ISSN: 0976-3104
SPECIAL ISSUE (RAE)
Thaore et al.

THE IIOAB JOURNAL

ARTICLE OPEN ACCESS

MICROBIAL CONTAMINATION OF LAB COATS WHILE PERFORMING ENDODONTIC TREATMENT

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ABSTRACT

Aims: *Lab coats are known to act as vectors in transmitting the potentially pathogenic multi-drug resistant type microorganisms. This study was conducted to determine the site, type and antibiotic susceptibility of microbial flora present on lab coats of health care professionals engaged in doing endodontic treatment in order to assess the risk of transmission of pathogenic micro- organisms.* ***Materials and methods:*** *A total of 20 lab coats of clinicians were included in the study. Swabs were taken from 3 different sites of the lab coat – collar, pocket and cuff, on the 1st and 3rd day. The swab samples were processed and the biochemical characterization of the isolates was done using standard microbiology protocols.* ***Results:*** *Of the three predetermined sites, the pocket was more contaminated than the chest and cuff. Coagulase negative Staphylococci was the most common isolate followed by Staphylococcus aureus and Gram negative non fermenters. All other isolates were either environmental microorganisms or skin commensals.* ***Conclusion:*** *In order to prevent transmission of infection, a strict protocol should be set into play in order to prevent cross contamination between doctor and patient.*

Received on: Feb 29th 2016
Revised on: Mar 7th 2016
Accepted on: 22nd – Mar-2016
Published on: 1st– June-2016

KEY WORDS

Bacterial contamination, Coagulase negative Staphylococci, Lab coat, Nosocomial infection

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INTRODUCTION

Infection is a dynamic process involving invasion of body tissues by pathogenic micro-organisms and their toxins. Nosocomial/ hospital/ acquired infections are those which are not present or incubated before admission of patient to the hospital but obtained during the patient's stay in hospital. Lab coats, nurses' uniforms and other hospital garments, materials and articles may play an important part in transmitting pathogenic bacteria in a hospital setting .The hands of healthcare personnel are most commonly implicated in transmitting the pathogens [1]. Various nosocomial pathogens, such as methicillin-sensitive *Staphylococcus aureus* (MSSA), methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococci* (VRE) and gram negative organisms is well documented [2]. Specifically in the area of dentistry, health care professionals are routinely exposed to potentially pathogenic microorganisms which are present in the surrounding environment. Most of them originate from the mouths of patients [3]. Contamination may occur from instruments through contamination vectors. These contaminated object infections may be transferred from patient to patient or from patient to professionals [4]. Methicillin resisitant *Staphylococcus aureus* which is the most pathogenic microorganism, comes in contact with health care professionals via direct hand contact with contaminated body fluids, devices, items or environmental surfaces [5].

There are very few studies regarding the wearing and laundering of lab coats in hospitals and medical practice. This study highlights the role of lab coats acting as vector for transmitting health care infections to the patients and the common areas where contamination occurs.

MATERIALS AND METHODS

The study was conducted in the Department of Conservative Dentistry and Endodontics, Sinhgad Dental College and Hospital, Pune with technical aid from the Department of Microbiology, SKN Medical College and Hospital, Pune. All the participants were informed about the study and necessary informed consent was taken. Ethical clearance was obtained from the ethical committee of college. Total 20 aprons of dental healthcare professionals (interns, PG students, faculty members) were included in the study.

THE IIOAB JOURNAL
ISSN: 0976-3104

Inclusion criteria

- Postgraduate students, Interns and Faculty members of Department of Endodontics willing to participate in the study.
- Half sleeved aprons worn for 3 consecutive days.
- Aprons which are not exchanged with other colleagues.
- Aprons worn inside the department.
- Working for minimum 3 hours on patients.

Exclusion criteria

- Aprons worn outside the department.
- Aprons exchanged with other colleagues.
- Full sleeved aprons.

Sample collection technique

- The collection of microbiological samples from dental lab coats was performed by the technique of rolling a sterile swab moistened in glucose broth on the target site.
- Samples from each lab coat was taken from the three predetermined areas i.e. chest area, upper part of pocket and sleeve ends.
- The samples were appropriately labeled and then transported in glucose broth media to the laboratory for microbial analysis. Twenty clean, washed lab coats were used as controls.
- On the first day, 60 swabs were taken of contaminated lab coats after minimum three hours of working. At the same time, 60 swabs were taken from the lab coats used as controls.
- On the third day, 60 swabs were collected from the same contaminated lab coats from the target sites [**Figure- 1]**.

