The Sterility of Dental Burs Directly from the Manufacturer

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ABSTRACT

Background: The purpose of this research was to assess the sterility of burs directly from manufacturers. The authors wished to determine the types of bacteria, if any, found on nonsterilized burs.

Methods: The authors used burs from a major manufacturer. Sterilized and nonsterilized burs were cultured for bacteria. Any burs found to be contaminated were further cultured on agar plates. The bacteria on the plates were identified by a commercial laboratory.

Results: Of the 100 sterilized and nonsterilized burs, the authors found none of the sterilized burs to be contaminated. Eight of the nonsterilized burs showed growth of bacteria after 24 hours. Seven of the eight bacteria identified on the burs belonged to the genus *Bacillus*.

Conclusions: The *Bacillus* genus is encountered in daily living and is not considered to be pathogenic; however, there have been documented cases of infection in humans in which these bacteria dominate. They should never be introduced into the bloodstream.

CLINICAL SIGNIFICANCE

The dentist must consider that soft tissue exposure may be unavoidable with subgingival restorations or even those close to the gingiva. Therefore, it is imperative that the dentist use sterile burs during dental procedures. This article will prove the necessity for sterile burs and leave the rest to the manufacturers.

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INTRODUCTION

Dental practitioners replace dental handpiece burs on a regular basis. When a dentist receives burs from the manufacturer, it is recommended that the dentist sterilize the bur before its initial use. Some manufacturers presterilize burs, but not all. It is important to know whether the burs being used on a patient have been through a sterilization process. The US Centers for Disease Control (CDC) classify dental burs as *critical* due to possible uses including penetration of soft tissue or bone. Because they have the highest risk for transmitting infection, the CDC recommends that burs be sterilized minimally with heat to prevent transmission of infectious agents.[1] However, repeated sterilization procedures affect the sharpness and ability of the

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bur to effectively cut tooth structure.[2]

If the bur is received from the manufacturer in a sterile condition, additional sterilization would not be necessary. This would serve to increase the life and cutting efficiency of the bur. It would further serve to make the dentists' practice more productive and cost efficient. Most dentists know from experience that 9 or 10 visits to the autoclave may be devastating to a bur. If one of these can be eliminated by receiving burs sterile, it will increase a bur's functional usage time by around 10%. The purpose of this study was to assess the sterility of prepackaged burs from a major dental bur manufacturer when compared with a control of autoclave-sterilized burs from the same company.

MATERIALS AND METHODS

This research was carried out under a laminar flow hood, in an aseptic environment. All surfaces and gloves were cleaned with 70% isopropyl alcohol and sterilized instruments were used to open the packaging and handle the burs. Two hundred nine autoclaved microtubes of Luria-Bertani (LB) broth were prepared. In each 2-mL tube, one bur was placed in 1,250 µL of the LB broth (enough broth to cover the bur completely). The burs were a combination of carbide and diamond burs by Brassler, who openly state that their burs should be sterilized before use. Seven hundred fifty microliters of air in each tube were left to allow for aerobic metabolism. Two hundred tubes were prepared for testing of 200 burs. One hundred burs used as the controls were sterilized by autoclave while still inside the manufacturer's package. The 100 burs to be evaluated were taken directly from the manufacturer's package. For both study and control burs, aseptic techniques were employed throughout the evaluation. Autoclaved tweezers and scissors were utilized to open the manufacturer's packets and remove the bur. Ten microtubes were opened at one time, and each one was closed as its respective bur was dropped in. Once the bur was dropped in the microtube of broth, the lid was carefully closed to ensure that the contents of each microtube were not contaminated through operator manipulation.

A total of nine control samples were prepared to include three positive and six negative microtubes. The positive control sample tubes were inoculated with *E. coli*. *E. coli* was chosen because it is known to grow particularly well with LB agar. None of the control microtubes contained burs. All tubes were placed in a shaking incubator at 37°C at 200 rpm for 24 hours to continuously aerate the broth in the tubes at a temperature to promote growth.

Following incubation, the microtubes with bacteria were streaked and cultured on LB agar plates. The microtubes that did not show cloudiness after incubation did not contain sufficient bacteria to infect a patient. Under a flame, with sterile gloves and countertops, 10 agar plates were streaked in a hexagonal pattern, streaking and turning the plate in a counterclockwise direction. Eight plates contained sample bacteria from the microtube cultures. One positive control was streaked with *E. coli*, and a negative control plate was streaked with the previously prepared negative control microtube solution. The plates were placed in an incubator at 37°C for 24 hours. All plates that grew cultures were sent to a laboratory (MIDI Labs, Inc. Newark, DE, USA) for identification. Bacterial identification was accomplished by the commercial laboratory using fatty acid profiles and 16S rRNA gene alignment profiles.

RESULTS

No autoclaved burs out of the 100 autoclaved burs submitted were found to contain bacterial contamination. The nine control samples were also free of any bacteria. Eight of the 100 nonautoclaved burs were contaminated with unspecified bacteria. These tubes, containing the contaminated burs, became cloudy after 24 hours of incubation. The bacteria, once streaked on agar and cultured, were sent to MIDI Labs,

Inc. for identification. A plate was also streaked with one of the negative control preparations, and it did not show growth of any organisms. The results from the laboratory, while not 100% conclusive, identified the bacteria present. The bacteria identified include *Bacillus amyloliquefaciens*, *Bacillus atrophaeus*, *Bacillus laevolacticus*, *Bacillus licheniformis*, *Bacillus mojavensis*, *Bacillus pumilis GC subgroups A* and *B*, *Bacillus subtilis*, and *Paenabacillus lentimorbus*. Table 1 shows the distribution of the bacteria on each of the eight plates.

