaluator (ACE) Panel, a volunteer group of ADA members who contribute feedback for the clinical input segments of the ADA Professional Product Review program.

Respondents rated the performance of up to two desensitizing agents for the following features: application method, directions for use, packaging, patient acceptance, required treatment frequency, and treatment time per tooth. The bar graphs show how product ratings compared for these qualities.

Note: Duraphat and Gluma Desensitizer were rated by more respondents than the other products. Ratings are more reliable when based on a larger number of respondents.


Application Method
Directions for Use
Packaging
Patient Acceptance
Required Treatment Frequency
Treatment Time per Tooth
D/Sense Crystal Desensitizer, Centrix (n=23)
Duraflor Sodium Fluoride Varnish, MEDICOM (n=44)
Duraphat, Colgate Oral Pharmaceuticals (n=121)
Gel-Kam DentinBloc, Colgate Oral Pharmaceuticals (n=42)
Gluma Comfort Bond, Heraeus Kulzer (n=38)
Gluma Desensitizer, Heraeus Kulzer (n=249)
Hemaseal & Cide Desensitizer, Advantage Dental Products (n=28)
HurriSeal Dentin Desensitizer, Beutlich LP, Pharmaceuticals (n=45)
Microprime B Desensitizer, Danville Materials (n=21)
Pain-Free Desensitizer, Parkell (n=24)
PROTECT Desensitizing Solution, Sunstar Americas, Inc. (n=16)
Vanish 5% NaF White Varnish, OMNI Preventive Care (n=42)
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Excellent
Very Good
Good
Fair
Poor
Unacceptable

We also asked dentists to choose the best and worst features for the products they reviewed. Across the board, the majority of dentists selected ease of use as the best feature for all of the products. Responses were more varied for the worst feature, with cost, efficacy, recommended treatment frequency and packaging each garnering votes (Table 2).

Table 2. **Worst Features, According to Surveyed Dentists.**

Product (Manufacturer)	**Worst Feature (No. of Respondents)**
D/Sense Crystal Desensitizer Centrix	Cost (n=9)
Duraflor Sodium Fluoride Varnish MEDICOM	Packaging, application system (n=22)
Duraphat Colgate Oral Pharmaceuticals	Packaging, application system (n=41)
Gel-Kam DentinBloc Colgate Oral Pharmaceuticals	Efficacy (n=13)
Gluma Comfort Bond Heraeus Kulzer	Cost (n=19)
Gluma Desensitizer Heraeus Kulzer	Cost (n=140)
Hemaseal & Cide Desensitizer Advantage Dental Products	Cost (n=10) Recommended treatment frequency (n=10)
HurriSeal Dentin Desensitizer Beutlich LP, Pharmaceuticals	Efficacy (n=14) Recommended treatment frequency (n=14)
Microprime B Desensitizer Danville Materials	Recommended treatment frequency (n=7)
Pain-Free Desensitizer Parkell	Efficacy (n=10) Recommended treatment frequency (n=10)
PROTECT Desensitizing Solution Sunstar Americas, Inc.	Packaging, application system (n=5)
Vanish 5% NaF White Varnish OMNI Preventive Care	Cost (n=14)

PRODUCT TIPS FOR TREATING HYPERSENSITIVITY

David Pashley, D.M.D., Ph.D.

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Each dentist should consider adopting a regimen for treating dentin sensitivity that matches the severity and distribution of a patient's symptoms. Over the counter, potassium nitrate-containing desensitizing toothpastes could prove effective in cases of mild-hypersensitivity. Professionally applied products may be indicated for widespread, toothbrush-induced, wedge-shaped cervical lesions involving several quadrants.

Among the professionally applied products, glutaraldehyde/HEMA-based desensitizing products (e.g., Gluma Desensitizer [Heraeus Kulzer], Glu/Sense [Centrix], MicroPrime G [Danville]) may be a good first choice for treating hypersensitivity. They require no special techniques. They have almost no film thickness, and they do not require polymerization.

If the patient's symptoms do not resolve, the oxalatebased products (e.g., BisBlock [Bisco], D/Sense Crystal [Centrix], Pain-Free, PROTECT [Sunstar Americas, Inc.], or Super Seal [Phoenix Dental, Inc.]) offer good second-tier treatment options. These products are usually effective. However, they cover the dentin surfaces with calcium oxalate crystals that prevent optimal resin-dentin bonding. If oxalates are tried first and are not successful for that patient, the clinician must treat that surface with pumice to remove the surface crystals. By trying glutaraldehyde/HEMA-containing products first, the oxalate option remains available as an excellent second choice if the glutaraldehyde/HEMA product does not desensitize.

