The Effect of Ultraviolet to The Growth of Candida Albicans and Transversal Strength of Acrylic Plate

Teguh Tri Widodo*, Rachman Ardan*, Eddy Prijono*

***Department of Prosthodontics Faculty of Dentistry Universitas Padjadjaran**

ABSTRAK

Introduction: Acrylic plate was the basis for a number of tools used in the oral cavity, such as artificial teeth and obturator. In its function, acrylic plate was always in contact with the oral mucosa, so a good disinfection was required without reducing the strength of the acrylic plate. Disinfection could be done with ultraviolet irradiation. Method: This research was a laboratory experimental research with Replication Random Design. Successful tests of disinfection were performed by observing colonic Candida albicans population, while acrylic transversal strength test was performed on 35 acrylic heat curing plates tested according to the ADA specification. Result: Ultraviolet light was able to inhibit the growth of Candida albicans colonies with optimum irradiation time of 20 minutes at 254nm wavelength. Meanwhile irradiation with ultraviolet on an acrylic plate between 5-30 minutes indicated a significant transverse strength. Conclusion: Ultraviolet light at the appropriate wavelength and time proved to inhibit the growth of bacterial colonies and significantly increase the transverse strength of the acrylic plate.

INTRODUCTION

Postoperative infection is a problem that requires attention, especially surgical wound infections and nosocomial infections. In the United States, approximately 2 million people per year are infected with nosocomial infections and nearly 90,000 patients die from it (Tortora, Funke, and Case, 2001).[1] According to Nichols (1998), postoperative infections may originate from patients, operators, operating room environments, or medical devices and materials are in contact with postoperative wounds. The use of prostheses and obturators that are not followed by good disinfection procedures, when installed in postoperative patients can lead to secondary infections, especially in patients who have multiple series of surgical procedures, and in the intermediate stage of one operation with another the past obturator is still in use, or in post-operative patients who are still hospitalized for a long period of time. The use of obturator equipment is a source of post-operative wound contamination, so that will require a disinfection. Ultraviolet ray radiation is a way that can be used, because ultraviolet radiation can kill microorganisms (Fisher, Fegelman, and Johannigman, 1999).[2,3]

Ultraviolet light can inhibit the growth of microorganisms by destroying deoxyribonucleic acid (DNA). Wavelengths between 200 and 300 nm, are the most effective wavelengths, which when absorbed by a DNA molecule will cause the microorganism to die. Therefore, ultraviolet light is routinely used as disinfection of laboratory equipment, rooms, operating rooms and water (Ishida, et al., 1991).[4] Ultraviolet disinfection unit is used to disinfect dentistry material without using chemical solution, so it can avoid the emergence of problems that arise related to the type of disinfectant. The use of ultraviolet disinfection of printed materials and prostheses will not damage the material (Boylan, Goldstein, and Schul-

Correspondence author: Dinah Wibisono, Department of Orthodontic. Faculty of Dentistry Universitas Padjadjaran Jl. Sekeloa Selatan No.1 Bandung, West Java-Indonesia, Tel./Fax.+6222-2504985/2532805

man, 1987[1,5]

Acrylic plate as the basis of artificial teeth in its function is always in contact with mucosal tissue in the mouth. Users of prostheses and obturators on the basis of the acrylic resin material should always maintain hygiene (Mahrus, 1993).[6] According to Connors (1977) and Budtz-Jorgensen (1978), to maintain denture hygiene, two denture cleansing methods are known, namely mechanical and chemical. Mechanical cleaning includes cleaning with toothbrush and ultrasonic. While chemical cleaning is done by soaking in denture cleanser solution or denture cleanser.[7,8]

Disinfection using ultraviolet irradiation is one of the most important alternatives for obturator users, postoperative patients requiring advanced treatment using obturators, disabled patients at rehabilitation centers, elderly patients in nursing homes or immediate denture patients. Cleaning will be quite effective by irradiation using ultraviolet light (Shen, 1984).[9]

Candida albicans are grouped into opportunistic and nosocomial fungi, as they can cause infection especially in immunocompromised patients, long-term broad-spectrum antibiotic use, and the use of prostheses that cause oral clearance are naturally difficult. And the isolated Candida species, Candida albicans, is considered to be the most pathogenic species and the main cause of oral candidiasis and the most anti-fungal resistant because inside the hyphae contains cytoplasm with one or more nuclei, the cytoplasmic membrane contains sterols that act as stabilizers in antimicrobial administration . Candida albicans can produce aspartyl proteinase, phospolipase, and lysophospolipase enzymes that play a role in the adhesion process in the mucosal epithelium, thus facilitating invasion into the host tissue (Bhattacharya, et al., 2003).[10]

Research by Boylan, Goldstein, and Schulman (1987) used bacterial broth solution media and 5 species of oral microorganisms, reported that long irradiation by ultraviolet light at a wavelength of 254 nm could damage the timin bond in DNA and irradiated cells. Continuous irradiation will cause the cell to die. This is because the cells are not able to make improvements to the damage to its DNA part.[5] Ishida, et al. (1991) reported that irradiation using ultraviolet light (8000 uW / cm2) with various time variations, capable of killing Candida albicans (107 cells / ml).[4] Some cleaning agents in the form of a solution that is routinely used to treat printed and denture materials in the field of dentistry often cause considerable changes in this material, especially in excessive use. Additionally, solutions routinely used as a cleaning agent may result in rusted metals, producing irritating vapors, or other damages, depending on the type of disinfectant used[5] (Boylan, Goldstein, and Schulman, 1987). Polymethyl methacrylate has resistance to acid solvents, or weak bases and organic solvents. Acrylic aim soluble in aromatic hydrocarbons, ketones and esters, therefore acrylic should not be cleaned using alcohol and acetone solutions (Craig, 2002).[11]

