

MICROBIAL CONTAMINATION OF PUMICE SLURRY, PUMICE POWDERS AND ACRYLIC DENTURES CONSTRUCTED IN DENTAL LABORATORIES OF LAHORE

QAISAR A.,¹ ASMAT M.,² FAREED M.A.,³ BAIG Q.A.,⁴ AND NOOR N.⁵

Departments of ¹Prosthodontics, ^{2,3,5}Science of Dental Materials and ⁴Community Dentistry
FMH College of Medicine and Dentistry, Lahore – Pakistan

ABSTRACT

Background and Objectives: Polishing of dental prosthesis prepared in dental laboratories can transmit different infectious agents. These are potential sources of cross – contamination for dental laboratory technicians, dentists and for patients. Non-sterilisable appliances in the dental clinic and laboratory have a health hazard to members of the dental team. The objective of this study was to evaluate the microbial contamination of polishing materials, newly polished acrylic denture and equipment used during the construction of acrylic dentures in dental laboratories.

Methodology: Five samples of pumice powder, pumice slurry, rag wheel and sterile gauze swab rubbed on newly polished acrylic dentures were collected from four randomly selected dental laboratories in sterile containers. The specimens were transferred to microbiology laboratory for isolation and identification of bacterial and fungal microorganisms.

Results: All specimens collected were contaminated either by bacteria or fungi and both pumice powder and rag wheel specimens were contaminated by 80% of gram positive bacilli and 40% of fungus *Aspergillus* species. In pumice slurry 100% *Pseudomonas* and 60% *Aspergillus* species were identified. The results of this study showed considerable bacterial and fungal contamination particularly in pumice slurry may be due to the use of non-sterile water to mix the pumice powder, Gram-positive bacilli and fungi were present in the samples of pumice powder, rag wheel and polished dentures.

Conclusions: Improved sterile techniques in handling dental prosthesis can substantially reduce cross contamination that may occur from the pumice and rag wheel, thereby diminishing the patient's exposure to potentially pathogenic bacteria.

Key Words: Microbial contamination, Dental laboratories, Dental pumice, Dental slurry, Rag wheel, Dental prosthesis.

INTRODUCTION

Cross contamination of non-sterilisable appliances in the dental clinics and laboratories may potentially be a health hazard to the members of the dental team. Although acceptable sterile techniques are applied to most of dental procedures however, disinfection of dental prosthesis has received inadequate attention.¹ The final step of making a denture before delivery to patient is finishing and polishing which is usually done in the dental laboratory. Polishing materials for example, brushes, wheels, pumice, polishing buff and burs used in finishing of dental prosthesis prepared in dental laboratories can transmit different infectious agents and are possible sources of cross – contamination for dental laboratory technicians, dentists and for patients.² Therefore, the common use of polishing agent for prosthesis finishing could be a potential source of cross – contamination and a transmission source for

different oral and non-oral infections.³

The prosthesis delivered to dental clinics from dental laboratories may be contaminated with several pathogenic microorganisms for example, streptococci, lactobacilli, diphtheroids. In prosthetic laboratories, pumice is usually used for polishing and finishing of dental prosthesis which was reported as greatest sources of contamination.⁴ Older patients wearing dentures contaminated by Gram negative bacillus and Enterobacter may cause oropharyngeal and pneumonic infection.⁵ During the polishing process, contaminated aerosols particles remain in air for a long time causing risk for dental personnel and patients. Inhalation of these aerosols is hazardous for immune – compromised, endocarditis and respiratory disease patients.⁶ Pathogenic microorganisms, such as gram – negative bacilli, *pseudomonas* have been detected in pumice. These bacteria, which are not the part of normal flora,

Table 1: Bacterial and fungal contamination of pumice, pumice powder, slurry rag wheel and polished dentures collected from different dental laboratories (MSSA).

Specimens	Bacterial Contamination		Fungus Contamination	
Pumice powder	Gram positive bacilli	80%	Asperrgillus species	40%
Pumice slurry	Pseudomonas	100%	Asperrgillus species	60%
Rag wheel	Gram positive bacilli	80%	Asperrgillus species	40%
Polished denture swab	Gram positive bacilli	60%	Asperrgillus species	40%
	Gram negative bacilli	5%		
	Methicillin – sensitive Staphylococcus aureus (MSSA)	5%		

can be transmitted to patients if dental prosthesis is polished with contaminated pumice.⁷ Therefore, the aim of this study was to evaluate the level of microbial contamination of polishing materials used during the construction of acrylic prosthesis in various dental laboratories in Lahore Pakistan.

