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Risk of Microbial Contamination of Laptop Keyboard in Clinical Areaof Dental Settings. An In Vitro Study

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Abstract: *INTRODUCTION:Laptops are widely used in healthcare for improved and effective care. Healthcare providers move back and forth, between computers and patients while delivering healthcare, as a part of the daily routine. Investigations have suggested that laptops may contribute to cross contamination and can serve as vehicles for infection transmission in clinical area. AIM:This study was conducted to evaluate the microbial contamination found on laptop keyboards in clinical settings of various departments of a dental school in Greater Noida. METHODOLOGY:The examination was carried out by self administered questionnaire regarding the disinfection practices by the consenting participants and the specimen were collected from laptops that were located in the clinical section of different departments. This study was carried out at two intervals during morning before the clinical hours and at afternoon when laptop is exposed during clinical hoursThe samples were collected from 27 laptops from dentists working in a dental college in Greater Noida. The samples were collected aseptically using sterile cotton swabs dipped in sterile saline by rotating the swabs on the keyboard surfaces of laptops, inoculated into phosphate buffered saline (PBS), vortexed for 1 minute in Fischer Vortex Genie 2 on highest setting & streaked immediately on 5% Trypticase Soya agar plates and were incubated at 37°C for 24 hours aerobically. The isolates were evaluated based on the colony count and gram staining.STATISTICALANALYSIS:Descriptive statistics was done for the colony forming units The intergroup comparison for the difference of mean scores between the different departments was done using One Way ANOVA.RESULTS:The Intra department analysis of laptops was done to see the significance between the CFU/ml for the morning and evening samples which came out to be significant. percentage change in CFU/ml was analyzed between the departments maximum percentage change was found in Endodontics (1877.77). CONCLUSION : Laptops used in clinical area are potential reservoir for bacteria. They might be a vector playing an important role in the transmission of potential pathogenic microorganisms.*

Keywords: *Disinfection, Contamination, Laptops*

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I. Introduction

Laptops in today's world are an integral part of our daily professional activities. Ranging from storage and forward of data to internet utilities, its applications are extremely varied.

For students it acts as an educational tool also. Technological advancement has changed the environment of the healthcare facilities. Computers have become a vital component of healthcare delivery for improved and effective care.Valuable patient related information is available in computers at the click of a button. Healthcare providers move back and forth, between computers and patients while delivering healthcare, as a part of the daily routine.[2] Theburden of data recording, data maintenance & analysis of data have become very easy with the introduction of multiple software in health care sector.

People in non-healthcare sectors do not have to bother about the inevitable bacterial accumulations on their laptops, but the scenario is significantly different for people in healthcare sectors, more so for doctors involved in direct patient care and treatment delivery.[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.[3,4]

Studies have revealed that mobile phones and laptops have a great potential for dissemination of disease and the incidence of such cross contamination diseases to be 4.8% in U S A, 7.1% in European countries,10-30% in India and 17.1 % in Iran.[5,6,7,8]

The colonization of the potentially pathogenic microorganisms on the various inanimate surfaces present in a clinical setup like dental chairs, mobile phones, ballpoint pens, patients' file and computer keyboards has been reported as a potential vehicle for transmission of nosocomial pathogens from dental health care personnel.[9]

Laptops easily escape from the purview of sterilization and infection control practices because it is a personal device owned by everyone and has not gained the attention that it should. If infection control practices are to be applied in action comprehensively, items of personal use like laptops, mobile phones, pens, eye wear, key chains etc. need to be included within the list of items to be cleaned at least, if not disinfected. Presently there are no guidelines concerning laptop hygiene practices for a dental setting

Research has shown that improper disinfection of the dental environment can transmit infectious diseases and prove to be a health hazard to both dental personnel, as well as patients. This can prove to be fatal for immune deficient patients. Although it is well-known that the dental environment, which includes the instruments, dental materials, and dental units, can be means for cross-contamination, there is little data on the microbial involvement.[10]

Hence, a study was conducted to evaluate the microbial contamination found on laptop keyboards in clinical settings of various departments of a dental school in Greater Noida.

