Microbiota Found in Protective Athletic Mouthguards  April 8, 2011

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Abstract

Background: Protective athletic mouthguards (PAM) produce oral mucosal injuries and may be associated with other systemic conditions.

Hypothesis: With wear, PAM become contaminated by a range of microorganisms. The number of microorganisms in PAM can be reduced by daily use of an antimicrobial solution. Study Type: Case series.

Study Design and Methods: Sixty-two division I football player volunteers were divided into 4 groups, using PAM for varying lengths of time before surrendering them for microbial analysis. One group had their PAM soaked in an antimicrobial solution between uses. The PAM were analyzed qualitatively and quantitatively for bacteria, yeasts, and fungi, using previously accepted methods.

Results: The 62 football players surrendered a total of 81 PAM for microbial analysis. The PAM yielded 154 gram-positive cocci, 150 gram-positive bacilli, 21 gram-negative cocci, 31 gram-negative bacilli, 22 yeasts, and 107 molds. The most common species of gram-positive cocci were Staphylococcus spp. and Micrococcus spp. Only 3 PAM (4%) were positive for Staphylococcus aureus. The most common species of gram-positive bacilli were Brevibacterium spp. and Cellulomonas spp. The most common species of yeasts were Candida parapsilosis and Rhodotorula mucilaginosa, while the most common species of mold were Cochliobolus spp. and Penicillium chrysogenum. Soaking the PAM in an antimicrobial solution between uses substantially reduced the numbers of microorganisms.

Conclusions: Substantial microbial contamination of PAM occurs with use. The microbial load can be reduced by soaking in an antimicrobial solution between uses. Clinical Relevance: PAM are contaminated by microorganisms that have the potential to produce oral and systemic diseases. They should be sanitized daily and changed when they become sharp and/or jagged.
Researchers warn of mouth guard contamination
By Laird Harrison, Senior Editor

June 4, 2009 – Mouth guards may protect teeth from trauma, but the bacteria and fungus they contain are making athletes sick, according to researchers from Oklahoma State University (OSU).

In a study presented at the recent American College of Sports Medicine annual meeting in Seattle, the researchers reported that mouth guards worn by football players may harbor harmful microorganisms, including antibiotic-resistant bacteria.

“Mouth guards should be discarded at least every two weeks.”

— R. Thomas Glass, D.D.S., Ph.D.

"Mouth guards should be discarded at least every two weeks," said R. Thomas Glass, D.D.S., Ph.D., a professor of forensic sciences, pathology, and dental medicine and an adjunct professor of microbiology. In addition, he recommends sanitizing the mouth guards between uses, a protocol that no athletes routinely follow, as far as he knows.

Asked to comment on the study, John Molinari, Ph.D., director of infection control and safety at the University of Detroit Mercy School of Dentistry, noted that finding bacteria on mouth guards doesn't prove they are making people sick. "People assume the bacteria automatically cause infection," he said. "You need to show us the cases."

Dr. Glass and his colleagues say they do have evidence that mouth guards cause lesions in the football players' mouths, and they will present it in a forthcoming article in *Sports Health*. "It's actually causing disease," Dr. Glass said.

Lesions increased

For the study, the researchers analyzed the mouth guards of 62 Division I football players from the National Collegiate Athletic Association (NCAA). Before the study began, the 62 players had a collective total of 85 lesions (1.4 per player), Dr. Glass said. By the end of the season, the 53 who completed the study had 198 lesions (3.74 per player). In addition, the lesions increased in severity over the season.

The area of the mouth in which the lesions appeared further supported the idea that the mouth guards were causing them, Dr. Glass said. The number of lesions on the palate, which isn't touched by a mouth guard, decreased. But the number of gingival, buccal, and tongue lesions increased.

Much of the research focused on the organisms on the mouth guards. The researchers examined 84 mouth guards and found 164 gram-positive cocci, 158 gram-positive bacilli, 13 gram-negative cocci, and 23 gram-negative bacilli. Of the gram-positive cocci, 57% were methicillin-resistant and 5% were resistant to vancomycin, one of the antibiotics of last resort against methicillin-resistant bacteria, said Stan Conrad, Ph.D., an OSU professor of microbiology.
In addition, the researchers found 21 isolates of yeast and 108 of mold. "Almost anyone who is breathing down large quantities of mold spores has the potential to develop exercise-induced asthma or other respiratory diseases," Dr. Glass said.

