FUNGAL CONTAMINATION AND DISINFECTION OF DENTAL CHAIRS, TERESINA, PIAUI, BRAZIL

Antônio I. V. de Almondes[1], Jhonatta O. P. de Araújo[1], Larissa Mendes de Sirqueira Amaral[1], Renandro C. Reis[1], Jhonatas C. S. Porto[1], João Batista Teles[2], Thiago L. Monte[2], Iraci de M.S. Noleto[2], Tanit C. Santos[2], Ivonizete P. Ribeiro[1], Mitra Mobin[1]

[1] *Laboratory Research, Centro Universitário de Saúde, Ciências Humanas e Tecnológicas do Piauí*

[2] *Dental Clinic, Centro Universitário de Saúde, Ciências Humanas e Tecnológicas do Piauí.*

ABSTRACT

The aim of this study was to analyze fungal contamination on dental chairs at the clinic of a Higher Education Institution in Teresina-PI, Brazil, and to evaluate the effectiveness of different disinfectants: 70% alcohol and 1% sodium hypochlorite. We selected the five sites with most contact between patient and chair: headrest, backrest, armrests, seat and foot rest. Samples were collected from these sites on 14 chairs and inoculated in agar Sabouraud culture medium containing chloramphenicol. Pathogenic fungi were isolated from all sampling sites on the chairs. Highest frequencies were found on footrest, followed in decreasing order by seat, backrest, armrests and headrest. Fourteen species of filamentous fungi were identified, belonging to the genera Alternaria, Aspergillus, Cladosporium, Curvularia, Drechslera, Fusarium, Penicillium and Paecillomyces. After sampling, seven chairs were disinfected with 70% alcohol and seven with 1% sodium hypochlorite, and samples were taken again using the same procedure. No fungal growth was detected following disinfection with sodium hypochlorite, which was clearly more effective than alcohol, after which there was still fungal growth. This study highlights the need for the biosafety protocol to include cleaning and disinfection of dental chairs with 1% sodium hypochlorite after each attendance in order to prevent cross-infection.

Key words: *Dental equipment; fungi; cross infection; disinfection.*

CONTAMINAÇÃO DE FUNGOS E DESINFECÇÃO EM CADEIRAS ODONTOLOGICAS, TERESINA, PIAUÍ, BRASIL

RESUMO

O objetivo deste estudo foi analisar contaminação fúngica em cadeiras odontológicas na clínica de uma Instituição de Educação Superior em Teresina-PI, Brasil, e avaliar a efetividade de diferentes desinfetantes: álcool 70% e hipoclorito de sódio 1%. Nós selecionamos os cinco locais com maior contato entre o paciente e a cadeira: encosto da cabeça, das costas, dos braços, assento e encosto dos pés. As amostras foram coletadas destes locais das 14 cadeiras e inoculadas em meio de cultura agarSabouraud contendo cloranfenicol. Fungos patogênicos foram isolados de todos os locais de amostragem das cadeiras. As frequências mais altas foram encontradas no encosto dos pés, seguido em ordem decrescente pelo assento, encosto das costas, dos braços e encosto da cabeça. Quatorze espécies de fungos filamentoso foram identificados, pertencente aos gêneros Alternaria, Aspergillus, Cladosporium, Curvularia, Drechslera, Fusarium, Penicillium e Paecillomyces. Após a coleta, sete cadeiras foram desinfetadas com álcool 70% e sete com hipoclorito de sódio 1%, e as amostras foram colhidas novamente usando o mesmo procedimento. Não foi detectado crescimento fúngico após desinfecção com hipoclorito de sódio, que foi claramente mais efetivo que o álcool, do qual ainda houve crescimento fúngico.Este estudo destaca a necessidade da inclusão no protocolo de biossegurança a limpeza e desinfecção das cadeiras odontológicas com o hipoclorito 1% após cada atendimento, a fim de prevenir infecções cruzadas.