II. Materials And Method

A cross sectional study was done to assess the microbial contamination of laptops used by post graduate students in clinical settings of I.T.S dental college in Greater Noida, U.P, India. Ethical clearance was obtained from the Institutional Ethical Committee before the start of the study. Necessary permission was obtained from head of the institution and informed consent was obtained from the participants prior to the study.

Before starting the study, training and calibration of the examiner was done for collection of samples and streaking on agar plates. Intraexaminer reliability was found to be 0.80 based on kappa statistics.

Those laptops which were being used in the clinical cubicles of post graduate students were taken for the study. Students who did not give consent to participate were excluded from the study. A pilot study was conducted by collecting the samples from 6 participants.

The investigator made unannounced visit to the clinics to recruit participants. A self administered questionnaire regarding the disinfection practices were completed by the consenting participants. Respondents were asked to answer questions like do they wash their hands before and after using their laptop while working in clinical cubicle, do they discard gloves before entering data in laptop, how frequently do they clean their laptop, do they use keyboard cover sheet while working on laptop, If they use the same laptop at home and clinical area and does their family members also use the same laptop at home.

Microbial sample of 27 laptops, i.e 3 laptops from each dental department which satisfied eligibility criteria were considered for the study. The laptops were randomly selected using a simple random sampling technique.

The samples were collected at two intervals. Once in the morning before the clinical hours and once in the afternoon after the clinical hours. Each keyboard was first cleaned with 70% isopropyl alcohol wipes and allowed to dry for 10 minutes then a sterile cotton swab moistened with phosphate buffered saline (PBS) was wiped over the entire keyboard surface. The swab was placed in 50µl of PBS and immediately transported to the laboratory. The samples were then vortexed for 1 minute in Fischer vortex genie 2 on highest setting and inoculated and streaked onto Trypticase Soya agar plates by the use of the spread plate technique and were incubated at 37°C for 24 hours aerobically. The procedure was repeated at second interval in the afternoon after the laptop has been exposed during clinical hours. The isolates were then counted on a colony counter by pen and click counter method to check the number of colonies and colonies were then identified on the basis of gram stain finding and colony morphology.

III. Statistical Analysis

The data for the present study was entered in the Microsoft Excel 2007 and analyzed using the SPSS statistical software 19.0 Version. The descriptive statistics included mean, standard deviation and calculation of percentages. The differences in the responses to questions regarding laptop usage among the different departments was analyzed using Chi Square test. The intergroup comparison for the difference of mean scores between the different departments was done using One Way ANOVA The intra group comparison for the change in CFU between different time intervals was done using paired t test. The level of significance for the present study was fixed at 5%.

IV. Results

The Intra department analysis of laptops was done to see the significance between the CFU/ml for the morning and evening samples. The data showed the significant difference in all the departments when CFU/ml of the morning was compared with the CFU/ml in the evening (Table 1).

When percentage change in CFU/ml was analyzed between the departments maximum percentage change was found in Endodontics (1877.77) followed by OMFS, PHD, Pedodontics, Prosthodontics, Orthodontics, OMDR, OP and Periodontics. (Table 2).

On analyzing the microbial samples collected in the evening from various departments using post hoc analysis the results were found to be statistically significant in most of the departments. (Table 3)

When the participants were asked whether they used laptops only in clinical cubicle most of them said always but in periodontics department none of them used in the clinical cubicle.

On asking whether they washed their hands before and after using laptop the majority of the participants answered that they did sometimes but not always. On asking whether if they discarded their gloves before entering data in laptop it was found that in endo, prostho, pedo, PHD department sometimes they discarded but in perio department they always discarded.

