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Evaluation of Microbial Contamination of Digital Radiography Area of the Endodontic Department of an Educational Institution

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Abstract

Digital radiographs are used frequently because of its various advantages like reduced radiation, quick image processing, improved image quality, but usage of same sensor leads to cross contamination. The aim of the current study is to evaluate microbial contamination on the surfaces of the digital radiographic equipment used in the Endodontics Department. Samples were collected randomly at the radiology unit over three consecutive days at two different times, in the morning – before attending patients, at the end of the day – after clinical attendance. Samples were collected from different surfaces of radiology unit such as tube head, control unit, activator switch, sensor, mouse and keyboard. The samples were cultured in different culture media and gram stained after incubation. The study results showed the presence of Staphylococci, Streptococci and other gram positive Bacilli species. The digital radiography increases the risk of cross contamination, there should be strict protocols to maintain the infection control by proper disinfection, using physical barriers.

Keywords: Digital Radiography; Microbial Contamination

Introduction

Radiographic examinations are an additional diagnostic tool for the identification of significant oral diseases. Reduced radiation exposure, quick image acquisition, convenient digital storage, electronic image transmission, removal of the need for a darkroom, and the potential to improve image quality by adjustments to contrast and density are some of the benefits of digital radiography. These convenient usage advantages led to the popularity and increased usage of digital radiography [1,2].

Digital radiography has various advantages over the conventional radiography but the digital sensor cannot be replaced for every patient and the infection control is challenging. As the image receptors cannot be sterilized, the physical barriers need to be placed on the image receptors for each patient to control the cross contamination [3]. In case of educational institutions the image receptors or radiographic sensors are used by various operators for many patients which make infection control more challenging. Apart from the sensors, further precautions should be taken with the other digital system equipment, such the computer, especially the keyboard and mouse, and the intraoral X-ray machine itself MacDonald R [4-6].

Even though the dental radiography is not invasive like the surgical procedure the contact with patient's saliva and rarely blood will result in cross contamination [7]. The dental practitioners are responsible for control of cross

contamination and provide infection control [8]. The aim of the current study is to evaluate microbial contamination on the surfaces of the digital radiographic equipment used in the Endodontics Department.

Material and Methodology

36 Samples were collected randomly at the radiology unit of department of conservative dentistry and endodontics, Priyadarshini dental college and Hospital over three consecutive days at two different times; before treating patients in the morning, and before cleaning and disinfection processes at the end of the day, after appointment hours. Samples were collected from different surfaces of radiology unit such as tube head, control unit, activator switch, sensor, mouse and keyboard. Samples were collected using sterile swab.

The collected samples were subjected to serial dilution in which 1 mL aliquots were transferred to tubes containing 0.85% NaCl. 100 µL aliquots were dispensed using a pipette and streaked on to the surface of culture media. The culture media used were MacConkey agar and Blood agar. Blood agar - culture media were incubated at 35 ± 2°C for 24 to 72 hours, Mac-Conkey agar -culture media were incubated at 35 ± 2°C for 24 to 48 hours. Following the period of incubation, the colonies were counted. Colony forming units per milliliter (CFU/mL) of each sample site were determined using the dilution procedure, and the results were averaged. Gram staining was done for colonies to identify the organisms. Descriptive analysis was done to tabulate the various organisms isolated from radiology unit.

Results

The control panel of radiograph unit had maximum contamination followed by the keyboard and tube head. The digital sensor had least contamination with exposure switch had nil contamination except for few filamentous fungi (Table 1). Among the microorganisms staphylococcus species were most predominant followed by streptococcus species (Chart 1). 79% Staphylococcus species, 9% Streptococcus species, 6% Gram positive bacilli, 5.22% Aerobic gram positive spore bearers (Chart 1). Microbial load after clinical hours show as 38% in control panel, 20% in keypad, 16% in mouse, 17%in tube head 6% in sensor (Chart 2).

Equipment	Staphylococcus species	Streptococcus species	Aerobic gram positive spore bearers	Gram positive bacilli	Fungi
Control panel	33	12	7	-	-
Tube head	24	-	-	-	Filamentous fungi
Sensor	8	-	-	8	-
Exposure button	-	-	-	-	Filamentous fungi
Mouse	22	-	-	-	-
Keyboard	20	-	-	-	-

Table 1: Microbial load on different surfaces of digital radiography unit.

