RESEARCH ARTICLE

Microbial contamination of laptop/ keyboards in dental settings

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Abstract

Background: Computers/ laptops are ubiquitous in the healthcare setting and have been shown to be contaminated with potentially pathogenic microorganisms. Aims & Objectives: To determine the degree of pathogenicity on the computer/laptops keyboards. Materials & Methods: Specimens were collected from 25 laptops that were located in the clinical section of a dental college. To determine the level of microbial contamination for the disinfection efficacy testing, a single sterile swab moistened with trypticase soy broth (TSB) was wiped over the entire keyboard surface of the laptop. Results: Potential pathogens cultured from more than 80% of the computers. These organisms included coagulase-negative staphylococci (88% of keyboards), diphtheroids (80% of keyboards), Micrococcus species (40% of keyboards), and Bacillus species (60% of keyboards). Other pathogens cultured included Oxacillin Resistant Staphylococcus Aureus (ORSA) (8% of keyboards), Oxacillin Susceptible Staphylococcus Aureus (OSSA) (4% of keyboards), vancomycin-susceptible Enterococcus species (16% of keyboards), Streptococci (29% of keyboards) and Aspergillus (36% of keyboards). Conclusions: The data from the study suggests that microbial contamination of keyboards is prevalent and that keyboards may be successfully decontaminated with disinfectants. Keyboards should be disinfected daily or when visibly soiled or if they become contaminated with blood.

Key Words: Laptops;Computer;Microorganisms;Disinfection.

Introduction

Healthcare associated infections are an important cause of morbidity and mortality in hospitals. Each year more than 2 million patients acquire healthcare-associated infections, resulting in 90,000 deaths and healthcare costs that are estimated to exceed $5 billion (1).Some investigators have suggested that computer keyboards may contribute to cross-transmission because of acquisition of transient hand carriage by healthcare personnel during contact with the contaminated computer keyboard surface (2, 3).

Computers continue to have an increased presence in almost every aspect of our occupational, recreational, and residential environments. In the university environment, students have indicated that 100% have access to computers, 92.1% regularly use the Internet, and 73.3% regularly use e-mail (2). Keyboards have become reservoirs for pathogens because of the increased use of computers in patient areas (2-7). The risk of transmission of pathogens from computer keyboards to patients would be prevented by compliance with current hand hygiene guidelines. Unfortunately, some studies have demonstrated that the mean rate of compliance with the Centres for Disease Control and Prevention guidelines on hand hygiene is approximately 40% among healthcare workers (8), which is a likely explanation for the frequent contamination of computer keyboards.

This study was performed to determine the degree of microbial contamination on the keyboards of laptops used by the dentist in clinical sections of various departments of dental college.This study aims to know the degree of bacterial contamination on the laptops of dental care personnel of Sri Sai College of Dental Surgery, Vikarabad, Andhra Pradesh, India.

Materials & Methods

The cross sectional study was conducted at the clinical sections of various departments of Sri Sai College of Dental College, Vikarabad, Andhra Pradesh, India where approximately 200 computers / laptops are in use in different areas of each department. The laptops were randomly selected from each department that were in close proximity to patients in high use areas. The laptops selected were those which were in use for a minimum period of one year and above.

Before experiments were conducted, each laptop was tested for its functionality and use. The swab was moved from one side to the other of the keyboard covering all the keys.

Specimens were collected from 25 laptops that were located in the clinical section of different departments. To determine the level of microbial contamination a single sterile swab moistened with trypticase soya broth (TSB) was wiped over the entire keyboard surface. The swab was placed in 2 mL of TSB and immediately transported to the laboratory.

After the swab in the TSB was vortexed for 1 minute in the Fisher Vortex Genie 2 on the highest (i.e., number 8) setting, 100 mL of the specimen was plated onto trypticase soy agar with 5% sheep blood by use of the spread plate technique. The specimens were incubated at 37^0C for 48 hours. Isolates were identified on the basis of Gram stain findings, colony morphology, detection of haemolysis on sheep blood agar, and colony

pigmentation, as well as results of the tube coagulase test (for Staphylococcus species), detection of NaCl and results of the bile esculin test (for Enterococcus species), and detection of conidia by microscopy (for Aspergillus species). Susceptibility testing was performed on Staphylococcus aureus and enterococcal isolates by use of antibiotic-containing agars (6 mg/mL for oxacillin and 6 mg/mL for vancomycin) (6).Descriptive statistics were used to determine The Microbial Contamination of Laptop.

Results

Of the 25 cultures performed for keyboards, all had growth of 2 or more microorganisms (Table 1). Many keyboards were tested positive for skin organisms, pathogens detected were coagulase- negative staphylococci (CONS) (88% of keyboards), diphtheroids (80%), Micrococcus species (40%), Bacillus species (60%), Propionibacter (24%), alpha streptococci (29%), Aspergillus niger (36%), Oxacillin susceptible staphylococcus aureus (OSSA) (4%) , Oxacillin resistant staphylococcus aureus (ORSA) (8%), Vancomycin resistant Enterococcus species (VRE) (4%), Vancomycin susceptible Enterococcus species (VSE) (16%).