Another option available to the practitioner is to fabricate a "bleaching tray" that extends over the affected sites. Have the patient use a potassium nitrate desensitizing gel (e.g., Den-Mat Desensitize! [Den-Mat] Soothe Desensitizing Gel [SDI Limited]) in the tray each night until they obtain relief.[1]

Light-cured adhesive resins also can serve as desensitizing agents although they can prove to be technique sensitive. Self-etching primer adhesives such as CLEARFIL SE BOND or CLEARFIL PROTECT BOND (both by Kuraray) or all-in-one adhesives are preferred because they do not require a separate etching and rinsing step. These all have significant film thicknesses and are either unfilled or only lightly filled. Care should be taken to correct the patient's improper toothbrushing habits to help retain the physical barrier provided by the resins. Both the tray and resin bonding therapies require more time and hence cost the patient more money.

Reference

1. Haywood VB, Caughman WF, Frazier KB, Myers ML. Tray delivery of potassium nitrate-fluoride to reduce bleaching sensitivity. Quintessence Int 2001;32(2):105-9.

EXPERTS DISCUSS PROFESSIONALLY APPLIED DESENSITIZING AGENTS

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PPR: What are the primary factors dentists should consider when choosing a desensitizing agent?

Haywood: First, you have to ask some preliminary questions: What kind of sensitivity are you treating? Isolated tooth sensitivity? Bleaching sensitivity? Post-periodontal chronic sensitivity? The answers to questions like those may change your product selection.

Pashley: You also have to consider how extensive the problem is; are you treating one tooth or 20 [teeth]? Those situations are handled differently.

Tay: Treatment also must match the severity of the problem. For example if you have just minor sensitivity, you may just use desensitizing toothpaste, but as the problem gets more severe you need more elaborate and more extensive treatment.

PPR: So what would be your decision-making process?

Haywood: With a single tooth, I would do a differential diagnosis to determine the cause [of the sensitivity]. I would consider chronic factors, cracked tooth factors, dietary and toothbrush habits … different things like that. I'd go through the entire diagnostic process until I'd ruled out everything other than the fact that this patient just has a sensitive tooth.

Pashley: I also would consider whether the patient volunteered this information … if they came to you and said, "I have a sensitive tooth," or whether you detected [sensitivity] during the oral exam; you use a bit of air and find a sensitive area. If they raise the issue, you have to treat it differently than if it were just incidental. That is, if the patient's chief complaint is dentin sensitivity, then they will expect you to solve that problem during that appointment, with the goal of eliminating their sensitivity. In contrast, if they respond to air-blasts used to dry dentin, they may say that they remember that region is mildly sensitive. That is an incidental finding and is not a chief complaint. Encouraging such a patient to switch to a desensitizing dentifrice may be sufficient for that patient.

Haywood: Other factors to consider when making the diagnosis include seeing whether you can replicate the sensitivity. Is it sporadic? Isolated to that tooth or spot? Or is it a vague kind of [pain]?

PPR: Are there any product-related factors that should be considered when choosing a desensitizing agent?

Haywood: [Available products use one of] two approaches: tubular blockers—occluding factors that [block] the tubules—or potassium nitrate products that have an impact on the nerve inside the tooth.

Haywood: In my [research] area, which is treating bleaching sensitivity with potassium nitrate, we did a study that determined that tray delivery of the potassium nitrate was very effective.[1] That's when the manufacturers began to offer the profession three products: two of which are 5 percent potassium nitrate, and one that's 3 percent. Delivery can make a big difference in efficacy. Typically, desensitizing toothpastes can take about two weeks to become effective. Tray delivery of potassium nitrate gel can be effective in 10-30 minutes. But you have to have a dentist make a tray, and hold the potassium nitrate on the tooth for that length of time. Pre-brushing with a desensitizing toothpaste can also reduce discomfort.[2]

PPR: Are there any materials or technologies that have an advantage from the standpoint of features or benefits? Longevity, rapid onset, ease of application?

Tay: None of these desensitizers are really permanent; some may work longer than the others. [Longevity] depends on how the patient actually treats [his or her] teeth after the desensitizers are applied.

Pashley: Right. Tubular occlusion is usually a very superficial treatment. However, if the patient is a "scrubber" who doesn't know how to brush properly, the desensitizing agent can be brushed off in several weeks.

Haywood: It's also important to know that approximately 55 percent of the American public still buys medium to hard toothbrushes. That's a big factor in how long a sensitivity treatment will be successful.

Pashley: Dentin sensitivity is often called "toothbrush disease," because how the patient brushes is so important. Patients with dentin sensitivity should use an ultrasoft toothbrush.

Haywood: Diet also has a lot to do with [sensitivity]. Look at the acidity of cola drinks, white wine, yogurt, orange juice; each of these has an acidic pH. They're very acidic, and so you not only have to look at brushing [technique] but also at diet and the things patients do on a routine basis that may exaggerate the problem.

PPR: Do any of the products have stronger or more clinical data available, in your experience?

Tay: Both *in vitro* and *in vivo* data are available on the Gluma desensitizers, since they have been around for such a long time. Studies have shown that they actually coagulate plasma proteins within the dentinal tubules and some very good in vivo studies show that they work pretty well.