The researchers were unable to measure respiratory effects in this study, and they did not culture microorganisms in the athletes' lesions. However, in a previous article (General Dentistry, September/October 2007, Vol. 55:5, pp. 436-440), they reported a case in which they found the same microorganism in an athlete's infected leg as on his mouth guard. The researchers said that mouth guards become jagged because athletes chew on them. The jagged edges may cut into soft tissue, allowing bacteria to enter the bloodstream. The athlete in the case study had a bruised leg, and blood may have rushed to the site, carrying bacteria with it, they theorized.

Athletes should throw away their mouth guards every two weeks or as soon as they become jagged, whichever comes first, Dr. Glass said. Mouth guards sell for less than $2 each off the shelf, he noted. He also said there is no advantage to custom-made mouth guards; in fact, a tighter fit may increase the enclosed spaces where microorganisms flourish.

Dr. Glass and Conrad also recommend that athletes use denture-sanitizing products daily on their mouth guards. While the pathogens can escape into the pores in the plastic that are too small for sanitizer molecules to enter, the sanitizers can reduce the number of bacteria on the surface, they said.

**Ultraviolet sanitizer**

At least one mouth guard manufacturer, Brain-Pad, is now offering a specially designed mouth guard sanitizer, NatureZone, that uses ultraviolet light and ozone to sanitize the mouth guard. In promoting it, the company cites Dr. Glass' research about the dangers of pathogens on mouth guards and says the device "will destroy 99.9% of any known infectious bacteria."

Dr. Glass and Conrad said they couldn't comment on NatureZone because they haven't studied it directly. But whether reducing the number of bacteria by 99.9% is sufficient depends on how many bacteria are on the mouth guard to begin with, Dr. Conrad said. "It doesn't matter much if you reduce the amount of bacteria from $10^{13}$ to $10^{10}$.

Ultraviolet light may not be effective because shadows may be within microscopic pores and fissures that shelter microorganisms from light, Dr. Glass said. "The effective killing drops off substantially with the square of the distance," he said. Ozone has the same problems, he added in an e-mail.

Asked for a response, Brain-Pad spokesman Chris Bolan provided DrBicuspid.com with a copy of a test report conducted by Food Lab-Taipei earlier this year. The test showed a 99.98% or 99.99% reduction of *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Salmonella typhi*.
Possible disease transmission by contaminated mouth guards in two young football players

R. Thomas Glass, DDS, PhD "C. Rieger Wood, DDS .James W. Bullard, BA, MS .Robert S. Conrad, PhD

The vulnerability of teeth to trauma from contact sports (such as football and ice hockey) has underscored the protection provided to the dentition by athletic mouth guards. The ADA also has recommended mouth guards for all contact sports. Football and ice hockey players at all levels have been the most compliant in wearing mouth guards, to the extent that failure to do so can result in a team penalty.

Recent studies of mouth guards retrieved from football and ice hockey players found that these devices harbor a wide range of opportunistic or frank pathogenic bacteria as well as fungi, including both yeasts and molds. When these mouth guards were examined by scanning electron microscopy (SEM), the matrices were found to be equally porous to dentures, as reported in the literature. Microorganisms were found both on the surfaces and in the porosities of the used mouth guards; these microorganisms often were incorporated into well-established, complex biofilms.

These studies also demonstrated that used mouth guards have sharp and jagged edges capable of lacerating the oral tissues. This means that the mouth guard microorganisms have direct access to the rich vascular system of the oral cavity; in addition, the acts of swallowing and mouth-breathing during mouth guard wear provide microorganisms with direct access to the gastrointestinal and respiratory tracts. Recent studies have compared the spectrum of microorganisms found in mouth guards worn by football and ice hockey players to those found in mouth guards worn by medical student volunteers.

Several articles further underscore the unique types of infectious diseases associated with athletes. One article documented the problems that football players, wrestlers, and fencers experienced with methicillin-resistant Staphylococcus aureus (MRSA).

