ISSN 2220-315x (online)

World Journal of *Experimental Medicine*

Quarterly Volume 14 Number 1 March 20, 2024

Published by Baishideng Publishing Group Inc

W J E M

World Journal of Experimental Medicine

Contents

Quarterly Volume 14 Number 1 March 20, 2024

World Journal of Experimental Medicine

Quarterly Volume 14 Number 1 March 20, 2024

Contents

Contents

World Journal of Experimental Medicine

Quarterly Volume 14 Number 1 March 20, 2024

ABOUT COVER

Peer Reviewer of *World Journal of Experimental Medicine*, Ramya Badrachalam, MBBS, MD, Assistant Professor, Department of Biochemistry, Sri Manakula Vinayagar Medical College & Hospital, Puducherry 605107, India. drramya830@gmail.com

AIMS AND SCOPE

The primary aim of the *World Journal of Experimental Medicine* (*WJEM*, *World J Exp Med*) is to provide scholars and readers from various fields of experimental medicine with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJEM mainly publishes articles reporting research results and findings obtained in the field of experimental medicine and covering a wide range of topics including clinical laboratory medicine (applied and basic research in hematology, body fluid examination, cytomorphology, genetic diagnosis of hematological disorders, thrombosis and hemostasis, and blood typing and transfusion), biochemical examination (applied and basic research in laboratory automation and information system, biochemical methodology, and biochemical diagnostics), *etc*.

INDEXING/ABSTRACTING

The *WJEM* is now abstracted and indexed in PubMed, PubMed Central, Scopus, Reference Citation Analysis, China Science and Technology Journal Database, and Superstar Journals Database. The *WJEM*'s CiteScore for 2022 is 1.0 and Scopus CiteScore rank 2022: Internal medicine is 106/140.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Ying-Yi Yuan*; **Production Department Director:** *Xu Guo*; **Editorial Office Director:** *Ji-Hong Liu*.

NAME OF JOURNAL
World Journal of Experimental Medicine

ISSN
ISSN 2220-315x (online)

LAUNCH DATE
December 20, 2011

FREQUENCY
Quarterly

EDITORS-IN-CHIEF
Leonardo Roever, Jian Wu

EXECUTIVE ASSOCIATE EDITORS-IN-CHIEF
Fang Gong, Ya-Jie Wang

EDITORIAL BOARD MEMBERS
https://www.wjgnet.com/2220-315x/editorialboard.htm

PUBLICATION DATE
March 20, 2024

PUBLISHING PARTNER
Department of Clinical Laboratory, The Affiliated Suzhou Hospital of Nanjing Medical University, Suzhou Municipal Hospital

INSTRUCTIONS TO AUTHORS
https://www.wjgnet.com/bpg/gerinfo/204

GUIDELINES FOR ETHICS DOCUMENTS
https://www.wjgnet.com/bpg/GerInfo/287

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH
https://www.wjgnet.com/bpg/gerinfo/240

PUBLICATION ETHICS
https://www.wjgnet.com/bpg/GerInfo/288

PUBLICATION MISCONDUCT
https://www.wjgnet.com/bpg/gerinfo/208

ARTICLE PROCESSING CHARGE
https://www.wjgnet.com/bpg/gerinfo/242

STEPS FOR SUBMITTING MANUSCRIPTS
https://www.wjgnet.com/bpg/GerInfo/239

ONLINE SUBMISSION
https://www.f6publishing.com

PUBLISHING PARTNER's OFFICIAL WEBSITE
http://www.smh.cc/home2020/page/index/index.html

W J E M World Journal of Experimental Medicine

Submit a Manuscript: https://www.f6publishing.com

World J Exp Med 2024 March 20; 14(1): 84284

DOI: 10.5493/wjem.v14.i1.84284

ISSN 2220-315x (online)

EDITORIAL

Potential of photodynamic therapy in the management of infectious oral diseases

Cinzia Casu, Germano Orrù

Specialty type: Dentistry, oral surgery and medicine

Provenance and peer review: Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): A
Grade B (Very good): B
Grade C (Good): C
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Aoun G, Lebanon; Liu HQ, China; Wu J, China

Received: July 28, 2023
Peer-review started: July 28, 2023
First decision: October 9, 2023
Revised: November 24, 2023
Accepted: December 19, 2023
Article in press: December 19, 2023
Published online: March 20, 2024

