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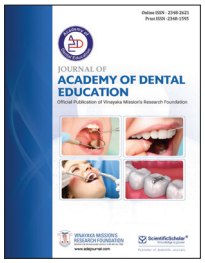

Original Article

Assessment of microbial strains contaminating the white coat of preclinical and clinical dental students – A comparative cross-sectional study

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ABSTRACT

Objective: The objective of the study was to identify the microbial strains contaminating the white coats of preclinical and clinical dental students through microbial culture from swabs of the coat. In addition, the study intended to create awareness regarding the contaminated attire among the students.

Materials and Methods: The cross-sectional study was conducted among 100 students working in the clinical and preclinical labs in the institution. The microbial contamination on the white coat was assessed from swabs using blood agar and MacConkey agar standard techniques. A structured questionnaire was given to the participants to collect demographic data and details about their wearing habits, laundering habits, the habit of exchanging coats, and self-grading about the cleanliness of the white coats.

Results: The white coats of the clinical students were more contaminated than preclinical students. Chest area 52% (n = 26) of preclinical students was less contaminated than clinical students 80% (n = 40). Gram-positive bacilli 24% (n = 12) were more predominant followed by Gram-negative Cocci 20% (n = 10) in white coats of the study participants.

Conclusion: The authors concluded that the white coats of preclinical and clinical dental students were significantly contaminated with microbes. Although the awareness of microbial contamination of white coats among the dental students was high, their casual attitude to the coats being a mode of transmission of infection was observed. The study highlighted the importance of implementing government and institution protocols for coat hygiene.

Keywords: White coat, Microbial, Contamination, Awareness, Students, Hygiene

INTRODUCTION

The contamination of the attire used by the dental fraternity during clinical and preclinical work is an expected reality. Despite this knowledge, the medical and dental students are seen wearing the same attire in common places other than the clinical operatory. Priya *et al.*, and Pydi *et al.* have concluded through their research that white coats might act as vectors of transmission of infections.[1,2] The objective of the present study was to assess the microbial contamination of the white coat by culture and a questionnaire survey to create awareness among the dental students.

MATERIAL AND METHODS

The cross-sectional study was conducted at the Vinayaka Mission's Sankarachariyar Dental College Salem, Tamil Nadu, India. The approval for conducting this study was obtained from the Institutional Ethical Committee of the institution (VMSDC/IEC/Approval No.203). A total of 100 dental students from the institution were selected by convenient sampling to participate in the study. The students were divided into two groups the Group A - Preclinical students and Group B - Clinical students. The participants of the study were included after being informed about the study and getting their consent.

The study was conducted in two parts. Part 1 - The swab samples were collected using peptone water moistened swabs from two areas of the white coat (a) chest area and (b) mouth of the pocket by passing the swabs up and down twice on the desired areas of the white coats of the study participants. The swabs were transferred in a sterile test tube in an icebox to the Department of Microbiology of Vinayaka Mission's Kirupananda Variyar Medical College. The swabs were immediately streaked onto the blood agar plates which were incubated overnight at 37°C [Figure 1]. Gram staining was used to stain the bacterial colonies. The colonies which were obtained were identified using standard techniques.

A structured questionnaire was validated by two expert professionals of more than 15 years of clinical experience. The questionnaire collected demographic variables that included name, age gender, year of studying, and consisted of ten questions to assess the duration of use of their white coats, frequency of washing the white coats, and practice of exchanging their coats with others. The questions included the duration of wearing coat/scrubs in a week (1 day, 2 days, 3 days, and more than 3 days), the duration of wearing a coat in a day (2–3 h, 4–5 h, 5–6 h, and 6-7 h), the use of additional white coats (one coat, two coats, >two coats, and no additional white coats), the frequency of washing (every day, twice a week, once a week, and once a month), washing agents used (only water, detergent, antiseptic, and all of the above), length of usage of coat (6 month once, once a year, 2 years once, and never), and exchange of white coats with others (yes, sometimes, and no). Further, the habit of wearing coats outside the department (yes, sometimes, and never) self-grading of white coats (clean, moderately clean, and dirty) and the wearer's awareness about the transmission of infection through the white coat (yes/no) were also assessed.