Collection of samples

Fig: 1. Pocket

Chest

Cuff

Laboratory procedure

The collected swabs were cultured on blood agar and Mac Conkey's agar **[Figure–2]**.The agar plates were incubated at 37^{0}cfor 24 hours. Gram staining was used to examine the morphology and staining reaction of the organisms.Biochemical evaluation included testing for catalase, coagulase, bile, oxidase, triple sugar iron, indole and citrate using standard prescribed protocols for identification and characterization of microorganisms. Methicillin resistance in *Staphylococcus* species were tested with the help of cefoxitin disc and oxacillin disk (Hi-Media Ltd, Mumbai, India) on Mueller Hinton agar by using Central Laboratory Standard Institutional (CLSI) guidelines. Antibiotic sensitivity testing was done by using Kirby Bauer's disc diffusion method as has been described in the CLSI guidelines 2011[6].

Statistical analysis

Statistical analysis was done using SPSS 20.0 v. Descriptive analysis was done to estimate the percentage of microorganisms and Chi Square test was done to assess the difference in proportions. Level of significance was taken at $p<0.05$.

RESULTS

Of the study participants, 60%were post graduate students, 25% were faculty and 15% were interns. Gram positive cocci dominated the colonization, followed by Gram negative cocci with the difference being statistically significant ($p< 0.05$).51%cultures showed Gram positive cocci, making it the major microbial group contaminating the lab coats in the dental operatory **[Table–1]**.Among the Gram positive cocci, coagulase negative *Staphylococcus* was the dominant microbe and 10% were gram negative bacilli. The microorganisms obtained in the study were Methicillin Resistant Coagulase negative *Staphylococci* (MR CONS), Methicillin sensitive Coagulase negative *Staphylococci* (MS CONS), Actinobacter, Methicillin sensitive *Staphylococcus aureus*

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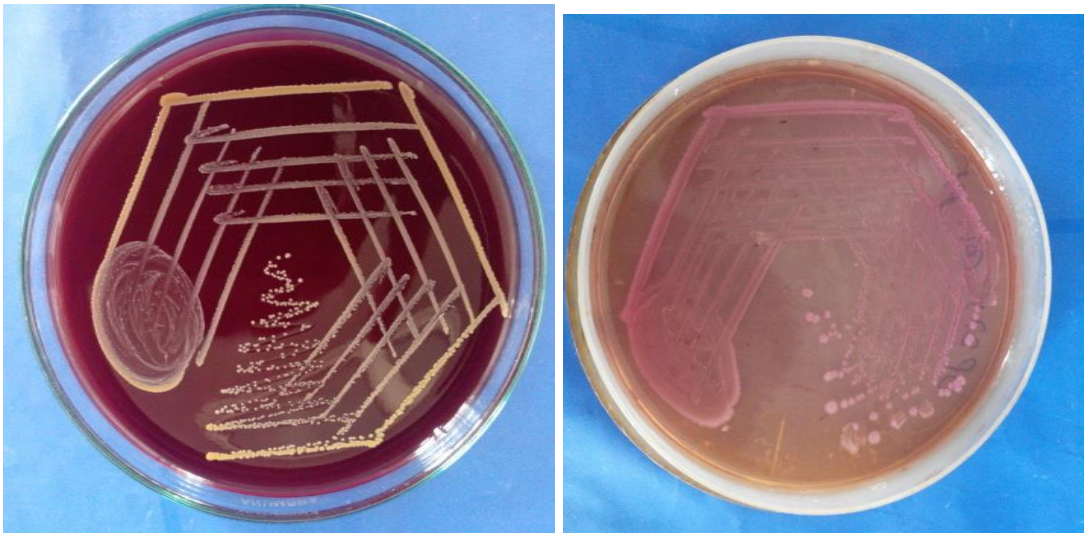
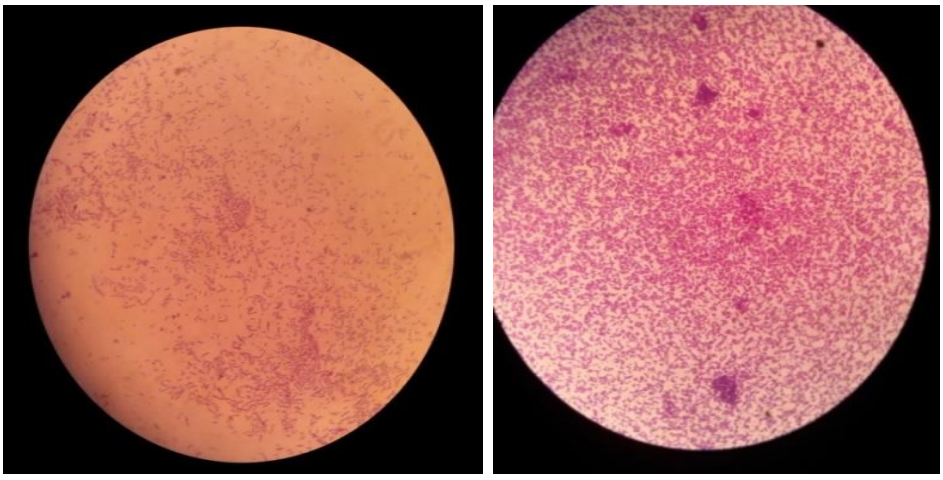
ISSN: 0976-3104