Cinzia Casu, Germano Orrù, Department of Surgical Science, Oral Biotechnology Laboratory, University of Cagliari, Cagliari 09124, Italy

Corresponding author: Cinzia Casu, MD, Adjunct Professor, Department of Surgical Science, Oral Biotechnology Laboratory, University of Cagliari, Via Ospedale 54, Cagliari 09124, Italy. ginzia.85@hotmail.it

Abstract

Photodynamic therapy (PDT) can take place in the presence of three elements: Light with an appropriate wavelength; a photosensitizer; and the presence of oxygen. This type of treatment is very effective overall against bacterial, viral and mycotic cells. In the last 10 years many papers have been published on PDT with different types of photosensitizers (*e.g.*, methylene blue, toluidine blue, indocyanine green, curcumin-based photosensitizers), different wavelengths (*e.g.*, 460 nm, 630 nm, 660 nm, 810 nm) and various parameters (*e.g.*, power of the light, time of illumination, number of sessions). In the scientific literature all types of PDT seem very effective, even if it is difficult to find a standard protocol for each oral pathology. PDT could be an interesting way to treat some dangerous oral infections refractory to common pharmacological therapies, such as candidiasis from multidrug-resistant *Candida spp*.

Key Words: Photodynamic therapy; oral infections; Photodynamic therapy *vs* candidiasis; Blue light; 460 nm; *Streptococcus mutans*

Core Tip: In recent years there are more and more multidrug resistant infections at the oral level, and this has led researchers to find alternative solutions to conventional pharmacology that have no impact on systemic health. Among these, there is photodynamic therapy, which has demonstrated efficacy both *in vitro* and *in vivo*, for treating bacterial, viral (reducing recrudescence) and fungal infections, particularly multidrug-resistant *Candida spp*.

Citation: Casu C, Orrù G. Potential of photodynamic therapy in the management of infectious oral diseases. *World J Exp Med* 2024; 14(1): 84284
URL: https://www.wjgnet.com/2220-315x/full/v14/i1/84284.htm
DOI: https://dx.doi.org/10.5493/wjem.v14.i1.84284

INTRODUCTION

There are over 780 results in PubMed when searching the keyword "Photodynamic Therapy for Oral Infection," with an exponential growth of the works published in the last 10 years. All this denotes the strong scientific interest of this instrument in the field of infectious pathologies of the oral cavity.

Photodynamic therapy (PDT) can take place in the presence of three elements: Light with an appropriate wavelength; a photosensitizer; and the presence of oxygen. When a photosensitizer is activated by light, it will either lose energy or form an oxygen triplet[1]. This second type of PDT is linked to the amount of oxygen, while the first type of PDT can work in anaerobic conditions[2]. The interaction that the photosensitizer has with oxygen can determine the formation of hydrogen peroxide, hydroxyl radicals, superoxide radical oxygen, and singlet oxygen. These products determine the killing of microorganisms due to damage to the cell membrane and their metabolic activity[1].

The maximum absorption of light by the photosensitizer occurs at a wavelength between 600 nm and 800 nm. In fact, a higher wavelength would not have enough energy to stimulate oxygen to produce radicals[1]. The penetration of the wavelength comprised between 700-1100 nm is wider than that comprised between 400-700 nm[2].

Among the infections that afflict the oral cavity, endodontic infections are caused by microorganisms that colonize the inside of the tooth and can give rise to infections in the periapical bone tissue. One of the most important microorganisms in this infectious process is *Enterococcus faecalis* (*E. faecalis*), which is also the most studied *in vitro* and *ex vivo* model. The difficulty of eradicating this microorganism responsible for endodontic re-infections and refractory infections has prompted researchers to make use of PDT in eradicating this microorganism. Researchers have found that the photosensitizer curcumin activated by LED (450 nm, 67 mW/cm^2, and 20.1 J/cm^2) has shown very interesting results in reducing the colony forming units of *E. faecalis*[1]. Other authors have tested Ce6 methyl ester (Zn(II)e6Me), a chlorophyll-derived photosensitizer activated by red light (627 nm, 75 mW, 3150 J/cm^2) for 90 s, with success against *E. faecalis*. Furthermore, an *in vitro* study found that a PDT using 500 g/mL of Chlorella plus 660 nm diode laser at an energy density of 23.43 J/cm^2 was effective against *E. faecalis* biofilms[1].