Summary

The two cases presented in this article strongly implicate disease transmission by mouth guard wear. While wearing a mouth guard to protect teeth is well-established and required in many sports, cases such as those presented in this article underscore the importance of proper mouth guard hygiene. Previous studies have shown that athletic mouth guards can harbor a wide range of opportunistic and frank pathogenic microorganisms. The rough and jagged nature of worn mouth guards allows for laceration of the oral tissues and for vascular dissemination of the microbes. The aspiration of the types of mold found in mouth guards could be an important etiologic factor in the rise of EIA seen in athletes. The authors recommend discarding mouth guards on at least a weekly basis. Because “boil and bite” mouth guards are so inexpensive, these might be considered as single-use mouth guards.

You wash your forks and spoons...why not your toothbrush?

Lately more studies and Public Service Ads are addressing the widespread of E.Coli, Staph, Strep and Yeast/Fungus contamination. From toothbrushes and mouth guards to ATMS; public restroom’s faucet handles and paper dispenser levers to cell phones and remotes, even hospitals. Hotel remotes are notorious for contamination. With a wide range of users, there is no guarantee that everyone washes their hands before handling remotes.

Improper hand washing is a culprit. So are toothbrushes, Protective Athletic Mouthguards (PAM) or the air you breathe and share.
There are certain requirements for proper hand washing. An ample dose of regular soap dispensed along with thorough washing for a specific length of time is necessary. If you are doing it right, time measured would be to the “Happy Birthday” song.

**Staph, strep and yeast in the mouth are common and considered normal.** There is about 500 to 1,000 bacterium in the mouth. Everything is fine until they multiply into unhealthy levels or get into the bloodstream.

These unhealthy levels may increase when the immune system becomes compromised. The immune system becomes compromised by:

1. stress
2. poor eating habits/diet
3. poor dental hygiene
4. improper elimination (yeast overgrowth can occur)
5. medications
6. social drug use
7. disease
8. being a transplant patient
9. cancer patient
10. or auto-immune disorder such as Lupus, Chronic Fatigue Syndrome or AIDS.

These bacteria and virus strains can get into the bloodstream by:

1. brushing so hard that the gums bleed (healthy gums with regular brushing, don’t bleed, if they do there is a problem)
2. biting your tongue or cheek to the point of bleeding
3. biting down on a protective athletic mouthguard PAM where it produces a cut
4. Surgery
5. Injuries
6. Dental work.

Germs are invisible. Some hospitals are initiating a no tie policy. They recognize that ties are not cleaned on a regular basis. Unless a tie has a visible stain it may not get cleaned for awhile.

Most hospitals and some public restrooms have no toilet lids to close; many have high pressure flushing valves. In 1975 Dr. Charles Gerba from U of A concluded that flushing the toilet with lid open sends aerosolized e.coli from fecal matter airborne propelling as far as 6 feet landing and causing contamination. Researchers refer to this as “aerosolized toilet funk”. An audience member’s lipstick was tested and Dr. Oz reported it was contaminated with E.Coli. **Whatever is stored in the bathroom is fair game.**

A cough, a sneeze a toilet flushed with an open lid all have the potential to release into the air you breathe – airborne pathogens.

Washing your hands properly is a good practice. **Reducing the germs in your environment is another.**

**Toothbrushes become contaminated after 4-7 days of regular use** and highly contaminated after 17-24 days. Those microbes in your mouth (the Staph, Strep and Yeast) remain on the toothbrush. Every time you brush their numbers increase. Moisture on toothbrushes allows these microbes to reproduce. And some will travel to a nearby toothbrush infecting it.

Strictly **rinsing under tap water does not sanitize or clean the toothbrush or your hands.** Cleaning toothbrushes in the microwave or dishwasher can dry out and damage bristles.

**James Song, a biochemist** from Wisconsin University has written a book titled "Why Your Toothbrush May Be Killing You Slowly: How Chronic, Silent Infections from Toothbrush Germs Cause Damaging, Long-term and Silent Inflammation Throughout the Body".

**Protective Athletic Mouthguards (PAM) are the focus and concern of Dr. Tom Glass** from OSU. Numerous studies cite these mouthguards worn by athletes to carry a high level of contaminants. Staph through cuts is entering the bloodstream. Some of these Staph infections are so difficult and in certain cases impossible to treat. Methicillin-resistant staph (MRSA), a potentially fatal bacteria have left Doctors no option but to amputate a limb.