Haywood: With potassium nitrate products, we can do only clinical trials [rather than laboratory studies] because these products affect the nerve so we're not talking about measuring reductions in fluid flow or any similar in vitro [tests]. Many patients may have perfectly good teeth, but they get sensitivity during bleaching. We have done a clinical trial here [Medical College of Georgia], and then one was done at North Carolina.[1,3]

References

1. Haywood VB, Caughman WF, Frazier KB, Myers ML. Tray delivery of potassium nitrate-fluoride to reduce bleaching sensitivity. Quintessence Int 2001;32:105-9.
2. Haywood VB, Cordero R, Wright K, et al. Brushing with a potassium nitrate dentifrice to reduce bleaching sensitivity. J Clin Dent 2005;16(1):17-22.
3. Leonard RH, Haywood VB, Phillips C. Risk Factors for developing tooth sensitivity and gingival irritation in nightguard vital bleaching. Quintessence Int 1997;28:527-534.

For the full discussion, visit the PPR online at "www.ada.org/goto/ppr."

SURFACE DISINFECTANTS

Disinfection of nonporous environmental surfaces is an important component of bloodborne infection control in the dental operatory. According to the Centers for Disease Control and Infection, environmental surfaces visibly contaminated with blood, saliva or other potentially infectious material should be disinfected with an Environmental Protection Agency (EPA)-registered hospital disinfectant that claims tuberculocidal activity (intermediate-level disinfection). Environmental surfaces that are not contaminated with potentially infectious material may be cleaned with EPA-registered hospital disinfectants with no label claim regarding tuberculocidal activity (low-level disinfection). You can find listings of disinfectants registered with the EPA, according to their efficacy against certain bloodborne/body fluid pathogens, at http://www.epa.gov/oppad001/chemregindex.htm. EPA-registered products are considered effective when used according to the manufacturer's instructions. In this review, we evaluated the efficacy of EPA-registered, intermediate-level disinfectants intended for use on hard surfaces in the dental operatory.

EPA's Role in Regulating Disinfectants

In the United States, disinfectants are regulated by the EPA and the Food and Drug Administration (FDA). The EPA regulates gaseous sterilants; they also regulate liquid chemical disinfectants used on noncritical surfaces. The FDA regulates everything else. (Figure 1)

As detailed in Figure 1, antimicrobial products registered with the EPA are classified by their level of germicidal action. They are primarily distinguished by whether they do (intermediate level) or do not (low level) inactivate *Mycobacterium tuberculosis* (tubercule bacillus). Unlike the high-level disinfectants regulated by the FDA, intermediate-level disinfectants are not necessarily capable of killing bacterial spores. This is not a critical consideration, however, on environmental surfaces in the dental operatory.

Tuberculosis Bacilli Germicidal Activity

Environmental surfaces are rarely associated with transmission of TB. Nonetheless, TB activity is a good indicator of broad spectrum germicidal activity because, the tubercule bacillus is considered the most difficult vegetative cell to inactivate. Some organisms can survive exposure to a tuberculocidal disinfectant, but most viruses (including HBV and HIV), fungi, and bacteria are inactivated.

Product Review

We tested the bactericidal activity of the nine intermediate-level disinfectants listed below. All the germicides claim bactericidal and tuberculocidal properties.

EPA Antimicrobial Testing Program: EPA is responsible for assuring the effectiveness of surface disinfectants used in healthcare settings. It does this by reviewing data a company submits for its product and issuing an EPA registration number for products meeting EPA requirements. The agency does not conduct premarket testing to confirm a company's data. In the aftermath of the 2001 bioterror events involving anthrax, the EPA began postmarket testing of registered disinfectants. The agency began with the newest registrants first. Reportedly, there is still a considerable backlog of older products awaiting EPA testing.

Household Bleach Usage. When using household bleach as an intermediate-level germicide to clean surfaces, the CDC recommend a 1:100 dilution of 5.25 percent bleach and tap water. Solutions should be prepared fresh, i.e. daily, to ensure potency. Generally, household bleach dilutions ranging from 1:100 to 1:10 effectively inactivate HIV.[1]

In this report, we tested the widely used Clorox Regular Bleach, which has a sodium hypochlorite concentration of 6 percent. We tested this product at a 1:100 dilution. Also, because some viruses are more easily inactivated by chemicals than other microbes, we tested Clorox Regular Bleach at a 1:10 dilution.

Lab Notes

We conducted a limited-spectrum testing for products used on hard surfaces and in suspension. We did not test the virucidal and fungicidal activity of the disinfectants, although we would expect tuberculocidal agents to be effective against viruses since they are generally easier to inactivate than tubercule bacillus on environmental surfaces. Additionally, we did not attempt to verify all of the antimicrobial claims of each product. All tests were performed in the ADA laboratory. For a detailed description of our test methods, visit the PPR Web site at "www.ada.org/goto/ppr".