The most frequent infectious disease at the gingival level is periodontitis. It is an infectious process mediated by various microorganisms, including *Porphyromonas gingivalis* and *Aggregatibacter actinomycetemcomitans* that leads to inflammation and destruction of bone and gingival tissue with loss of stability of the dental elements. *Curcuma longa* activated by blue LED lights (450-470 nm, output power density 1.2 W/cm^2) and Ce6 have shown the most effectiveness among the natural photosensitizers[1]. PDT carried out with *Curcuma longa* and diode light at 460 nm has also shown efficacy in drug-induced gingival hypertrophy[3].

Rose bengal with a light source for illumination (375 nm, 3 mW/cm^2) could be very useful for reducing the bacterial load of *Streptococcus mutans*, the most important etiological agent of dental cavities. Ozonated water used as a photosensitizer and activated by 460 nm LED lights has also demonstrated efficacy against *Streptococcus mutans*[4].

The most frequent oral viral infectious diseases are associated with herpes simplex type 1. Clinically, this is a condition that involves the formation of vesicles filled with infectious liquid that when they explode give rise to erosion and the formation of crusts if they affect the vermilion border of the lips. In this context, the gold standard treatment is represented by topical or systemic antivirals, particularly in extensive systemic cases. However, the reduction of effectiveness of traditional pharmacological treatments has prompted several researchers to find different solutions to mitigate these infections, including PDT[5]. For example, the most common photosensitizer for the treatment of *Herpes simplex* infection is methylene blue at concentrations between 0.1% and 1%, activated by lights with a wavelength of 660 nm. In another *in vitro* study, indocyanine green also showed good results when activated by wavelengths of 810 nm[6,7].

Human papillomavirus (HPV) plays a prominent role in causing viral infections in the mouth. According to the World Health Organization reports, it is estimated that in developed countries a growing prevalence of HPV-related cancer is reported each year, particularly for males. There are over 200 subtypes of HPV, but some of these can trigger malignant tissue transformations, including HPV 16. Surgical excision and histological evaluation represent the treatment of choice. Sometimes these lesions can reach considerable dimensions, are located in sites that are difficult to reach and can be recurring. These reasons have led clinicians to try PDT on the oral cavity in a patient with a large squamous papilloma in the soft palate. In this case, a formulation containing 5-aminolevulenic acid is injected at the perilesional level and activated with wavelengths of 630 nm at a power of 100 J/cm^2 and at 300 mW/cm^2 of power density for 6 min. After two sessions, the lesion healed[8].

PDT has also been proposed in the treatment of oral lesions from coronavirus disease 2019. In fact, *in vitro* studies have shown that methylene blue was able to inhibit the severe acute respiratory syndrome coronavirus 2 spike protein and its angiotensin converting enzyme-2 receptor. It was also used to treat the typical crusted lip lesions associated with coronavirus disease 19 at very low concentrations[9].