There are several studies that examine the effect of cleaning agents on the strength of acrylic resins. According to Mahrus (1993), soaking acrylic resins with soapy water can increase water absorption thereby decreasing the transverse power of acrylic resin.6 According to Rossalina (2002), immersion of acrylic resins in sodium hypochlorite can decrease transverse strength.[12] Shen (1984) states the immersion of acrylic resins in a chemical solution of a certain concentration may affect the transverse strength of the acrylic resin. Acrylic resins may be swollen, cracked when exposed to a solution containing phenol, toluene chloroform, resin monomers and concentrated acids (Shen, 1984). To begin the polymerization process, there must be free radicals. Free radicals can be generated by activating monomer molecules with ultraviolet light, heat or energy transfer and other compositions acting as free radicals. A number of substances capable of generating free radicals are potential initiators for polymerization of polymethyl methacrylate resins. The most commonly used initiator is bensoil peroxide, which decomposes at a relatively low temperature to release two free radicals per one molecule of bensoil peroxide. The decomposition process of bensoil peroxide, also called activation. A useful polymerization process for acrylic resins is generally activated through one and three processes. ie heat, chemical and light activation. The present-day proline of resin base on the market is mostly polymerized with heat activation. Thus free radicals are obtained by heating the benzoyl peroxide. During heating, the bensoil peroxide molecule bursts into two free radicals, which then

initiate polymerization of methyl methacrylate monomer. The method of activation by rays occurs by photons activating bensoil peroxide as an initiator, to produce free radicals which can initiate polymerization process (Annusavice, 1996).[9,13]

The highest residual monomers come out after polymerization and will continue to decrease. Reduction of residual monomers can also be carried out using a polymerization method of activation of the rays and by pressing during the polymerization process. Pressure is expected to cause a more dense polymerization result so that the remaining monomer will be pushed out, but if excessive pressure can damage the polymerization process thus affecting the physical properties of the resin (Munadziroh and Indrasari, 2000).[14] Transverse strength is an assessment of the mechanical and physical strength of denture acrylic materials used. Transverse forces are used more often than tank strength or compressive strength, because transverse forces accurately represent the type of load applied to an artificial tooth in the mouth during mastication (Craig, 2002).[11] Based on the description above the authors feel interested to do research the effectivity of ultraviolet rays as a disinfection tool against Candida albicans growth, then want to know whether the use of ultraviolet as a disinfection tool cause adverse impact on the strength of acrylic plate, then the next tested plate strength after irradiated with transverse power test , to find out whether there is a change of strength on the acrylic plate. The objective of the study was to prevent the occurrence of infection caused by Candida albicans, especially on the use of acrylic plate-based or obturator use in post-operative patients so that the patient's healing is better, and to know the extent of ultraviolet light irradiation effect on the transverse power of the acrylic plate.

METHODS

This research is a laboratory experimental research using Replication Random Design. In this study the population and sample size are determined as follows. For the first study population is Candida albicans. Samples are Candida albicans taken and breeding in clinical pathology unit of Dr. Hasan Sadikin Hospital by purposive sampling. For the second study, the population is all brands of heat curing acrylic resin in Bandung. Then determined the sample is a plate of acrylic resin material heat curing Stellon brand that is widely used in Bandung, which is determined by way of purposive sampling. The number of acrylic plate specimens used for 35 plates, divided into six treatment groups, with 5 repetitions for each treatment and 5 acrylic plates as control, according to ADA specification no 12 for transversal strength test replication number 3 to 6.

The research material used in the laboratory during the research which is, plaster cast, gypsum stone, Stellon heat cured acrylic-type acrylic resin, red night, cellophane, aqua distillate, physiological NaCl, vaseline and CMS, Candida albicans suspension, sabourouds glucose agar medium (SGA), a 30 W ultraviolet lamp with a wavelength of 254 nm. The research tool is a tool used in the laboratory during the research took place that is, kuvet, spatula, rubber bowl, quvet press tool, stove, panic, portable grinding machine Kayo brand, hand piece, fissure drill, glass size 65 x 10 x 2.5 mm3 polisher, spirit lamp, oese, disposable cotton swab, autoclave for sterilization, Petri dish, vortex mixer, 500 ml erlenmeyer tube, 100 ml measuring cup, sterile tweezers, closed reaction tube, incubator for incubation, transversal testing instrument bending and Technical Laboratory, Center for Industrial Materials Research and Technical Goods Jalan Sangkuriang no 14 Bandung, mixing jar, cement spatula, lecron, vibrator, thermometer and a caliper.

RESULTS

Ultraviolet light effectively inhibits the growth of Candida albicans, with a 20-minute irradiation at a wavelength of 254 nm being the optimal duration. In addition, ultraviolet irradiation on acrylic plates increases their transverse strength significantly at exposure times between 5 and 30 minutes, while no significant difference is observed between 5 and 10 minutes of irradiation.

CONCLUSION

Ultraviolet light was able to inhibit the growth of Candida albicans colonies. The longer the radiation, the higher the percentage of colony Candi-

da albicans killed. Long irradiation of 20 minutes with a wavelength of 254 nm is the optimum irradiation time.

Irradiation used ultraviolet light against the acrylic plate, was increasing its transverse power compared to the control group. Irradiation with a time of between 5 minutes and 30 minutes showed a significant difference in transverse strength. While the irradiation time between 5-10 minutes did not show any difference in transverse power.

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