Palavras chave: *Equipamentos odontológicos; fungos; infecção cruzada; desinfecção.*

INTRODUCTION

Dental offices harbor various forms of contamination by microorganisms, including fungi, exposing dentists to the risk of infections transmitted in various ways, including direct contact with infectious lesions and secretions; indirect contact by means of microorganisms on instruments, equipment and rigid surfaces; aerosols, and interpersonal contact [1,2].

High-speed handpieces can spread fungi by creating aerosols that settle on surfaces and equipment such as chair, spotlight, dental equipment and

instruments. This is particularly risky when air-conditioning further aggravates the occurrence of fungi and the area is not cleaned regularly [3,4].

Biosafety in dentistry includes a set of actions to protect staff and patients in a clinical setting, including ergonomic practices, control of physical and chemical hazards, use of specific protocols, and appropriate handling of products and equipment, in addition to the sterilization process, disinfection, antisepsis, use of barriers and individual protective equipment (IPE).[5]

Controlling disease transmission is a challenge to dentists, since the oral cavity contains microorganisms, many of which can cause diseases ranging from a mild cold to pneumonia and from tuberculosis to herpes. These infections may be transmitted by contaminated saliva, blood, fluid from the gingival sulcus, and even the patient's respiratory secretions [2,6]. This study analyzed fungal contamination on dental chairs at the clinic in a Higher Education Institution in Teresina-PI, and evaluated the effectiveness of two disinfecting agents: 70% alcohol and 1% sodium hypochlorite.

MATERIAL AND METHODS

This was a quantitative and descriptive study performed at the Research Laboratory of the University Center UNINOVAFAPI in Teresina-PI from January to November 2015, after authorization from the management.

Samples were collected from 14 (93.3%) of the dental chairs by rubbing sterile swabs soaked in