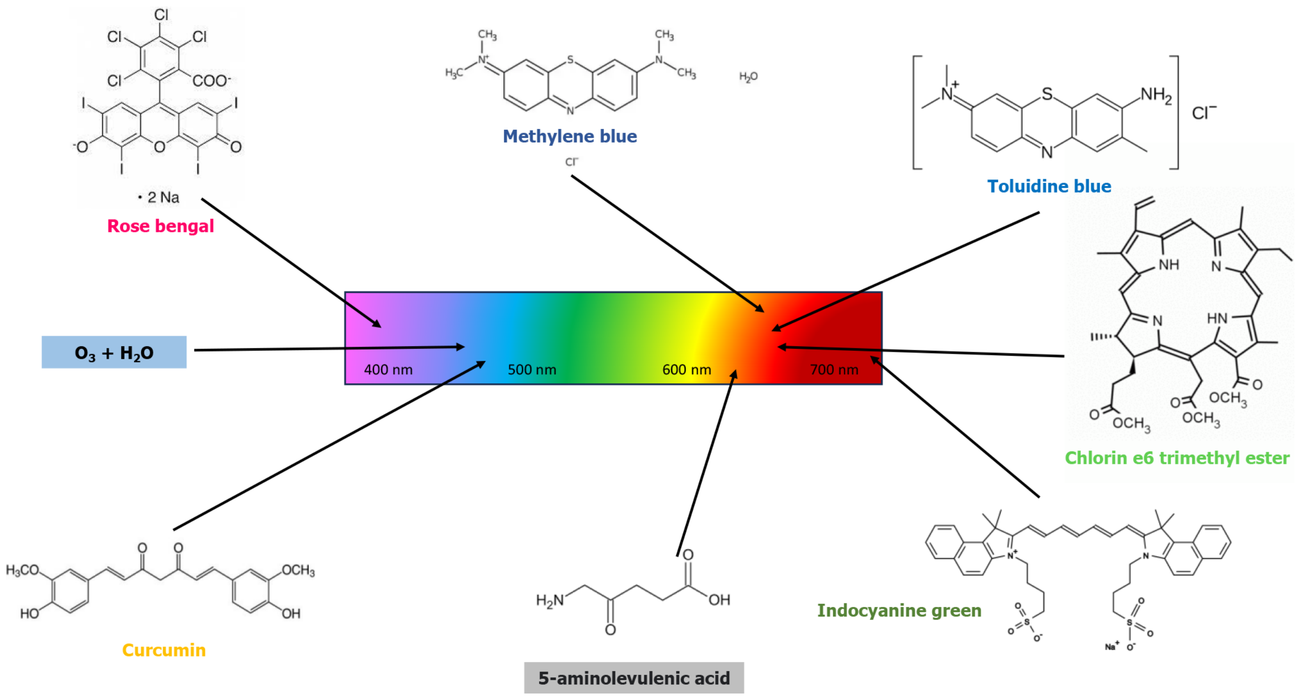

Figure 1 Schematic representation of the main photosensitizers used in oral medicine with the respective wavelength of excitation pointed in the visible light spectrum.

PDT FOR ORAL CANDIDIASIS

Oral candidiasis, as previously mentioned, is an infection that increasingly shows resistance to the main commercial antifungals, such as azoles. PDT was proposed 15 years ago as an alternative, especially in relapsing cases of oral candidiasis. Among the most tested photosensitizers, methylene blue, which is associated with laser and non-red laser lights, has demonstrated excellent antifungal properties at different concentrations[10-13]. Toluidine blue has also been widely proposed in different concentrations for the treatment of *Candida* infections in the oral cavity. A recent review on the subject has highlighted that most of these are *in vitro* studies, where the parameters used are very different between the various studies, even if almost all report the efficacy of PDT. In addition to the more common *Candida albicans*, it has also been tested against different species of *Candida* in some studies, such as *Candida glabrata, Candida krusei, Candida parapsilosis and Candida tropicalis*. Toluidine blue has been shown to be effective against all types of *Candida spp.* mentioned [14]. Most of the *in vitro* studies evaluated both the activity of PDT in its planktonic form and in the biofilm of the fungus. The prevailing method was that of microplates[14].

A recent compound, indocyanine green, activated by a light with a wavelength of 808 nm has also been proposed as a photosensitizer. In fact, by comparing this approach with a traditional treatment based on nystatin, a significant infection reduction was observed, which was similar to the healthy group control patient[15]. The same result was reported in another study on refractory subprosthetic candidiasis in which PDT showed better results than the group treated only pharmacologically[16]. Furthermore, in another study, PDT with indocyanine green was shown to be more effective *in vitro* than PDT performed with methylene blue[17].

Other photosensitizers tested *in vitro* against *Candida* were erythrosine and rose bengal, activated by green diode lights around 532 nm[18,19]. Erythrosine was also effective against *Candida dubliniensis*, demonstrating good efficacy in the planktonic form but less activity on the biofilm[20]. Among the natural photosensitizers reported are 5-aminolevulenic acid[21] and derivatives from *Curcuma longa*, which was first carried out in 2013[22]. In a study using LED light at 460 nm, 5-aminolevulenic acid showed *in vitro* antifungal activity higher than that of methylene blue, which was activated by red light at 660 nm[23]. A photosensitizer based on *Curcuma longa*/3% hydrogen peroxide, activated by polarized light (wavelength from 380 to 3400 nm), showed greater antifungal activity than activation with LED light at 460 nm (the wavelength most widely used in PDT to activate curcumin)[24]. Furthermore, PDT has also shown efficacy in other oral pathologies, perhaps by virtue of its antimicrobial action against microorganisms that colonize the damaged mucosal surfaces[25] or which may be at the basis of the pathogenic process[26]. The main photosensitizers used in PDT *vs* oral infections, with relative wavelength of activation, are summarized in Figure 1.