Statistical analysis

Data were tabulated in Microsoft Excel and the analysis was carried out using SPSS version 22.0. Chi-square test was used to compare the responses and swab results between genders, year of study, and preclinical and clinical students. $P < 0.05$ was considered to be statistically significant.

Figure 1: (Swabs were streaked onto the blood agar plates).

RESULTS

The study included a total of 100 participants of which 16 were males and 84 were females. The participants were students from the 1st year to the final year of the undergraduate program of dentistry. The total number of students who participated in the study year-wise were as follows; 1st year (n = 15), 2nd year (n = 8), 3rd year (n = 27), and final year (n = 50).

Of the respondents, 81% of males (n = 13) and females (n = 68) had the habit of wearing coats for more than 3 days which involved the continuous wearing of the coats for more than 5–6 h a day. From the responses, it was observed that 50% (n = 8) of the males had the habit of washing clothes once a week while 49% (n = 41) of females washed their clothes twice a week. All of them used detergent, antiseptic, and soap. The males (44%) (n = 7) were more in the habit of exchanging their scrubs with others when compared to the females 22% (n = 19). It was observed that only 25% (n = 4) of males and 28% (n = 23) of females never wore their coats outside the hospital. In self-grading of their white coats, 81% (n = 13) of males and 55% (n = 46) of females graded themselves as moderately clean. It was noted that 88% (n = 14) of males and 95% (n = 80) of females were aware that coats could transmit infections.

Between the years of study, I and II-year students of the preclinical group wore their coats for more than 6–7 h. It was also noted that 44% (n = 22) of the final-year clinical students had the habit of exchanging their coats with others and had the habit of wearing coats outside their department. As per the self-grading scale, 62% (n = 31) of final-year students graded themselves as moderately clean [Figure 2]. About 96% of the students of both groups (pre-clinical (n = 48) and clinical year students (n = 46) were aware that their white coats could transmit disease.

The results obtained from the analysis of the microbial culture of the chest and pocket areas of the student's white coat showed the following observations. The coat was getting contaminated with 95% of non-pathogens. The chest area of white coats in males 81% (n = 13) were positive for microorganisms. The Gram-positive bacilli was predominant in the chest area of the males 37% (n = 6) followed by Gram-positive cocci 18% (n = 3) Gram-negative cocci 12% (n = 2), Gram-positive cocci in the cluster 6% (n = 1), and Micrococci 6% (n = 1) (P = 0.040). The chest area of the white coats in females 63% (n = 53) were also positive for microorganisms. The Gram-positive bacilli and Gram-negative cocci 17% (n = 14) were predominant in the chest area followed by Micrococci 10% (n = 8), Non-hemolytic Gram-positive bacilli 6% (n = 5) and Gram-positive cocci, Gram-negative bacilli, Anaerobic spore form, Gram-negative cocci in a cluster 4% (n = 3) (P = 0.040).

The pocket area of males also showed the Gram-positive bacilli 25% (n = 4) predominantly, followed by Gram-negative cocci 18% (n = 3), Gram-positive cocci 6% (n = 1) and non-hemolytic micrococci 6% (n = 1) (P = 0.149). In the pocket area of females, the Gram-negative cocci 23% (n = 19) were predominant followed by Gram-positive bacilli 21% (n = 18), Anaerobic spore form 13% (n = 11), Gram-positive cocci 6% (n = 5), Micrococci, Gram-positive cocci in the cluster, Gram-negative bacilli 4% (n = 3), and Gram-negative cocci in the cluster 4% (n = 3) (P = 0.149).