On staining both gram positive and gram negative bacteria was seen with the mixed colonies of cocci and bacilli.

V. Discussion

There has been a continuous increase in hospital acquired infections in various types of operatories – Intensive Care Units, Geriatric Clinics, Dental Settings etc. There is no doubt that this upsurge is indeed because of lack of adequate Infection Control Practices but it could also be attributed to the better microbiological record keeping and standardization protocols since the past few decades.

Computers are ubiquitous in medical and dental settings where laboratory test results are accessed, radiographic 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.[11] 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.

Although proper infection control practices for a dental setting could easily be delineated, there exist a multitude of neglected loopholes to achieve that goal. Items of personal use comprise such a loop-hole because items like mobile phones, stationery, soaps, and even non-disposable aprons easily become a niche for microorganisms that could be transmitted not just to other patients but even to the doctor.

This study shows that almost all the laptops near clinical setup sampled at evening after use were contaminated with microorganisms, which can lead to nosocomial infections. The microbial contamination was more for the departments of Endodontics (1877.77) and least for the department of Periodontics (166.67).

Rutala et al 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.[12] In a study by Hartmann et al a total of 222 samples from keyboards and mouse were taken and micro bacterial 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 ($P = 0.15$)[13].

The findings of the present study is alarming which shows that dentists are lacking in awareness of safety measures and a significant number of them neither clean their hands before and after seeing a patient nor disinfect their laptops after using in the clinical setup. Hand washing is the simplest and most economical measure that can prevent the transfer of harmful pathogens.

We suggest that this study should be performed at a larger scale with more parameters as well as qualitative assessment of types of microorganisms found on laptop keyboards of post graduates using in clinical cubicle. Such studies should be performed in all the colleges of our country because it would greatly spread practical awareness amongst the dental students and help inculcate better laptop hygiene practices.

Currently in India, there are no protocols regarding the restriction for dentists to use laptops and mobile phones into a sterile clinical setup. There are also no cleaning guidelines for laptops and mobile phones of health care workers. The limitation of the study is that the different microorganism species were not isolated.

VI. Conclusion

Laptops used in clinical area are potential reservoir for bacteria. They might be a vector playing an important role in the transmission of potential pathogenic microorganisms. The risk of transmission can be reduced by using alcohol-based sanitizing agents for wiping laptops. Effective hand hygiene in clinical areas is the most effective means of ensuring the safe use of them.

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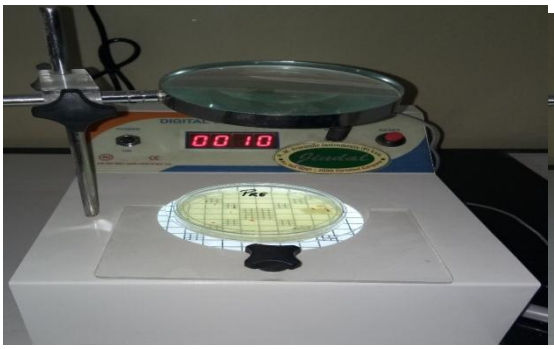

Fig 1: Morning Sample

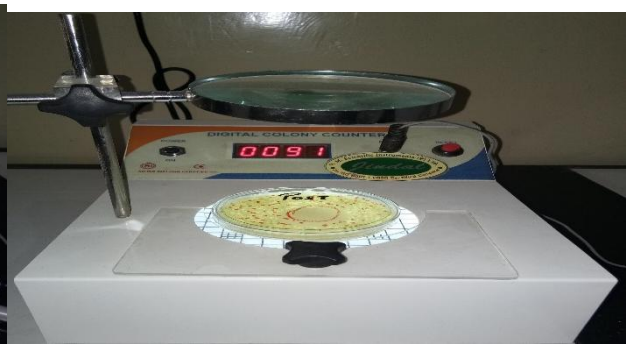

Fig 2: Afternoon Sample

Table 1 Distribution Of Microbial Contamination Of Laptops At Morning And Evening Intervals