It is being **recommended to sanitize PAM after each use or discard them.**
Ventilation systems (heating and a/c) at home or in public venues may not be regularly cleaned and decontaminated. You are breathing the same recycled air as everyone else in the building.

**Bocca Pura Daily Toothbrush & Space Purifier is the solution.** When sprayed onto toothbrush bristles, mouthguards or in the air - Bocca Pura goes to work instantly eliminating 99.9% of germs on contact.

Bocca Pura is more than an air freshener. Bocca Pura purifies and oxygenates the air you breathe offering up a clean fresh scent. It is non-aerosol, contains no harmful chemicals and does not leave a chemical or strong perfume odor.

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Dentistry News

**How Clean is Your Mouth Guard?**

OKLAHOMA, April 2008 — Researchers at Oklahoma State University (OSU) believe that athletic mouth guards may potentially do more harm than good. The American Association of
Orthodontists recommend that athletes use mouth guards to protect their teeth. While nobody is arguing the benefits associated with athletic mouth guards, questions have been raised about hygiene.

OSU microbiologist Dr. Tom Glass has been studying the contamination potential of athletic mouth guards. Dr. Glass swabbed a number of used mouth guards to study the different types of germs that were present. Expecting to find a variety of bacteria, Dr. Glass and his team were shocked to find that the germs were multiplying at an incredibly dangerous rate. Strep, staph and pneumococci are a mere sampling of the bacteria that can grow on a dirty mouth guard. Dr. Glass even found methicillin-resistant staph on a mouth guard, a potentially fatal bacteria.

Dirty mouth guards are more than an oral health concern.

The lungs could be affected from molds that are inhaled during use; the stomach and digestive tract could be affected by ingested bacteria; and cuts in the mouth could allow bacteria from the mouth guard to reach the bloodstream, where it could have devastating effects.

How do you protect yourself? Mouth guards should be washed thoroughly with boiling water after use and kept in a clean place. Unfortunately, washing is not enough to remove all the germs that could penetrate a mouth guard. Oral health practitioners generally recommend that mouth guards be replaced every couple of weeks to prevent bacterial growth and any associated health concerns.

**Bacteria in the mouth**

www.self-health-tips.blogspot.com/2008/03/mouth-bacteria.html

Your face is the mirror of your health. Sometimes the condition of your mouth can give you clues regarding your overall health. Maintenance of a good oral hygiene is very necessary during today's hectic lifestyles. You will be surprised to know that your body's well being lies entirely on the health of your mouth. Mouth bacteria can cause several oral ailments, including bad breath and infections.

From your mouth, you can observe various symptoms that can help you identify health problems that can indicate the first signs of a chronic disease. There are many mouth related disease such as gum disease which is caused by a mouth bacteria. People can avoid these bacteria if they maintain good oral health such as daily brushing and flossing. However, this is sometimes not sufficient because harmful bacteria can grow out of control and they can lead to infection or any serious disease. Saliva is a key to fight against bacteria and viruses because it contains enzymes that can fight against mouth bacteria different ways.

When your mouth is healthy, bacteria usually never enters into bloodstream, otherwise it can cause serious diseases. Sometime due to invasive treatments, it may allow bacteria to enter into your bloodstream. There are many reasons such as reduce saliva-flow or disruptions of normal balance of bacteria in your mouth may encourage bacteria to
enter into bloodstream. It is believed that these bacteria from your mouth are linked to several health related problems with your body.

There are more than 100 species of bacteria along with hundred species of fungi, protozoa and viruses that can cause mouth related diseases. Additionally there are more than 500 other living, breathing microorganisms inhabiting in our mouths out of which only 50 have been identified and named.

The most harmful mouth bacteria inhabiting in our mouth is streptococcus mutant strain, which is a cavity causing bacteria. It was initially thought to be a harmless bacterium, but later it was found to be harmful for mouth. The source of this bacterium is sugar; it thrives upon refined sugar and as a part of its digestive process that converts sugar into acid.

There are many harmful affects of bacteria such as it can decay our tooth. That is why people should brush their teeth after eating and avoid too many sweets. It is also recommended by dentists, that people should not open their mouth very now and then; this is the best way that they will avoid bacteria into their body, most of the time these harmful mouth bacteria either kill by mouth enzymes or stomach acids.

Some bacteria can be helpful and they can destroy harmful mouth bacteria without causing any harm to your body.