The microbial contamination in white coats among the preclinical and clinical students was analyzed based on the year of study. In the 1st-year students, 93% (n = 14) of the chest area of the white coats was free of pathogens, followed by 2nd-year students 37% (n = 3). The 3rd year and final-year students' coats were contaminated at 74% (n = 20) and 80% (n = 40), respectively (P = 0.005). The clinical students (3rd year and final year) had more pathogens 80% (n = 40) on the chest area of white coats than the preclinical students (1st year and 2nd year) 52% (n = 26) (P = 0.03) [Table 1]. All pocket areas of the white coats of the 2nd-year students were contaminated with pathogens, followed by 74% (n = 11) of the 1st-year students (P = 0.829).

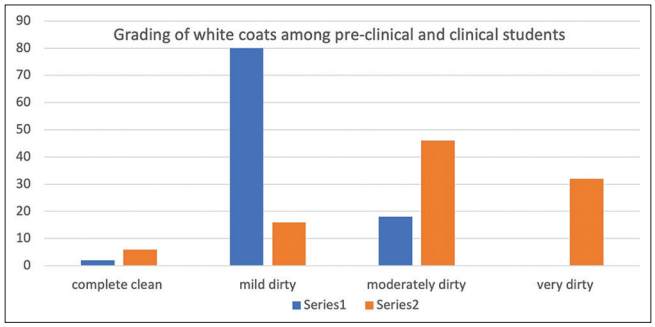

Figure 2: Grading of white coats among preclinical and clinical students (series 1-preclinical and series 2-clinical).

DISCUSSION

The white coat is a symbol of hope and healing to patients and dignity to health care professionals.[1] Health care workers are in constant contact with patients, which can contribute to high rates of bacterial contamination of white coats. Microorganisms are reported to survive for approximately 10–98 days in white coats consisting of cotton, cotton and polyester or polyester materials.[1,3,4]

Dental health workers come into contact with all kinds of infectious agents which could be attributed to the proximity to the patients during treatment. The chances of uniforms, and clothing of dental personnel (white coat) being splattered by blood, aerosol, and saliva raises the risk of infection with various infecting agents. The above-mentioned reasons increase the risk of transmission of infection between the patients, patient's families, and professionals.[1]

In the present study, the authors determined the type of microbial contamination present on the white coats of pre-clinical and clinical dental students and the awareness of microbial contamination of white coats. The female to male ratio was 5.3:1. The females were predominant which might be due to a greater number of female students recruited in the dental institution. With the high frequency of patient contacts in clinical students and due to the lab works of preclinical students, it is to be expected that white coats would be contaminated with microorganisms. The white coats of preclinical students were contaminated with Gram-positive bacilli in the chest area 16% and pocket area 26%. In the clinical students, 24% of the chest area was contaminated with Gram-positive bacilli and the pocket area 24% was contaminated with Gram-negative cocci [Table 1]. The present study was consistent with the study conducted by Priya *et al.* where the Gram-positive organisms were more commonly detected compared to Gram-negative organisms.[1] The other microbes found on these sites were Gram-negative bacilli and other forms of environmental microbes and non-hemolytic micrococci. These microbes were also found in previous studies.[5,6] The microbial contamination among the preclinical students was more in the pocket area 78% than in the chest area 52%. Preclinical students kept their instruments in their pockets and frequently touched them throughout their preclinical work. In clinical students, the pocket area and chest area of white coats were equally contaminated 80% which could be due to the close proximity to patients along with the frequent contact of the pocket area with contaminated gloves. In clinical students, the present study was consistent with the study conducted by Priya *et al.*, where it was concluded that the chest area was highly contaminated followed by pocket mouth.[1]

In the present study, the majority of preclinical students (86%) and clinical students (76%) wore their white coats

Table 1: Microbial contamination of white coats in preclinical and clinical students.

