Poster # **2245**

Treatment of Musical Instruments (Highland Bagpipe) as a Potential Infective Reservoir for Respiratory and Oro-Pharyngeal Infective Diseases

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Abstract

Bacterial accumulation in the air sac of bagpipes increases with each exhalation into the instrument. As air escapes the bag with playing, aerosolized bacteria may also escape, exposing the player and bystanders to potentially dangerous bacteria. There is evidence that may link oral diseases with systemic diseases, specifically pulmonary diseases. Such a link, if confirmed, might be an alternate explanation for numerous respiratory infections.

Objective: To determine if a disinfectant (BioSURF™) will eliminate all vegetative bacteria from a used bagpipe air sac.

Method: A previously used bagpipe air sac was filled with 500mL of sterile deionized water. The inner surface was exposed to the water for 5 minutes. Water was drained and effluent collected in a sterilized container. 500mL of disinfectant (BioSURF™) was added to the air sac for 5 minutes. Disinfectant was drained and effluent collected in a sterilized container. Final rinse of water was repeated. 100µL of each sample were serially diluted in 10^{-1} to 10^{-6} in water, plated on T-soy agar plates and incubated at 37°C for 48 hours. Colonies were manually counted and converted into Colony Forming Units (CFUs).

Results: Effluent of water prewash yielded CFU counts too numerous to count, 1.6×10^5 and 2.5×10^5 at dilutions 10^{-1},10^{-2} and 10^{-3} respectively. Following the application of BioSURF™ , the CFU count of the effluent was zero for all serial dilutions. Effluent from the first and second rinses following the application of BioSURF™ also had CFU counts of zero for all serial dilutions.

Conclusion: Exposure of BioSURF™ to the air sac of a used bagpipe effectively eliminated bacterial colonization and potentially the risk to the musician.

Background

Recently, much attention has been given to the role of oral bacteria in the pathogenesis of respiratory infection. Respiratory diseases are widely prevalent, and costly to health care systems. A 1997 study done by Harvard School of Public Health found that lower respiratory infections were the cause of 4.3 million deaths worldwide, the third most common cause of mortality.

For a pathogen to infect the lower respiratory tract it must overcome the immunological and mechanical defense mechanisms of the distil airway. These mechanisms maintain the sterility of the distal airway and the lungs despite the heavy bacterial load (10^6 aerobic bacteria and 10^7 anaerobic bacteria per millilitre) (Mojon, 2002). These mechanisms can be overwhelmed to cause infection in the presence of a virulent organism, a weakened immune state or a high inoculum load (Donowitz *et al.,* 1990**)**. One route oral bacteria reaches the lower respiratory tract is aspiration (Huxley *et al*, *1978),* whereby, bacteria are contained within aerosolized droplets or oral secretions. Poor oral hygiene or periodontal disease may increase the bacterial load in the saliva, which may then be aspirated. Interestingly, most oral bacteria which cause pulmonary infection are not known to cause oral infection (Scannapieco, 1999).

The mechanism of playing a Highland Bagpipe creates an environment whereby the musician and on lookers are exposed to aerosolized micro-organisms which likely originated from the oral cavity of the musician. Sound is created by blowing through the mouthpiece (Figure 1) into the air sac via a non return valve. Air is forced from the air sac through the chanter and over the reeds creating the sound. It is postulated that blowing air into the mouthpiece deposits oral bacteria into the blowpipe, which is then trapped in the air sac. The moist, warm conditions inside the air sac create an ideal growing environment for bacteria. A continuous biofilm extending from the mouthpiece to the air sac, the reeds and chanter is potentially created. Expelling the air over the reeds and the chanter aerosolizes the bacteria contained within the air sac, depositing them into the immediate environment, creating the potential for inhalation by the musician or close bystanders. In such a manner bagpipes are postulated to act as a reservoir for potentially pathogenic oral bacteria.

Purpose

To evaluate the efficacy of the disinfectant BioSURF™ (Micrylium Laboratories) to disinfect a used leather, lanolin treated ("seasoned") air sac of a Highland bagpipe (Scott's Highland Services Ltd).