DISCUSSION

Upon communication with six major bur manufacturers, it was noted that it is not standard practice to sterilize burs from any company. Two of the companies stated that they gamma sterilize only one line of burs: (1) Microcopy (Kennesaw, GA, USA) and their Neodiamond line and (2) Premier and their Solo Disposables (Plymouth Meeting, PA, USA). Kerr Dental (Orange, CA, USA), Dentsply (York, PA, USA), Midwest (Mondavi, WI, USA), and Star Dental (EZ Dental; Lancaster, PA, USA) do not presterilize any burs or diamonds. It seems that the disposable burs, which are meant only to be used once and then thrown away, come presterilized. The burs used in this experiment came from Brassler and were, as previously mentioned, not sterilized from the manufacturer.

Almost all of the microorganisms found were members of the genus *Bacillus* and are rod-shaped gram positive bacteria. *P. lentimorbus* was also identified. This bacterium infects insects and is not pathogenic to humans at all. *Bacilli* are spore-forming, aerobic bacteria that have a generation time of about 25 minutes. The genus is extremely versatile and extremely common.[3] There are currently 40 recognized species in the genus. The genus *Bacillus* is itself extremely diverse; between species, there are substantial genetic differences. Another characteristic of this genus is their formation of endospores. Endospores are highly refractile resting structures formed in cells. They have been proven to be the most durable cell in nature, being able to remain viable for millions of years. They can endure extreme heat, radiation, strong acids, and disinfectants.[4]

Bacillus species are ubiquitous to water, soil, air, and dust. They are found almost everywhere and humans come in close contact with them on a regular basis. In an area such as a dental office, one would expect to find several *Bacillus* species in the air around the patient. This is why the genus has been associated with nosocomial infections. Other infections to which *Bacillus* has been linked include endocarditis, and infection in immunosuppressed patients, transplant patients, and patients undergoing chemotherapy. The majority of infections have been determined to be aerially distributed. There have not been many documented cases of healthy patients developing infection from such species.[3]

Only two species of Bacillus have been recognized as serious human pathogens: *Bacillus anthracis* and *Bacillus cereus*. *B. anthracis* is the cause of anthrax. Because of its antiphagocytic capsule and toxins, it can be fatal to humans. *B. cereus* is known to cause food poisoning similar to *Clostridium botulinum*.[4]

According to the US Environmental Protection Agency (EPA), *B. licheniformis* is ubiquitous in the

TABLE 1. SPECIES IDENTIFIED BY MIDI LABS, INC. ON EIGHT PLATES.

Plate	1	2	3	4	5	6	7	8
Bacillus licheniformis	+	–	+	+	–	+	–	+
Bacillus laevolacticus	+	–	+	+	–	–	–	–
Bacillus subtilis	+	–	+	+	+	+	+	–
Paenabacillus lentimorbus	–	+	–	–	–	–	–	–
Bacillus atrophaeus	–	–	–	–	+	–	–	–
Bacillus pumilis GC subgroup A	–	–	–	–	–	+	–	+
B. pumilis GC subgroup B	–	–	–	–	–	+	–	–

environment. It is commonly found in soil in spore form. They admit that the possibility of human infection exists, but it is extremely low. The rare cases of infection with *B. licheniformis* were isolated to immunocompromised individuals and those who had recently experienced trauma, but only when the individual has been exposed to high numbers of the bacteria. The EPA stated, "While not completely innocuous, *B. licheniformis* presents low risk of adverse effects to human health or the environment." *B. licheniformis* was one of two species that was found on more than four of the eight plates (refer to Table 1).[5]

The only other organism found on more than half of the burs was *B. subtilis*. This bacterium is found commonly in soil, air, and decomposing plant residue. It is said within the microbiology community that *B. subtilis* is the *E. coli* of gram positive bacteria. It has not been found to contain any attachment apparatus that is capable of colonization within humans. It may be possible for *B. subtilis* to survive in the gastrointestinal tract or skin of humans, but it is very unlikely to be found anywhere else. Examples of infections from which this species was isolated are: endocarditis in a drug abuse patient, pneumonia in leukemia patients, and surgical wound drainage sites. In conclusion, *B. subtilis* is not considered a human pathogen and virulence characteristics are low. As with most *Bacillus*, the organism must be present in large numbers or in an immunocompromised individual to cause problems.[6] The Public Health Agency of Canada issued an official list of nonpathogenic organisms in 2001. All of the species identified were included on the list.[7]

Consultation with the Department of Microbiology at Nova Southeastern University disclosed that the organisms may be potentially harmful to use on patients who are at risk for infection due to systemic illness or are otherwise immunocompromised. There have been a limited number of documented infections to healthy humans with any of the cultured bacteria. In a dental office, these bacteria would be encountered in the clinical operatory setting. They could be harbored in the air, on the patient, and on the nonsterile operatory surfaces. Because burs may come into intimate contact with soft tissue, they cannot be contaminated with any bacteria that have even a remote chance of causing harm to the patient.

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