MATERIALS AND METHOD

The study was conducted at FMH College of Dentistry, in collaboration with clinical laboratory of Fatima Memorial Hospital, Lahore between Sep. to December 2014. Twenty specimens of pumice powder, pumice slurry, rag buff wheel and sterile gauze swab rubbed on newly polished acrylic dentures were collected from five randomly selected dental laboratories in Lahore using sterile containers. Specimens were transferred immediately to microbiology laboratory and processed within one hour for identification of possible bacteria and fungi contamination. Standard protocols for culture and identification microbes were observed. Sampling was conducted separately for bacterial and fungal culture. The specimens were inoculated in blood agar (Oxoid, England) for isolation of gram positive bacteria and MacConkey agar (Oxoid, England) for isolation of gram negative. The gram negative bacteria were identified by biochemical test such as AP1E20. The inoculated plates were incubated for 48 hours at 37°C for showing growth of colonies. For the isolation of fungi, incubation was done at room temperature for seven days on Sabraud agar plates (Oxoid, UK). These bacterial and fungal colonies were identified using microscopic and microbiological analysis.

RESULTS

All specimens collected from five dental laboratories were found contaminated either by bacteria or fungi or both. Table 1 show the results of microbial contamination of sample and suggest that both pumice powder and rag wheel specimens were contaminated by 80% of gram positive bacilli and 40% of fungus *Aspergillus* species. In pumice slurry 100% *Pseudomonas* and 60%

Aspergillus species were detected. Swabs collected from polished dentures was contaminated with 60% of gram positive bacilli 5% gram negative bacilli 5% methicillin sensitive staphylococcus aureus and 40% fungus *Aspergillus* species (Figure 2).

DISCUSSION

Microbiological contamination is the non-intended or accidental introduction of infectious material (bacteria, yeast, mould, fungi, virus, protozoa or their toxins and by – product) to human. Dental laboratory technicians are particularly exposed to oral and non-oral microbial cross contamination from dentures, pumice powder and particularly pumice slurry used for new and older (repaired) dental prostheses polishing. The risk of cross – contamination in dental clinics as well as transmission of microorganisms in prosthetic laboratories has been reported in various studies⁸. More than 60% of the prostheses delivered to clinics from dental laboratories were contaminated with pathogenic microorganisms, i.e., streptococci, lactobacilli, diphtheroids originating in the oral cavity of other patients.⁹

The results of microbial culture presented in this paper are based on the pilot experimental study to determine the contamination level of pumice powder, slurry, rag wheel and acrylic denture. Our results revealed massive bacterial and fungal contamination particularly in pumice slurry due to the use of non-sterile water to mix the pumice powder. This result is in accordance with Jafari, et al, who found massive bacterial and fungal contamination in pumice slurry.⁶ Moreover, Kahn et al, reported that prosthetic laboratories, lathes and pumice usually used for polishing procedures and finishing of prostheses have been described as the greatest sources of contamination ($1.4 - 8.0 \times 10^5$ colony forming units in pumice pans).¹⁰ Although we have not studied the colony forming units but extensive bacterial growth after 48 – 72 hour was seen in most of the specimens on blood agar medium (Figure 1 and 2). The pumice slurry is generally not changed frequently and