Methods

All holes in the leather air sac of a used Highland bagpipe (Figure 2) were sealed with rubber stoppers. A prewash of 500mL of sterile deionized water was exposed to all inner surfaces of the air sac for five minutes by gentle shaking. Effluent was collected in a sterile receptacle. The procedure was repeated using 500mL of disinfectant, BioSURF™. Effluent was collected in a sterile receptacle. Following the disinfectant wash, two post treatment washes were performed, each using 500mL of sterile deionized water. The effluent from both post treatment washes was collected in sterile receptacles.

Assay: 100µL of each of the four treatment eluents: prewash, disinfectant wash and two post treatment washes, were serially diluted 10^{-1} to 10^{-6} in deionized sterile water. Dilutions were plated on T-soy agar plates and incubated at 37°C for 48 hours. The subsequent growth of colonies was counted manually and converted to Colony Forming Units (CFUs).

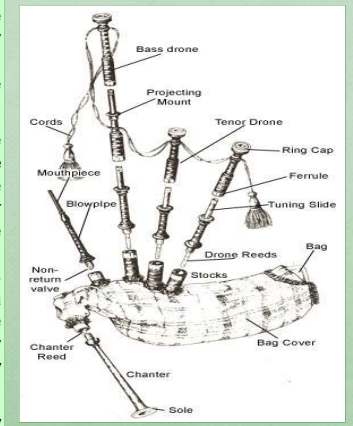

Figure 1: Scottish Highland Bagpipe, adapted from Kevin J. Auld 2003

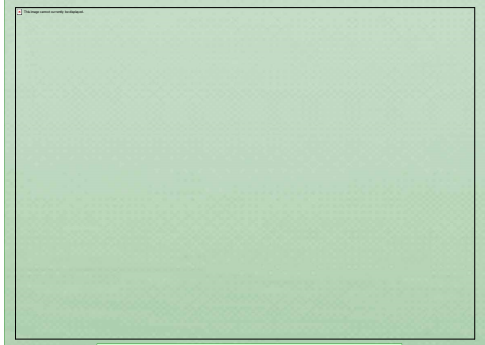

Figure 3: Colony Forming units observed in eluent from Highland bagpipe air sac.

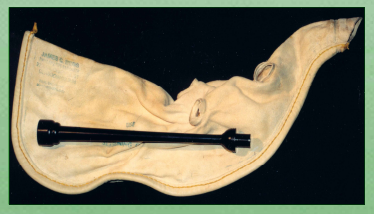

Figure 2: Leather (right) and Synthetic (left) Highland Bagpipe air sac and chanter.

Results

Eluent from the prewash plated at a dilution of 10^{-1} had vegetative bacteria too numerous to count. Diluted further to 10^{-2} and 10^{-3}, 1.6×10^5 and 2.5×10^5 CFUs respectively were observed. Zero colonies were observed in the eluent culture following the disinfectant rinse with BioSURF™. The eluent from both post treatment washes was also observed to have zero colonies. See Figure 3. This data indicates two things: 1. The air sac of a used bagpipe contains considerable bacteria. 2. The disinfectant BioSURF™ reduced this bacteria level to zero after exposure for five minutes.

Discussion

Oral bacteria are thought to be deposited into the leather air sac of the Highland bagpipe by the musician throughout the course of playing the instrument. Following each use, the instrument is disassembled and stored, sealing in moist air, creating an ideal environment for bacterial growth. Without disinfection, the instrument acts as a bacterial reservoir. Upon next usage the musician may be exposed to high levels of aerosolized bacteria or biofilm containing potentially pathogenic bacteria, which in compromised individuals may result in respiratory infection. Application of a disinfectant wash using BioSURF™ effectively eliminated the bacteria found in the air sac, potentially decreasing the risk to the musician of a respiratory infection due to exposure to aerosolized bacteria. However, further research must be done to determine the impact of an ethanol based disinfectant on the integrity of a leather air sac of a Highland Bagpipe.

This preliminary study requires further research to determine the bacterial load that the musician is exposed to during normal operation of the Highland bagpipes both via aerosolized bacteria and biofilm on the mouthpiece and blowpipe. Epidemiological studies must also be performed to determine the relative risk of respiratory infection due to exposure to aerosolized oral bacteria while playing the bagpipes or other wind instruments.

Conclusions

Treatment of a used leather air sac of a Highland bagpipe with the disinfectant BioSURF™ effectively eliminated bacteria contained within in one application of 500mL with an exposure time of 5 minutes.

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