Products were selected based on 666 Web-survey responses collected from members of the ADA Clinical Evaluator (ACE) Panel. This panel comprises a volunteer group of ADA dentists who contribute feedback for the clinical input segments of the ADA Professional Product Review™ program.

Asepticare TB + II
Ecolab
(800) 352-5326
www.ecolab.com

BIREXSE
Biotrol International
(800) 822-8550
www.biotrol.com

CaviCide Spray
Metrex Research Corp.
(800) 841-1428
www.metrex.com

Clorox Regular Bleach
Clorox Co.
www.clorox.com

DisCide® ULTRA
Palmero Health Care
(800) 344-6424
www.palmerohealth.com

GC Spray-CideTM
GC America Inc.
(800) 323-7063
www.gcamerica.com

Lysol Brand I.C. Disinfectant Cleaner

Lysol Brand II I.C. Disinfectant Spray
Reckitt Benckiser
(800) 820-8939
www.lysol.com

MicroStat 2
Septodont Inc.
(800) 872-8305
www.septodontinc.com

Sporicidin Disinfectant Solution and Spray
The Sporicidin Company
(800) 424-3733
www.sporicidin.com

Figure 1. **Methods for Sterilizing and Disinfecting Patient-Care Items and Environmental Surfaces***

Process	Definition	Method		Example	Application	
					Patient-Care Items	Evironmental Surfaces
Sterilization (products regulated by the FDA)	Destroys all microorganisms, including bacterial spores. Chemical solutions in this class are designated "sterilants" by the FDA and CDC	Heat	High temp	Steam, dry heat, unsaturated chemical vapor	Heat tolerant critical and semicritical	Not applicable
			Low temp	Ethylene oxide gas, plasma sterilization	Heat tolerant or heat sensitive critical and semicritical	
		Liquid immersion		Glutaraldehyde, glutaraldehydes with phenols, hydrogen peroxide, hydrogen peroxide with peracetic acid, peracetic acid	Heat sensitive critical or semicritical	
High-level disinfection (products regulated by the FDA)	Destroys all microorganisms, but not necessarily high numbers of bacterial spores. Chemical solutions in this class are designated "high-level disinfectants" by the FDA and CDC	Heat		Washer disinfector	Heat-sensitive semicritical	
		Liquid immersion		Glutaraldehyde, glutaraldehydes with phenols, hydrogen peroxide, hydrogen peroxide with peracetic acid, ortho-phthalaldehyde		
Intermediate-level disinfection (products regulated by the EPA)	Destroys vegetative bacteria, most fungi, and most viruses; does inactivate ***Mycobacterium tuberculosis* var. bovis**† Not necessarily capable of killing bacterial spores. Designated "hospital disinfectants with tuberculocidal claim" by the EPA, and "intermediate-level disinfectants" by the CDC	Liquid contact		EPA-registered hospital disinfectant with label claim of tuberculocidal activity (e.g. chlorine-containing products, quaternary ammonium compounds with alcohol, phenolics, bromides, iodophors, EPA-registered chlorine-based product)	Noncritical with visible blood	Clinical contact surfaces. Blood spills on housekeeping surfaces
Low-level disinfection (products regulated by the EPA)	Destroys most vegetative bacteria, some fungi, and some viruses. Does not inactivate ***Mycobacterium tuberculosis* var. bovis**. Designated "hospital disinfectant" by the EPA, and "low-level disinfectant" by the CDC			EPA-registered hospital disinfectant with no label claim regarding tuberculocidal activity (e.g. quaternary ammonium compounds, some phenolics, some iodophors)	Noncritical without visible blood	Clinical contact surfaces. Housekeeping surfaces

* CDC. Guidelines for infection control in dental health-care settings – 2003. MMWR 2003; 52(No. RR-17):1–66.
† Inactivation of the more resistant *Mycobacterium tuberculosis* var. bovis is used as a benchmark to measure germicidal potency.

Pre-Cleaning of Soiled Areas

The presence of organic soil such as blood, saliva or other potentially infectious material can compromise the germicidal efficacy of surface disinfectants by chemically reacting with the disinfectant or by sequestering the active agent so that it cannot interact with microbes. To maximize a product's germicidal efficacy, surfaces should be pre-cleaned, i.e. cleaned with an absorbent material before the disinfectant is applied. This is good practice even for those products labeled "one step" that do not call for pre-cleaning on the label. In fact, the EPA requires that **all** disinfectants carry this label direction: "For **heavily soiled** areas, a pre-cleaning step is required." [Emphasis added.] Pre-cleaning is especially important when using bleach to disinfect because free chlorine will rapidly and indiscriminately react with any organic material. The net result is that there will be less free chlorine to react with pathogens, and the effect would be similar to diluting the bleach.

One-step and Two-step Disinfectant Products

There are two types of chemical germicides, as defined by their cleaning and disinfectant processes: one-step germicides and two-step germicides.