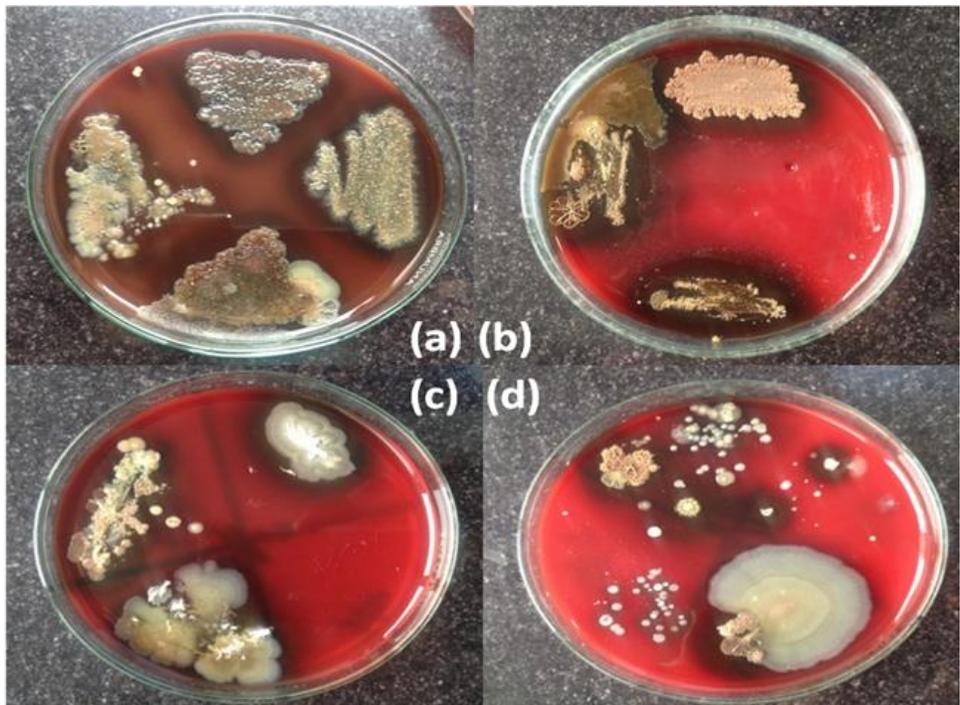


Figure 1: Microbial culture of (a) pumice Slurry, (b) pumice Powder, (c) rag wheel buff and (d) polished denture swab.