(A) (B)

Fig: 1. (A) Blood agar showing white beta hemolytic colony of *Staphylococci*, (B) Mac Conkey Agar with lactose fermenting colony of *Staphylococci*



(A) (B)

Fig: 2. Light microscopic screening of study slides. (A) Gram negative *Bacilli*, (B) Gram positive *Cocci*

Table: 1. Organisms isolated based on the morphology of study sample

Morphology	Number of organisms isolated in lab coats N=40 (%)	Number of organisms isolated N=120 (%)
Cocci	27(67.5%)	62(51%)
Bacilli	7(17.5%)	13(10%)
Total	34(85%)	75(62%)

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ISSN: 0976-3104

Table: 2. Types of various microorganisms isolated in 120 swabs (1st day and 3rd day)

Organisms	Total	1st day	3rd day
MR CONS	9	2	7
MSCONS	28	8	20
ACTINOBACTER SPECIES	3	1	2
MRSA	5	1	4
MSSA	14	3	11
MICROCOCCI	6	2	4
GRAM NEGATIVE BACILLI	10	3	7

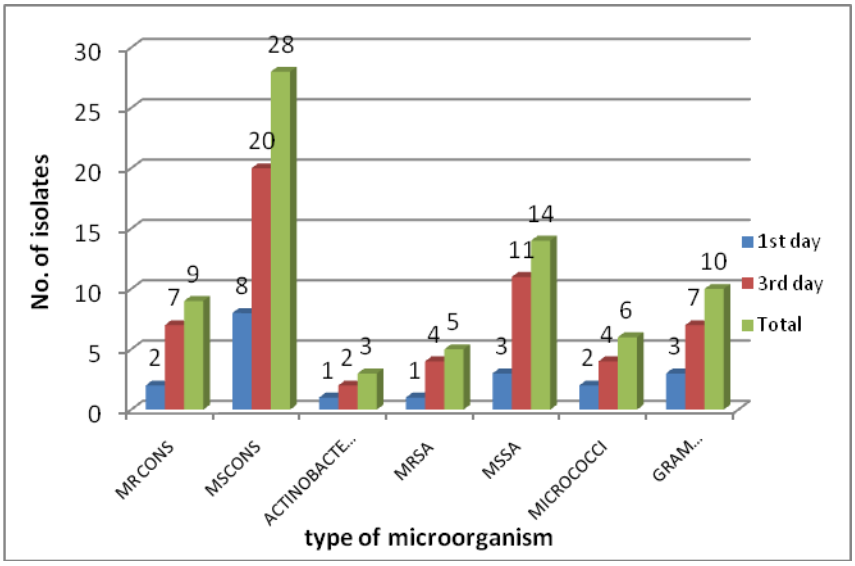

Fig: 3.Number of isolates and type of microorganism on 1st and 3rd day

Table: 3. Antibiotic sensitivity test results

Antibiotics	1st day		3rd day	
	Sensitive	Resistant	Sensitive	Resistant
AMIKACIN	90%	10%	80%	20%
AMOXYCILLIN	95%	5%	10%	90%
AMOX CLAV	75%	25%	50%	50%
AMPICILLIN	75%	25%	40%	60%
CEFTRIAXONE	50%	50%	50%	50%
CIPIROFLOXACIN	95%	5%	85%	15%
COTRIMOXAZOLE	35%	65%	20%	80%
ERYTHROMYCIN	30%	70%	10%	90%
GENTAMYCIN	20%	80%	15%	85%
PENICILLIN G	80%	20%	15%	85%
VANCOMYCIN	100%	0%	100%	0%
TETRACYCLIN	70%	30%	70%	30%

(MSSA), Methicillin resistant *Staphylococcus aureus* (MRSA), *Micrococci*, Gram negative *Bacilli* **[Table– 2]**. Microbial count was less on first day as compared to that of 3rd day **[Figure– 3]**. This difference was found to be statistically significant (p = 0.03). Antibiotic sensitivity showed that the microorganisms got more resistant to antibiotics Amoxicillin, PenicillinG, Cotrimoxazole, Erythromicin, Gentamicin at third day as shown in **[Table– 3]**.