1. One-step disinfectant. These products, which claim to clean and disinfect hard surfaces in one operation, do not require the contaminated surface to be pre-cleaned (unless it is heavily soiled).

2. Two-step disinfectant. Two-step germicides require separate cleaning and disinfection operations under all conditions; a pre-cleaner removes soil from the contaminated surface, then the product is applied as a disinfectant. Some disinfectants also can be used as a pre-cleaner. The EPA does not require a two-step germicide to be tested in the presence of a serum soil load.

Lab Tests

Per EPA testing protocol for intermediate level spray disinfectants, we tested all products against a gram-negative, a gram-positive and a tubercule bacterium, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Mycobacterium bovis,* respectively.[3]

Hard Surface Test: *Staphylococcus aureus, Pseudomonas aeruginosa.* In addition to the test culture, inoculum for the one-step products (BIREXSE and DisCide ULTRA) included a soil load of 5 percent horse serum to simulate a moderately dirty surface. Each product was tested using the contact time stated in the manufacturer's directions for intermediate-level disinfection. The disinfectant was sprayed on an inoculated cover slip and after elapse of the manufacturer-recommended contact time, the cover slip was placed in growth media.

Hard Surface Test: *Mycobacterium bovis.* Each product was challenged by adding a soil load of 5 percent horse serum to the test culture, and tested using the contact time stated in the label directions. The disinfectant was sprayed on an inoculated cover slip and after elapse of the manufacturer-recommended contact time, the cover slip was placed in growth media.

Suspension Test for *Mycobacterium bovis.* All products were tested in suspension. A coverslip inoculated with the bacteria was placed in a test tube containing the disinfectant for the contact time recommended by the manufacturer. Additionally, germicides that claimed to be one-step disinfectants were challenged with a soil load of 5 percent serum.

Table 1. **Hard Surface Bactericidal and Tuberculocidal Test Results**

	Instructions	Bactericidal		Tuberculocidal	
		Contact Time (min.)	Effective?	Contact Time (min.)	Effective?
Asepticare TB + II	Two - step	3	Yes	6	Yes
BIREXSE	One-step	10	Yes	10	Yes
CaviCide Spray	Two - step	3	No	5	No*
Clorox Regular Bleach (1:100)	Two - step	5	No	10	No*
Clorox Regular Bleach (1:10)	Two - step	5	Yes	10	Yes
DisCide ULTRA†	One-step	1	Yes	1	Yes
GC Spray-Cide	Two - step	3	Yes	6	Yes
Lysol Brand I.C. Disinfectant Cleaner	Two-step	10	Yes	10	No*
Lysol Brand II I.C. Disinfectant Spray	Two - step	10	Yes	10	Yes
MicroStat 2‡	Two - step	5	Yes	5	Yes
Sporicidin Disinfectant Solution and Spray	Two-step	3	Yes	10	Yes

* In the quantitative suspension test, Lysol Brand I.C. Disinfectant Cleaner again failed to meet the performance standard for the inactivation of *M. bovis,* but CaviCide Spray and Clorox Regular Bleach at 1:100 passed.

† DisCide ULTRA displayed excellent bactericidal properties with the shortest contact time, but left a significant residue on a surface if left to dry. Its relatively high alcohol content allows it to evaporate more quickly than most other disinfectants. Sudsing upon removal with a sponge soaked in clean water required several rinses to completely remove.

‡ MicroStat 2 requires dissolving two tablets in tap water for use. However, at 22°C the tablets took up to 30 minutes longer to dissolve than labeled. Furthermore, tablets A & B are in similar packaging, which could easily lead to mixing mistakes, especially if one is in a hurry. Perhaps color-coded or distinctive lettering on the packaging would help. Mixing in an opaque container makes it difficult to determine when the tablets are completely dissolved.

Comments. CaviCide Spray failed the hard surface tuberculocidal test at a contact time of five minutes, but passed at a contact time of 10 minutes. Our test results for Lysol Brand I.C. Disinfectant Cleaner at a contact time of 10 minutes demonstrated that this product had almost no tuberculocidal activity. We conducted an additional experiment that tested double the concentration of this product's active ingredient, 2.5 percent citric acid, at 5.0 percent citric acid. Even a doubled concentration failed to meet the performance standard for tuberculocidal activity for the inactivation of *M. bovis*.

Discussion

Generally, any product including plain water will reduce microbial loads on surfaces through dilution or physical removal/cleaning action. However, only some products evaluated in this study met the performance standards set in the EPA protocols through their tuberculocidal activity. Even for products with effective active ingredients, the potential for acceptable disinfection is greater when surfaces are cleaned before applying the disinfectant.

The active ingredients determine the effectiveness against different microbes. For example, alcohols are added to quaternary ammonium detergent products (quat compounds) to achieve a tuberculocidal claim, since quats will not directly inactivate mycobacteria. Halogens and phenolics are directly tuberculocidal, but generally may have disadvantages (e.g., corrosive to equipment, strong odor, toxic) that quats do not have (Table 2).