Microbes	Type of organisms	Pre-clinical *n* (%) (Chest area)	Clinical *n* (%) (Chest area)	Pre-clinical *n* (%) (Pocket area)	Clinical *n* (%) (Pocket area)
	Pathogenic/Non-pathogenic	*n* (%)	*n* (%)	*n* (%)	*n* (%)
ASF	Non-pathogenic	1 (2)	2 (4)	7 (14)	4 (8)
GNB	Pathogenic	-	3 (6)	1 (2)	2 (4)
GNC	Non-pathogenic	6 (12)	10 (20)	10 (20)	12 (24)
GNC in cluster	Non-pathogenic	3 (6)	-	1 (2)	1 (2)
GPB	Non-pathogenic	8 (16)	12 (24)	13 (26)	9 (18)
GPC	Non-pathogenic	1 (2)	5 (10)	3 (6)	3 (6)
GPC in cluster	Pathogenic	1 (2)	-	3 (6)	4 (12)
Micrococci	Non-pathogenic	4 (8)	5 (10)	-	3 (6)
No growth	-	24 (48)	10 (20)	11 (22)	10 (20)
NON- hemolytic GPB	Non-pathogenic	2 (4)	3 (6)	-	1 (2)

*ASF: Anaerobic spore form, GPB: Gram-positive bacilli, GNB: Gram-negative bacilli, GNC: Gram-negative cocci, GPC: Gram-positive cocci.

for more than 3 days. It has also been understood that the coats become contaminated once worn. The clinical students laundering their white coats twice a week were 42% and the students washing white coats once a week were 52%. The habit of laundering coats was not consistent with the findings of the study done by Pydi *et al*. and Mishra *et al*.[2,7] In the study by Mishra *et al*., it was found that (55%) of their students launder the coats 3 times a week.[3] The study conducted by Pydi *et al.* (64%) on clinical and (72%) of preclinical students wash their coats twice a week.[2] The frequency of washing coats among the students was more in Pydi *et al*.[2] and Shyam *et al*. studies.[3] The contaminants of the coats of students in the study groups of above-mentioned reports were less when compared to the present study; thereby indicating that coat hygiene is essential or inversely proportional to microbial contamination. About 96% of clinical students and 92% of preclinical students were aware that the white coats transmit disease. Despite being aware of the transmission of disease, clinical students 30% had the habit of exchanging coats with others. The clinical students 36% and the preclinical students 30% continued to wear the white coats in different areas of the college, such as the library, reading rooms, canteen, classes, and even outside the hospital when it was not necessary. The study by Banu *et al*. Conducted on medical students showed that they also had the habit of wearing white coats outside the hospital premises.[8]

In the present study, white coats of 80% (40) of the preclinical students' were mildly dirty and 46% of the clinical students' were moderately dirty as graded by the examiner. The study showed that 44% of the pre-clinical students and 62% of the clinical students who thought that their white coats were clean, were not perceived to be clean by the examiner. The findings in the current study had similarities with the studies conducted by Priya *et al*.[1] Hence, it is necessary to train the students further and mandate a stricter laundry regime for them so that they would be able to acquire the habit.

There are few limitations in the study. The statistical significance of colonized bacteria in the pocket area could not be demonstrated and could be attributed to the sample size. A better understanding of the microorganisms could be obtained if analyzed quantitatively and qualitatively in a larger sample. In addition, the microbial sensitivity to antibiotics could also be evaluated.

CONCLUSION

From the present study, the authors concluded that the coats were a potential mode of microorganisms transport from one area to another, although 95% of the microorganism were non-pathogenic which would explain the reason for no reports of outbreaks of infection in a clinical set up. Yet, it would be wise to restrict the students from wearing the coats outside the departments should be considered as an institutional protocol. The habit of exchanging coats should also be controlled and the importance of the burden on health care system due to cross infections should be stressed among students to deter their casual behavior toward coat hygiene.

Further, it can be stated that the white coat despite being a symbol of healing, could be a mode of transmission of disease. Even though the preclinical and clinical students were aware of white coat hygiene and transmission of disease, it was observed that the contamination of their white coats was high. It is more important for the health-care system to ensure students to practice good coat hygiene habits. It is also important to educate them on when, where, and how often the white coat needs to be changed. Health education on coat hygiene could make a huge difference in reducing the role of the white coat as a vector of infections. Joint efforts by the government and institutions are necessary toward implementing hygiene practices among young undergraduate students.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

Dr. Reena Rachel John, Corresponding author of this manuscript is Editor of this journal.

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