Departments	CFU In Morning	CFU In Evening	Mean Change In CFU	P Value
OMDR	33.33±11.54	173.33±92.31	140.00±10.3.92	0.001
OMFS	15.00±8.66	193.33±75.31	178.33±70.76	0.001
PROSTHO	15.00±8.66	93.33±30.55	78.33±22.54	0.001
ENDO	35.00±27.84	320±87.17	285.00±60.62	0.001
PHD	21.66±17.55	180±40.00	158.33±36.17	0.001
ORTHO	41.66±31.74	140±52.91	98.33±22.54	0.001
PERIO	46.66±11.54	120±20	73.33±23.09	0.001
PEDO	16.66±20.20	100±34.66	83.33±14.43	0.001
OP	53.33±11.54	186.67±50.33	133.33±41.63	0.001

* Statistically Significant At P<.05†Statistically Significant At P<.001

Table 2 Distribution OfMicrobial Contamination Of Laptops According To Specialty

Departments	CFU In Morning	CFU In Evening	Percentage Change In CFU/Ml
OMDR	33.33±11.54	173.33±92.31	566.67±635.08
OMFS	15.00±8.66	193.33±75.31	1566.67±1026.32
PROSTHO	15.00±8.66	93.33±30.55	666.67±378.59
ENDO	35.00±27.84	320±87.17	1877.77±2101.93
PHD	21.66±17.55	180±40.00	1350.0±1213.46

ORTHO	41.66±31.74	140±52.91	622.22±760.36
PERIO	46.66±11.54	120±20	166.67±76.37
PEDO	16.66±20.20	100±34.66	1083.33±721.68
OP	53.33±11.54	186.67±50.33	250.00±50.00

*Department Wise Comparison Of Percentage Increase In CFU (Colony Forming Unit)

Table 3 Intra Department Comparison Between Evening Samples Among Various Specialities

Departments	OMDR (566.67±635.08)	OMFS 1566.67±1026.32	PROSTH (666.67±378.59)	ENDO 1877.77±2101.93	PHD (1350.0±1213.46)	ORTHO (622.22±760.36)	PERIO (166.67±76.37)	PEDO 1083.33±721.68	OP (250.00±50.00)
OMDR (566.67±635.08)	-	P=0.034*	P=0.899	P=0.021*	P=0.045*	P=0.985	P=0.763	P=0.078	P=0.542
OMFS 1566.67±1026.32	P=0.039*	-	P=0.042*	P=0.876	P=0.895	P=0.046*	P=0.021*	P=0.456*	P=0.028*
PROSTH (666.67±378.59)	P=0.899	P=0.042*	-	P=0.024*	P=0.051*	P=0.992	P=0.798	P=0.081	P=0.598
ENDO 1877.77±2101.93	P=0.021*	P=0.876	P=0.024*	-	P=0.642	P=0.039*	P=0.017*	P=0.245	P=0.019*
PHD (1350.0±1213.46)	P=0.045*	P=0.895	P=0.051*	P=0.642	-	P=0.050	P=0.028*	P=0.782	P=0.032*
ORTHO (622.22±760.36)	P=0.985	P=0.046*	P=0.992	P=0.039*	P=0.050*	-	P=0.745	P=0.079*	P=0.586
PERIO (166.67±76.37)	P=0.763	P=0.021*	P=0.798	P=0.017*	P=0.028*	P=0.745	-	P=0.012*	P=0.923
PEDO 1083.33±721.68	P=0.078	P=0.456	P=0.081*	P=0.245	P=0.782	P=0.079*	P=0.012*	-	P=0.015*
OP (250.00±50.00)	P=0.542	P=0.028*	P=0.598	P=0.019*	P=0.032*	P=0.586	P=0.923	P=0.015*	-

*Post Hoc Analysis †Statistically Significant At P<.05

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