The apparent inconsistency between the hard surface and suspension tuberculocidal tests for Clorox Regular Bleach highlights differences in standard testing methodologies. Water beads and evaporates on hard surfaces at varying rates among products, which may leave some mycobacteria inocula without the full contact time required for efficacy. This likely would occur in clinical use. We chose to present the results of the hard surface testing rather than the suspension test, because the hard surface test more closely approximates conditions of product use in a dental office.

The suspension test gives us some information on the antimicrobial potential of a product by testing the potency of the active agent(s) in a germicide unencumbered by hard surface test difficulties such as maintaining a completely wet surface throughout the length of the contact time, thus ensuring full contact time. For this reason, a germicide may pass the suspension test but fail a hard surface test. Alternatively, if a product fails the suspension test yet passes the hard surface test, factors such as the physical removal or cleaning of the inoculum from the test surface should be considered as contributing to reduction of viable numbers of the inoculum rather than the germicidal action of the active agent. Therefore, the potency of the active agent must be questioned, at least at the concentration tested.

Our testing of Lysol Brand I.C. Disinfectant Cleaner, with an active ingredient of 2.5 percent citric acid, at a contact time of 10 minutes found that it has very little tuberculocidal activity. Neither were we able to find any published literature that supported tuberculocidal activity for 2.5 percent citric acid. We performed an additional experiment that tested twice the concentration of this product's active ingredient, or 5.0 percent citric acid. Even at double the concentration, citric acid failed to meet the performance standard for tuberculocidal activity.

Table 2. **Intermediate-level Disinfectant Product Features According to Manufacturers**

Product Manufacturer	**Active Ingredients**	**Type**	**Ready to use**	**Shelf-life**
Asepticare TB + II Ecolab	isopropyl alcohol, 21%; n-alkyl dimethyl benzyl amm Cl, 0.154%; n-alkyl dimethyl ethylbenzyl amm Cl, 0.15%	alcoholic dual quat	yes	N/S
BIREXSE Biotrol International	o-phenylphenol, 7.7%; p-tertiary amylphenol, 7.6%	phenolic	no, mix w/ tap water	about 1 year
CaviCide Spray Metrex Research Corp.	isopropyl alcohol, 17.2%; diisobutylphenoxyethoxyethyl dimethyl benzyl amm Cl, 0.28%	alcoholic single quat	yes	about 2 years
Clorox Regular bleach Clorox Co.	6.00% Na hypochlorite	halogen	no, mix fresh daily at 1:10 dilution in tap water	1 day, diluted
DisCide ULTRA Palmero Health Care	isopropyl alcohol, 63.25%; n-alkyl dimethylbenzyl amm Cl, 0.12%; n-alkyl dimethyl ethyl benzyl amm Cl, 0.12%	alcoholic dual quat	yes	N/S
GC Spray-Cide GC America Inc.	isopropyl alcohol, 21%; n-alkyl dimethyl benzyl amm Cl, 0.154%; n-alkyl dimethyl ethylbenzyl amm Cl, 0.154%	alcoholic dual quat	yes	about 2 years
Lysol Brand I.C. Disinfectant Cleaner Reckitt Benckiser	citric acid, 2.5%	citrus	yes	N/S
Lysol Brand II I.C. Disinfectant Spray Reckitt Benckiser	ethanol, 79%; alkyl dimethylbenzyl amm saccharinate, 0.1%	alcoholic single quat	yes	N/S
MicroStat 2 Septodont Inc.	Na bromide, 9.7%; Na dichloroisocyanurate dihydrate, 24.75%	halogen	no, 2-part ingredient mix	7 days, after mixed
Sporicidin Disinfectant Solution and Spray The Sporicidin Company	phenol, 1.56%; Na phenate, 0.06%	phenolic	yes	N/S

N/S = Not Stated

Lysol Brand Disinfectant Products: Notable Issues

We tested two Lysol products: Lysol Brand II I.C. Disinfectant Spray (aerosol can) and Lysol Brand I.C. Disinfectant Cleaner (refillable pump spray bottle). Both products are registered with the EPA as germicides with tuberculocidal claims, and thus, presumably, are indicated as appropriate for use in a dental operatory.[4]

As indicated in Table 1, test results for Lysol Brand II I.C. Disinfectant Spray (aerosol can) indicate this product is appropriate for use in a dental clinic as an intermediate-level disinfectant.