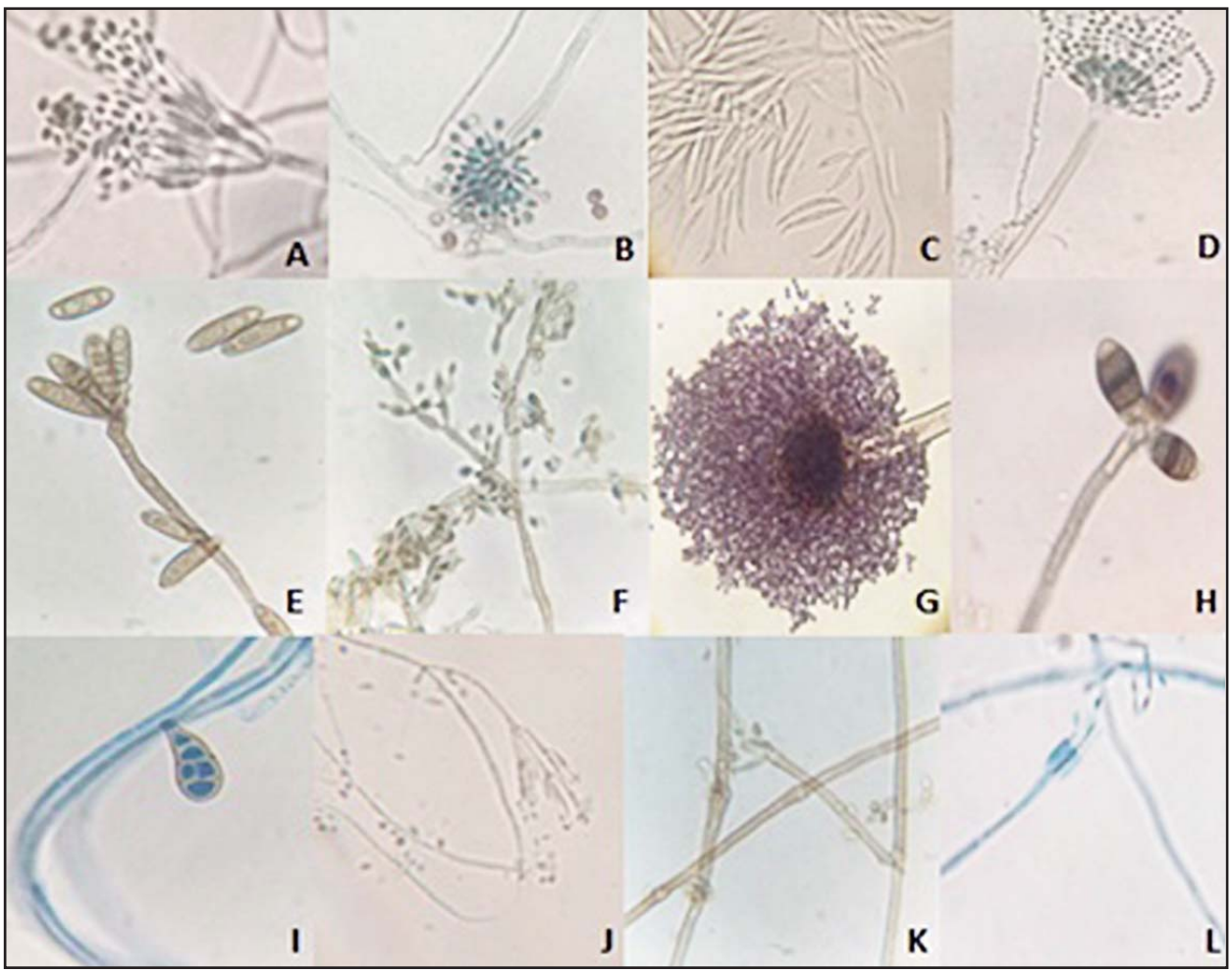

Fig. 1: Micromorphology of filamentous fungi isolated in dental chairs of a Higher Education Institution (HEI):
A- *Penicillium oxalicum;* B- *Aspergillus flavus;* C- *Fusarium aff. incarnatum;* D- *Aspergillus carnus;* E- *Drechslera biseptata;*
F- *Cladosporium cladosporioides;* G- *Aspergillus niger;* H- *Curvularia clavata;* I- *Curvularia brachyspora;*
J- *Penicillium piceum;* K- *Cladosporium oxysporum;* L- *Penicillium decumbens.*

Table 1: Presence of fungal species per dental chair site at a clinic at a Higher Education Institution (HEI).

Fungal Species	Regions				
	Headrest	Backrest	Seat	Armrest	Footrest
Fusarium aff. *Incarnatum*		•			
Paecilomyces variotii		•			
Curvularia lunata		•		•	•
Alternaria infectoria	•	•			•
Aspergillus niger	•	•	•	•	•
Aspergillus flavus			•		•
Cladosporium oxysporum			•		
Cladosporium cladosporioides	•		•		
Drechslera biseptata			•		
Penicillium decumbens			•	•	
Penicillium oxalicum				•	
Aspergillus carneus				•	
Penicillium piceum					
Curvularia brachyspora					

Source: Research Laboratory UNINOVAFAPI.

saline on the five sites selected: headrest, backrest, armrests, seat and footrest.

From each sample, 100µL were inoculated in Petri dishes containing Sabouraud Dextrose agar (Difco™) culture medium plus chloramphenicol (0.05g/L) and incubated at room temperature to enable the growth of the fungal colonies.

After growth of the colonies, microcultures were mounted for recognition of species using identification keys previously described[7,8].

The same procedure was used to test the disinfectant efficacy of 70% ethanol and 1% sodium hypochlorite. For statistical analysis, the chi-square test for goodness of fit was applied with a significance level (α) of 5%.

RESULTS

We identified 14 species belonging to the genera *Alternaria*, *Aspergillus*, *Cladosporium*, *Curvularia*, *Drechslera*, *Fusarium*, *Penicillium* and *Paecillomyces* (Fig.1).

Aspergillus niger was the most frequent species, being found at all sites of the dental chair. *Curvularia clavata* and *Alternaria infectoria* were identified from three site seach (Table 1).

The region with the highest level of contamination was footrest, with 50.0%, followed by seat (42.9%), backrest and armrest (35.7% each), and finally headrest (21.4%) (Table 2).

Following disinfection with 70% alcohol, fungal growth occurred in the samples from all sites, whereas following disinfection with 1% hypochlorite, no fungal growth was observed.