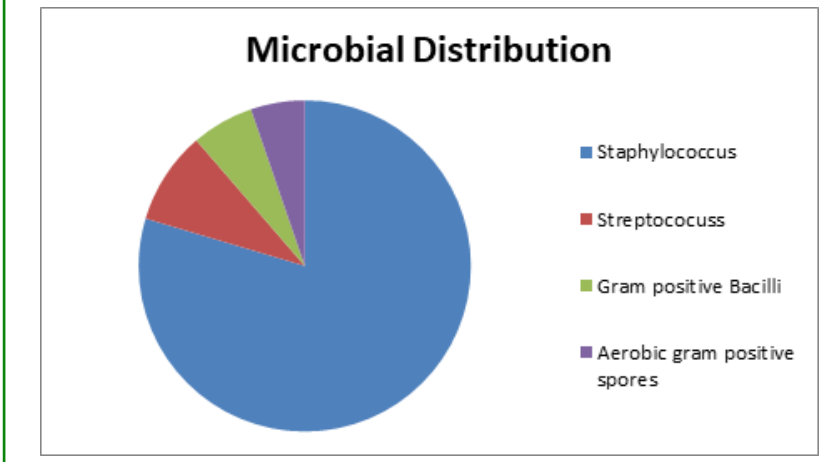

Chart 1: Microbial distribution.

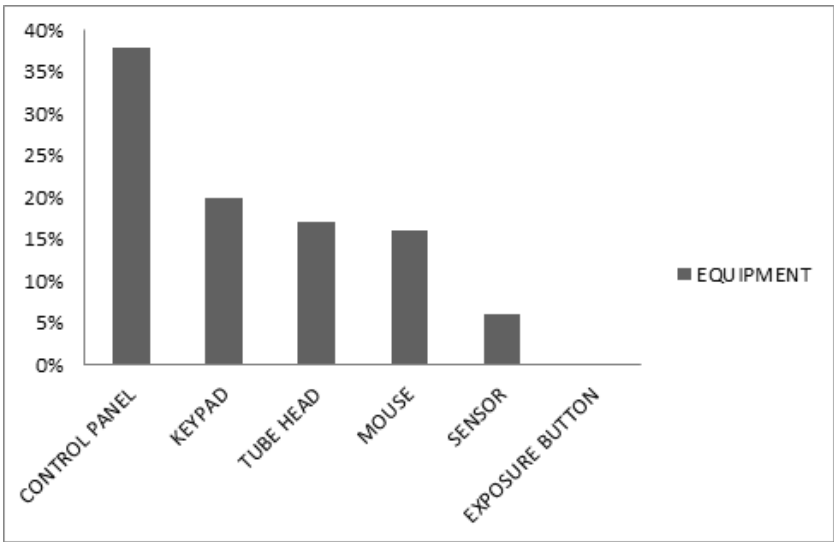

Chart 2: Microbial load in digital radiography.

Discussion

Radiography is essential procedure during endodontic treatment. Digital radiography makes things easy with its advantages of instant image, image adjustments and electronic image storage. Because of its advantages digital radiography has been adopted by many dentists and educational institutions [9,10].

Radiographs are considered as less infective because of less invasive procedure compared to other dental procedures. But in case of digital radiography the sensor could not be changed between the patients, which makes cross contamination prone procedure. In educational institutions the digital x-ray is been used by multiple operators for various patients so the cross infection chances are very high. Previous studies also show that digital radiography had higher contamination even though barriers were used Hokett SD, et al. [11-13].

This study investigated the microbial contamination present at six different surfaces of x -ray equipment and its related accessories which were routinely contaminated. Contamination was more at control panel, tube head, keypad and mouse compared to that of sensor and exposure button which is consistent with previous studies Kalathingal S, et al. [2,7,14]. This may be attributed to greater surface area and frequency of handling the area. The sensor was covered with physical barrier which may be the reason for reduced contamination [11].

Many organisms isolated in the study were common commensal of oral cavity, but if introduced to immune compromised patients these may change to opportunistic pathogens and can cause infective diseases. Staphylococcus species isolated maximum in our study are responsible for infective diseases such as skin diseases, bacteremia, endocarditis, pneumonia, osteomyelitis, septic arthritis, urinary tract infections and opportunistic infections [15]. Streptococcus and enterococcus species are responsible for sub-acute endocarditis, pneumonia, meningitis, bacteremia, GI infections [16]. Candidiasis and dermatophytosis are the common infections caused by fungi Brooks GF, et al. [17].

Endodontic radiography is one of the prime areas for cross contamination. The dentist must take proper precautions to avoid cross infection among the patients Silva MAS, et al. [18]. The bacterial load in the current study shows the radiology unit of endodontics department had various cross infection, may be due to operate by various students for many patients.

Based on the finding of the current study it can be concluded that, the digital radiography increases the risk of cross contamination, there should be strict protocols to maintain the infection control by proper disinfection, using physical barriers.

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