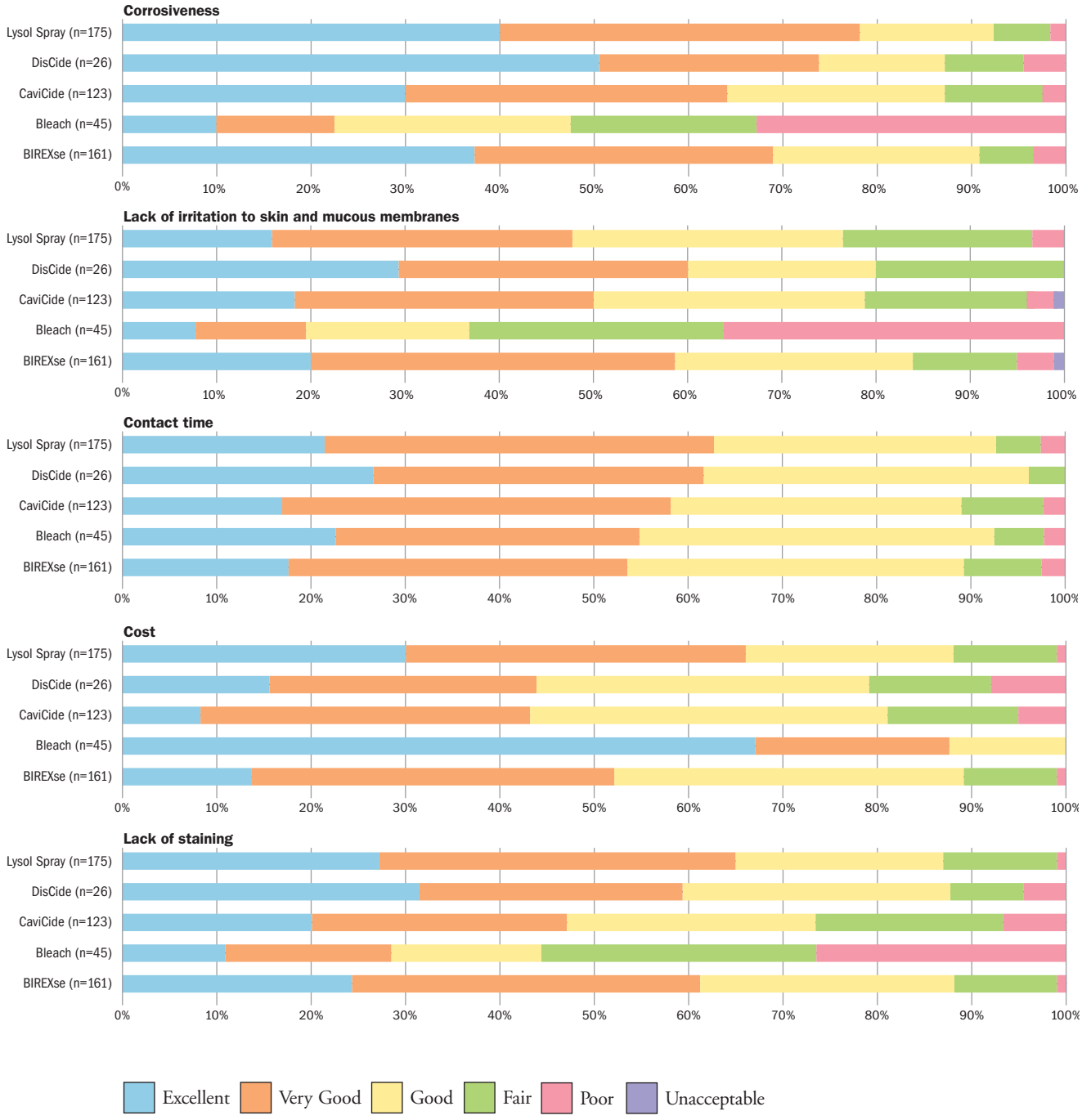
Regarding Lysol Brand I.C. Disinfectant Cleaner (pump spray cleaner), ADA laboratory staff initially tested this product, believing it was identical to the above-referenced aerosol product. Both of these products are strikingly, and confusingly, similar in their packaging and label design. Each product makes a tuberculocidal claim.