DISCUSSION

Dental chairs can become contaminated by fungi in several ways: via air conditioning, failure to apply biosafety standards, lack of internal protocols and/or failure to comply with them, and invasive procedures performed during treatment.

Table 2: Frequency of fungi on the dental chair, Teresina – PI, 2015.

Dental chair sites	Number of fungal species	%*
Headrest	3	21.4
Backrest	5	35.7
Seat	6	42.9
Armrest	5	35.7
Footrest	7	50.0
Total found	14	100.0

(*) amounts to more than 100% because more than one type of fungus may be found per location.

Table 3: Disease occurrence caused by fungi isolated from dental chairs from a HEI in Teresina - PI.

Fungal Species	Diseases[7]
Penicillium piceum Raper&Fennell	Fungaemia
Penicillium oxalicum Currie & Thom	Eye infection
Aspergillus flavus Link: Fr.	Allergic bronchial aspergillosis, lung infections, ear infections, sinus infections and endocarditis.
Fusarium aff. *incarnatum* (Rob.) Sacc.	Endocarditis
Paecilomyces variotii Bain.	Pneumonia, sinusitis, endophthalmitis
Drechslera biseptata (Sac. & Roum.) Richardson & Fraser	Sinusitis
Cladosporium cladosporioides (Fres.) (de Vries)	Lung and cutaneous infection
Cladosporium oxysporum Berk. & Curt.	Keratitis and cutaneous infection
Aspergillus carneus (v. Tiegh.) Blochwitz	Lung infections
Curvularia clavata Jain	Sinusitis, cerebritis
Alternaria infectoria Simmons	Phaeohyphomycosis
Penicillium decumbens Thom	Fungaemia
Aspergillus niger v. Tiegh.	Pulmonary aspergillosis, endophthalmitis, endocarditis, peritonitis, onychomycosis, cutaneous infections
Curvularia brachyspora Boedijn	Keratitis and cutaneous infection

Source: De Hoog et al. 2000.

All the species found in this study are pathogenic and may cause infections ranging from cutaneous to systemic infections. *Aspergillus niger*, the most common species in this study, causes pulmonary aspergillosis, endophthalmitis, endocarditis, peritonitis and cutaneous infections[7]. The table 3 shows the main diseases caused by the species found in this study.

There is high risk of cross-infection in the dental office as a result of the invasive procedures performed and environmental contamination by biological agents or bioaerosols which may come from internal or external air conditioning, furniture and carpets [2, 3, 9].

Mobin and Salmito found the following pathogenic fungal genera in air conditioners of an Intensive Care Unit (ICU): *Acremonium, Aspergillus, Paecillomyces, Penicillium, Trichoderma, Cladosporium, Curvularia* and *Nigrospora.* Several other studies show that air conditioners provide a favorable environment for fungal growth, thus actively contributing to worsening health status of patients, whether in ICUs or dental offices [10].

Sousa and Fortuna studied air conditioned dental offices in Bahia, and in all cases found the highest frequency of microorganisms such as *Aspergillus* and *Fusarium* near the spittoon [3]. This might be due to high-speed drills spreading microorganisms through aerosols, which may become attached to equipment and accessories as well as remaining airborne.

A study comparing microbial load between a dental clinic and a non-dental public area found that the risk in the dental clinic may be greater than in the public area due to the diversity of microorganisms, susceptibility of the host and exposure time. In addition to bacteria, they found fungi, as *Aspergillus niger* and *Aspergillus flavus* [11].

Another study reports high number of aerosol and bioaerosol particles during dental procedures and a variety of microorganisms present in a dental office, including the fungal genera *Penicillium, Cladosporium* and *Alternaria* [9].

Internal air conditioning also contributes to proliferation and spread of fungi in dental offices. Re-circulating air and airing the room after each patient is recommended to prevent accumulation of fungal spores [10].

After disinfecting the chairs with 70% alcohol, there was still fungal growth from the samples, showing the method to be less effective than use of 1% sodium hypochlorite. Although alcohol is a

commonly used disinfectant, the results of this and of other studies suggest that it is ineffective against fungi [12].