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ISSN: 0976-3104

DISCUSSION

The lab coat can get contaminated by microorganisms due to improper handling practices. They get easily contaminated because patients continuously shed infectious microorganisms in the hospital environment, and the health care providers are in constant contact with these patients. *Staphylococci* are the pathogens belonging to the group of Enterobacter bacteria, which cause several infections to humans. They are facultative anaerobic gram-negative cocci mainly found in the skin and mucosa and are of three types *Staphylococcus aureus, Staphylococcus epidermidis* and *Staphylococcus haemolyticus* [7]. Health care professionals are most susceptible to colonization, and the main form of transmission is through temporarily colonized hands. Importantly, treatment of infections caused by *S. aureus* has become difficult because of their higher resistance to various drugs [8].

S aureus is part of the normal human microbial flora and it is found in the nasal passages, throat, gastrointestinal tract and skin. It is considered as one of the most important pathogenic bacteria, causing series of infections [9, 10] leading to the formation of abscesses. It causes infections such as furuncles, folliculitis, scalded skin syndrome, meningitis, and pneumonia. Coagulase-negative *Staphylococci* (CONS) which is a skin commensal has recently got attention as a potential pathogen, specifically for nosocomial infections [11,12,13]. CONS are a major cause of nosocomial infection and septicemia, especially in cases of immune-compromised patients [12].

This study evaluated the type of microbial flora present on the lab coats of the clinicians working in the Dept of Endodontics and their antibiotic sensitivity. Three sites were chosen i.e chest, pocket, cuff for determining the type of microbial flora. Microbial contamination was thought to be highest as these sites most commonly comes in contact with the patients [14,15].This study showed that the numbers of gram positive cocci was the same as that of other studies and maximum of them were potentially pathogenic [15,16].This is consistent with other studies that showed contamination of lab coats ranging from 23% to 95% [17]. They possess a risk of cross contamination if the host is immune compromised. *Micrococci* may act as an opportunistic pathogen in patients with compromised immune systems and they most commonly cause blood stream infection. Gram negative *Bacilli* were also isolated, but these were significantly lesser in number and they may be potentially infectious, as was reported by Zachary and Grabsch. They have shown that bacterial survival rate is of longer period of time on hospital fabrics[18,19].Chacko et al have shown that on lab coat fabrics made up of either cotton polyester or polyester material, bacteria can survive between 10-98 days [20]. Hence the lab coats should be washed daily or at least once in 3 days [20]. Of the two predetermined sites selected for examination on the lab coat, the mouth of the dominant pocket was more contaminated than the chest and cuffs of the sleeve. This is similar to the study of Nelly and contrary to that of Uneke and Ijeocoma which indicated that cuff has more bacterial load than the pocket [21, 22]. Pocket is the highly contaminated area because it frequently comes in contact with the hands of the health care professionals harboring bacterial contaminants.

Antibiotic sensitivity testing showed resistant species of microorganisms on the lab coats against Amoxicillin, Penicillin G, Gentamycin, and Cotrimoxazole. Antibiotic sensitivity results showed the organisms which were sensitive to most common antibiotics on 1st day got resistant on 3rd day **[Figure-4]**.Of the *S. aureus* isolated, 10% were MRSA. The MRSA has emerged as significant bacteria in hospital acquired infections. According to the Centre for Disease Control and Prevention, more than 60% of all hospital infections are caused by MRSA in United States. Because of frequent dermal contact, lab coats can harbor these resistant bacteria. In orders to prevent cross infection, guidelines should be followed for handling and washing procedures of lab coats.

This is a uni-centric study, done to create awareness among our dental colleagues. This study reflects center-specific microbial contamination in a dental operatory. To reach to a more generalized conclusion, the study requires a multi-centric evaluation with a larger sample size.

CONCLUSION

The present study highlights the fact that the lab coats may act as a vector for transmission of cross infection. In order to prevent transmission of cross infection, a strict protocol should be set in order to prevent cross contamination between doctor and patient. Efforts should be made to limit the use of coats outside the working area and they should be laundered every day .Wearing of plastic aprons or altering lab coat material to plastic-laminated clothing or closely woven waterproof cotton can reduce the bacterial transfer rate and cross-contamination

THE IIOAB JOURNAL
ISSN: 0976-3104

CONFLICT OF INTEREST

Authors declare no conflict of interest.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the technical support given by Dr. Dnyaneshwari Ghadage, MD, Professor and Head, Dept of Microbiology, SKN Medical College, Pune.

FINANCIAL DISCLOSURE

No financial support was received to carry out this project.

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