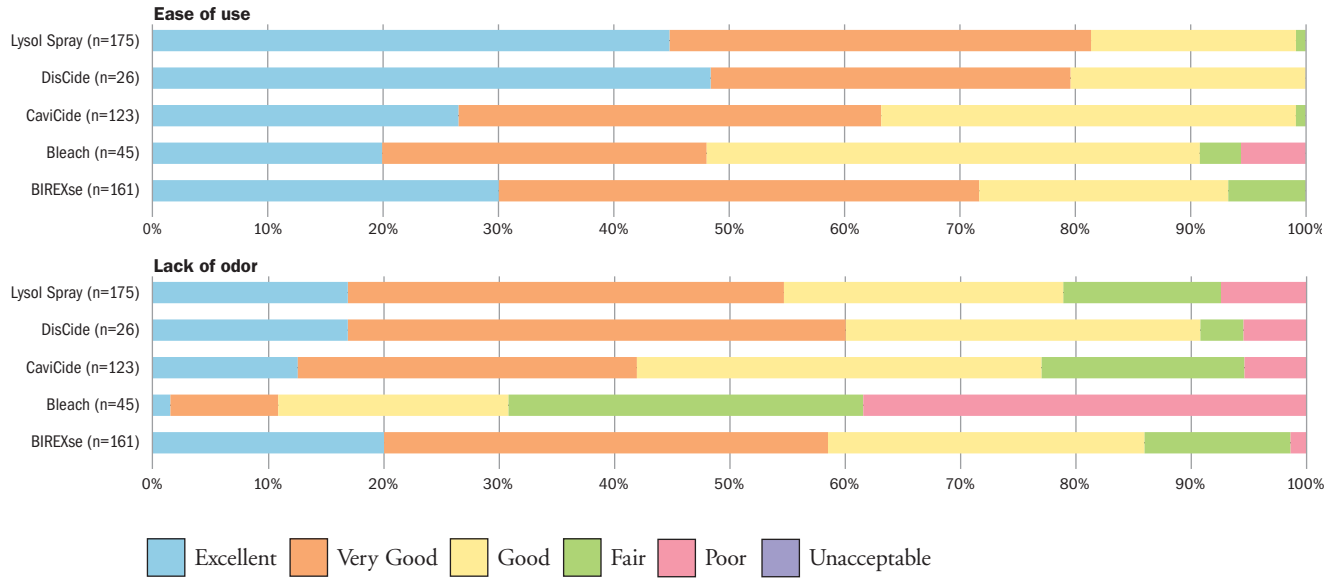
However, these products differ significantly in their active ingredients and efficacy. Lysol Brand II IC Disinfectant Spray contains alcohol with a quaternary ammonium chloride, while Lysol Brand IC Disinfectant Cleaner contains citric acid. The latter product passed the hard surface bactericidal tests against *Staphylococcus aureus* and *Pseudomonas aeruginosa*, but in the suspension test failed to meet the performance standard for the inactivation of *M. bovis*. It also failed the hard surface tests for tuberculocidal activity.

Reader Tip: When shopping for either of these Lysol products, scrutinize their respective product details or ask about the active ingredients to avoid confusion.

Practitioner Input

In our Web-based survey, a total of 530 dentists rated the selected products on a scale from "Excellent" to "Unacceptable" in each of the following categories: corrosiveness; lack of irritation to the skin and mucous membranes; contact time; cost; lack of staining; ease of use; and lack of odor. Ratings are more reliable when based on a larger number of respondents. See below.





General Discussion

The most popular products were Lysol Brand II I.C. Disinfectant Spray, BIREXSE and CaviCide. Not surprisingly, survey respondents rated bleach as the product most corrosive and irritating to skin and mucous membranes. Bleach also rated poorly with respect to odor, but was rated the most cost effective. Remember that when using bleach it is important to dilute a fresh 1:10 solution with water each day to ensure potency.

References
1. CDC. Recommendations for prevention of HIV transmission in health-care settings. MMWR 1987;36(No.52).
2. BD Davis, R Dulbecco, HN Eisen, HS Ginsberg. Microbiology, 4th ed. Philadelphia. JB Lippincott 1990:61.
3. Editor's note: EPA testing protocol does not require spray intermediate-level surface disinfectants to be tested against Salmonella. Testing against this bacterium, which is the most often reported cause of foodborne illness (http://www.cdc.gov/ncidod/dbmd/diseaseinfo/salmonellosis_g.htm), would be more appropriate for disinfectants intended for use on food processing equipment. *Pseudomonas aeruginosa* primarily is a nosocomial pathogen.
4. CDC. Guidelines for Infection Control in Dental Health-Care Settings - 2003. MMWR 2003;52(No. RR-17).

Your Views

Sensor Durability

I noticed your reply to the question on digital sensors (PPR Volume 2, Issue 3). I used the DEXIS digital sensor for mass disaster identification response during the Oklahoma City May 3, 1999 tornado and the Katrina Hurricane response in Louisiana. Both situations placed the sensors in conditions one would never see in the normal dental practice. During Katrina, hundreds of digital radiographs were taken daily using the DEXIS sensors and Nomad portable X-ray units. Both the X-ray units and digital sensors worked flawlessly and with no break downs. I have personally used these sensors in my practice for over ten years and I have had no problems. I do agree the replacement agreements are important in case of workmanship issues, but I don't expect any company to cover a sensor for misuse or neglect. The thicker hard cased sensors tend to be more resilient than the thinner sensors that are damaged if bent. I would think damage to a sensor with tooth imprints present from repeated patient biting would be considered due to misuse and poor technique training. As with any new technology a certain learning curve is expected, but I have found staff and patients both accept the sensor we use and enjoy the features and benefits of digital radiography.

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Corrections

- PPR, Vol. 2, Issue 2. Table 3 incorrectly listed that M11 UltraClave (Midmark) sterilizer has a DI water system. The PVdry2 has this feature.
- PPR, Vol. 2, Issue 3. Figure 1 on page 3 was mislabeled; the x-axis indicates frequency and the y-axis indicates amplitude.

The PPR regrets the errors.