Micro Organisms	No (%) of keyboards with positive contamination (n = 25)
OSSA	1(4 %)
ORSA	2(8 %)
VSE	4(16 %)
VRE	1 (4 %)
CONS	22 (88%)
DIPTHEROIDS	20 (80%)
MICROCOCCUS sps	10 (40%)
BACILLUS sps	15 (60%)
PROPIONIBACTER	6(24%)
STREPTOCOCCI	8 (29%)
ASPERGILLUS	9 (36%)

Table 1 shows distribution of the microorganisms on computers/laptops

Discussion

Computers are ubiquitous in medical settings where laboratory test results are accessed, radiologic findings are viewed, and computerized physician order entry is performed. Several investigations have evaluated the degree of microbial contamination and the types of contaminating organisms on computer keyboards (2-7). Concern has been raised that contact with contaminated computer keyboards might serve as a mechanism for contaminating the hands of healthcare workers with potential pathogens, thereby leading to cross-contamination of patients. Of special concern is transmission of pathogens that have been demonstrated to be present on environmental surfaces in proximity to colonized or infected patients, including ORSA, VRE, and Clostridium difficile.

As with health care settings, computer keyboards in educational institutions may act a mechanism for the transmission of pathogenic bacteria. Previous studies have demonstrated that other shared communication equipment, such as telephones, can also become contaminated by potentially pathogenic microorganisms, often members of the human microbiota. Two studies have provided suggestive evidence linking computer use to cross-contamination of patients (2, 3).

This study demonstrates that microbial contamination of computer keyboards was prevalent and that commensal skin organisms were the most common contaminating microbes which were similar to the finding in a study conducted by Schultz et al (9).

Noskin et al (10) studied both computer keyboards and keyboard covers to determine their ability to harbour vancomycin resistant Enterococcus faecium (VRE), Methicillin resistant staphylococcus aureus (MRSA) and Pseudomonas aeruginosa (PSEA). The keyboards and covers harbours MRSA and VRE for longer period of time when compared to PSEA.

Rutala et al (11) studied the degree of microbial contamination of computers, the efficacy of different disinfectants, and the cosmetic and function effects of these disinfectants on computer keyboards. Potential pathogenic microorganisms were cultured from more than 50 percent of the computers. Additionally six different disinfectants were assessed against three different microorganisms (oxacillin – staphylococcus aureus, pseudomonas aeruginosa and vancomycin resistant enterococcus) which were inoculated on laptop keyboards. The disinfectants were effective in removing 95 percent of the test bacteria and no functional or cosmetic damage to keyboard was found

In a study by Hartmann et al a total of 222 samples from keyboards and mouse were taken and microbacterial analysis was done which yielded 26 contaminated samples (5.9%) and at the physician's computer terminal two samples obtained from the mouse (6.3%) showed positive microbial testing whereas the ward's intercom and telephone receiver were not contaminated (P = 0.15) (4).

In a study by Siu et al results revealed a 17.4% (49/282) contamination rate of these computer devices by *S. aureus*, *Acinetobacter* spp. or *Pseudomonas* spp. The contamination rates of MRSA and *A. baumannii* in the ward computers were 1.1% and 4.3%, respectively (12).

In this study it was also found that contamination with ORSA and with potential pathogens, such as Aspergillus species, was less frequent than has been reported previously by Devine J, Man G et al. However, the degree of contamination we observed was high enough to potentially allow transmission via contaminated hands (7, 8).

These studies all demonstrated that computer keyboards can serve as reservoirs for contaminating microorganism. This raises the concern that contact with contaminated computer keyboards will serve as a mechanism for contaminating the hands of health care workers. These pathogenic microorganisms along with multi drug resistant gram – negative pathogens, viruses and fungi are of special concern as contributors to hand contamination and patient transmission.

Health care workers should not touch computer keyboards with contaminated hands or contaminated gloves. It is critical that health care workers must perform hand hygiene after contact with computer keyboards (13). Soap and water or alcohol based hand product should be effective in reducing transmission. In addition to good hand hygiene practices, computer keyboards should be disinfected at least daily and when visibly soiled (9).

Cleaning of computer keyboards and associated equipment's should be included in infection prevention and control policies and procedures for all areas within healthcare facility. Choosing a disinfectant that can be accessed at the point of use and convenient for the healthcare worker will enhance compliance with disinfection practices. Ready to use pre moistened quaternary ammonium containing disinfectant wipes are excellent choices for disinfecting keyboard surfaces and associated equipment (14).

In the healthcare environment, cutting down on the spread of microorganisms from person to person is beneficial. A computer keyboard is shared by many users and is a reservoir for pathogenic microorganisms. Healthcare workers must understand that computer is "high touch" surface in a patient care area. Cleaning computer keyboards and associated equipment must be incorporated into routine cleaning procedures. While it is important to disinfect computer on a regular basis, the most important disease prevention strategy is for healthcare workers to wash hands prior to patient contact and after contact with computer keyboards.

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