Regarding the action of alcohol on bacteria, several studies claim that its effect is more bacteriostatic than bactericidal. Moreover, there are studies that claim that the use of 70% alcohol is inappropriate for removing saliva layers on instruments, and it has been demonstrated that even water is more appropriate than alcohol for removing blood and organic matter [13].

The biosafety protocol should therefore include cleaning and disinfecting chairs with 1% hypochlorite after each patient in order to prevent cross-infection.

ACKNOWLEDGEMENTS

The authors thank Edivan Pereira da Silva, responsible for the microbiology laboratory, for technical support to the research.

CORRESPONDENCE

Dra. Mitra Mobin
Centro Universitário da Saúde, Ciências Humanas
e Tecnológicas do Piauí.
Rua Vitorino Orthiges Fernandes, 6123 – Uruguai Teresina
Piauí, Brasil. CEP: 64073-505
mitramobin@uninovafapi.edu.br

REFERENCES

1. Cardoso CT, Pinto Júnior JR, Pereira EA, Barros LM, Freitas ABDA. Contaminação de Tubos de Resina Composta manipulados sem barreira de proteção. ROBRAC. 2010; 48: 71-75.
2. Costa Arantes D, de Andrade Hage C, Silva do Nascimento L, Sirotheau Correa Pontes F. Biossegurança aplicada à Odontologia na Universidade Federal do Pará, Cidade de Belém, Estado do Pará, Brasil. Rev Pan-Amaz Saúde. 2015;6:11-18.
3. Silva de Sousa, K, Fortuna, JL. Microrganismos em ambientes climatizados de consultórios odontológicos em uma cidade do extremo sul da Bahia. Revista Baiana de Saúde Pública 2011; 35: 250-263. DOI: 10.5327/Z0100-0233-2015390300002.
4. Vilibor Xavier F, dos Santos Paiva MC, Roselino Ribeiro AL, Goncalves Krakhecke A. Fungos potencialmente patogênicos isolados de água de equipos odontológicos. J Odontol FACIT.2015; 2:22-28.
5. Aleixo RQ, Queiroz RC, Custódio VC, Moura JA. Contaminação dos tubos de resina composta utilizados na clínica odontológica. Clipe Odonto– UNITAU 2010; 1: 39-45.
6. Azeredo F, Macedo de Menezes L, Medina da Silva R, Deon Rizzatto SM, Gressler Garcia G, Revers K. Análises microbiológicas de alicates ortodônticos.Dental Press J Orthod 2011; 16: 103-112.
7. De Hoog GS, Guarro J, Gene J, Figueras MJ. Atlas of clinical fungi. Washington: ASM Press, 2000.1126p
8. Lacaz CS, Porto E, Martins JEC,Heins-Vaccari EM, Melo NT. Tratado de micologia Médica. São Paulo:Sarvier, 2002. 1120p
9. Polednik B. Aerosol and bioaerosol particles in a dental office. Environ Res. 2014; 134: 405-409.
10. Mobin M, do Amparo Salmito M. Microbiota fúngica dos condicionadores de ar nas unidadesde terapia intensiva de Teresina, PI. Rev Soc Bras Med Trop. 2006; 39: 556-559.
11. Kimmerle H, Wiedmann-Al-Ahmad M, Pelz K, Wittmer A, Hellwig E, Al-Ahmad A. Airborne microbes in different dental environments in comparison to a public area. Arch Oral Biol 2012; 57: 689-696.
12. da Silva Aquino I, Porto JC, da Silva JL, Morais KF, Coelho FA, de Sousa Lopes T, Ribeiro IP, Noleto IS, do Amparo Salmito M, Mobin M. Evaluation of disinfectants for elimination of fungal contamination of patient beds in a reference hospital in Piauí, Brazil. Environ Monit Assess. 2016; 188: 2-4.
13. Ferreira AM, de Andrade D, Rigotti MA, de Almeida MT, Guerra OG, dos Santos Junior AG.Assessment of disinfection of hospital surfaces using different monitoringmethods.Rev Lat Am Enfermagem. 2015; 23: 466-474.