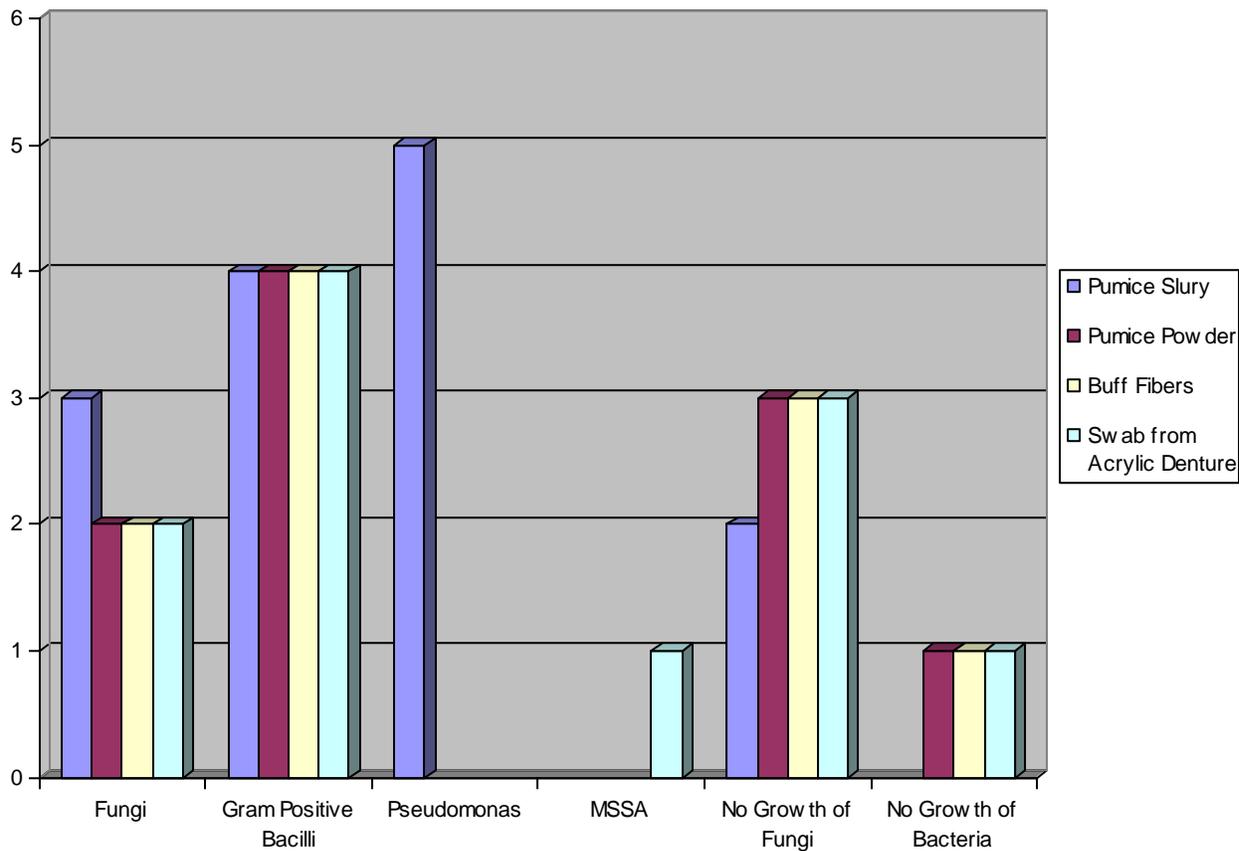


Figure 2: Frequency of distribution of bacterial and fungal contamination in pumice powder, pumice slurry, rag wheel and polished dentures specimens collected from different dental laboratories.

the use of same rag wheel in dental laboratories for polishing of dentures may allow the growth of bacteria and fungi. Therefore, it is possible that bacteria and fungi may be entrapped in micro-porosities and small scratches present on the denture surface to host microorganisms which are difficult to remove by brushing. However, the abrading action of pumice dislodges the microorganisms from denture and causing them to adhere to the pumice and polishing buff. Moreover, water borne microbes from tap water used for mixing of pumice can contaminate it.⁴ The bacteria such as *Pseudomonas* and *Moraxella* are not part of normal flora, can cause serious illness if patient wears contaminated dentures.¹¹ Fungi recovered from samples in current study included *Aspergillus* species that can increase the risk of fungal infection especially in persons who are exposed to it for longer time. Firoozeh, et al, also found *Aspergillus* species from pumice samples.⁷ Results of present study revealed that Gram-positive bacilli and fungi were present in the samples of pumice powder, rag wheel and polished dentures. Gram – positive cocci and Gram – negative bacilli, as the causative agent of denture stomatitis were reported by Van Reenan.¹² The presence of oral microorganisms as lactobacillus, streptococci and diphtheroids was reported by Powel et al, who found a high level of contamination of complete dentures, with presence of *Klebsiella* and *Pseudomonas*.¹³ Contamination of dentures polished from pumice could be a source of cross contamination to the patients at an unacceptable risk. Old patients, who wear dentures, are considered at higher risk to infections.¹⁴ The dentures contaminated during polishing, may transfer organisms to the mouth and pharynx of patients and cause gastrointestinal diseases.¹⁵ William et al, reported increased cases of pneumonia in technicians exposed to lathe aerosols. Technicians working in dental laboratories were diagnosed with *Mycoplasma pneumoniae*. It was suspected that they were infected due to manipulation of contaminated prosthesis.¹¹ Savitha and Srinivas reported that the pumice slurry freshly made by using disinfectant was free from most of contaminations.¹⁶ However, in present study, when we inquired the dental laboratories about the water they used, most of the laboratories use tap water and do not use disinfectant in pumice slurry. Therefore, considering the current practices it is suggested that meticulous infection control measures should be used for disinfection of dentures and indirect restorations before delivery to the patients. The surplus pumice slurry left after polishing should be cleared out after every polishing step be at replaced daily. Residual contaminated pumice slurry should not be left behind over the weekend as it encourages the incubation and growth of microorganisms. The attachments of lathe machine used for polishing denture is also required to remove from the machine after each

use and stored after sterilization. Furthermore, laboratory protective shields, glasses, mask are to used as barriers during polishing to avoid any air borne contamination¹⁷. Nonetheless, Council on Dental Materials; on Dental therapeutics recommended that prosthetic devices should be thoroughly cleaned before grinding or polishing that might generate aerosols.¹⁸ Different others methods such as shields, slow evacuation systems be used when prosthetic materials are polished or ground.

In **conclusion** this study provided the evidence for dentists and dental laboratory personnel about cross – contamination of dental prosthesis during the fabrication especially while polishing process. Improved sterile techniques in handling patients, dental prosthesis can substantially reduce cross contamination that may occur from the pumice and rag wheel, thereby diminishing the patient's exposure to potentially pathogenic bacteria. This study confirmed that pumice slurry was contaminated with *Pseudomonas*, pumice powder predominately have Gram – positive bacilli. Fungi were found in most of the cultured specimens. It is recommended that pumice slurry should be made with disinfection solution (sodium hypochlorite) changed after every polishing or at least daily. The dental laboratories should adapt adequate infection control procedures, to prevent the possibility of cross-contamination by pathogenic microorganisms among patients, dentists and dental laboratory personnel.

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