CONCLUSION

The increasing resistance to antibiotics, antifungals and antivirals, the side effects of the drugs themselves on some categories of patients and the possibility of resolving some infections in a single session have led researchers to propose the use of PDT as a treatment tool for refractory infections of the oral cavity. The wide variability of the parameters used, including the wavelength, the type of photosensitizer, the pre-illumination and irradiation times, makes it difficult to have standard protocols for the treatment of each oral pathology. Further studies will be needed to find the most suitable protocols for each type of oral infection.

ACKNOWLEDGEMENTS

Cinzia Casu performed this research activity in the framework of the International PhD in Innovation Sciences and Technologies at the University of Cagliari, Italy.

FOOTNOTES

Co-corresponding authors: Cinzia Casu and Germano Orrù.

Author contributions: Casu C contributed to ideas and writing of the work; Orrù G contributed to bibliographic support, creation of the figure and final revision; Casu C and Orrù G are both corresponding authors because they have different areas of expertise (Casu C is a clinician with expertise in oral pathology, and Orrù G is a biologist with expertise in microbiology and molecular biology); All authors read and approved the final manuscript.

Conflict-of-interest statement: All the authors declare having no conflicts of interest.

Country/Territory of origin: Italy

ORCID number: Cinzia Casu 0000-0002-7962-2712.

S-Editor: Liu JH
L-Editor: Filipodia
P-Editor: Yuan YY

REFERENCES

1 **Afrasiabi S**, Partoazar A, Chiniforush N, Goudarzi R. The Potential Application of Natural Photosensitizers Used in Antimicrobial Photodynamic Therapy against Oral Infections. *Pharmaceuticals (Basel)* 2022; **15** [PMID: 35745686 DOI: 10.3390/ph15060767]

2 **Gao J**, Chen Z, Li X, Yang M, Lv J, Li H, Yuan Z. Chemiluminescence in Combination with Organic Photosensitizers: Beyond the Light Penetration Depth Limit of Photodynamic Therapy. *Int J Mol Sci* 2022; **23** [PMID: 36293406 DOI: 10.3390/ijms232012556]

3 **Casu C**, Murgia MS, Orrù G, Scano A. Photodynamic therapy for the successful management of cyclosporine-related gum hypertrophy: A novel therapeutic option. *J Public Health Res* 2022; **11**: 22799036221116177 [PMID: 36226306 DOI: 10.1177/22799036221116177]

4 **Casu C**, Orrù G, Fais S, Mazur M, Grassi R, Grassi RF, Nardi GM. Efficacy of ozonated water as a PS in photodynamic therapy: A tool for dental caries management? An *in vitro* study. *J Public Health Res* 2023; **12**: 22799036231182267 [PMID: 37378003 DOI: 10.1177/22799036231182267]

5 **La Selva A**, Negreiros RM, Bezerra DT, Rosa EP, Pavesi VCS, Navarro RS, Bello-Silva MS, Ramalho KM, Aranha ACC, Braz-Silva PH, Fernandes KPS, Bussadori SK, Horliana ACRT. Treatment of herpes labialis by photodynamic therapy: Study protocol clinical trial (SPIRIT compliant). *Medicine (Baltimore)* 2020; **99**: e19500 [PMID: 32195950 DOI: 10.1097/MD.0000000000019500]

6 **Khalil M**, Hamadah O. Association of Photodynamic Therapy and Photobiomodulation As a Promising Treatment of Herpes Labialis: A Systematic Review. *Photobiomodul Photomed Laser Surg* 2022; **40**: 299-307 [PMID: 35483089 DOI: 10.1089/photob.2021.0186]

7 **Namvar MA**, Vahedi M, Abdolsamadi HR, Mirzaei A, Mohammadi Y, Azizi Jalilian F. Effect of photodynamic therapy by 810 and 940 nm diode laser on Herpes Simplex Virus 1: An *in vitro* study. *Photodiagnosis Photodyn Ther* 2019; **25**: 87-91 [PMID: 30447412 DOI: 10.1016/j.pdpdt.2018.11.011]

8 **Jin J**, Zhang Y, Zhiyue L. Successful treatment of oral human papilloma by local injection 5-aminolevulinic acid-mediated photodynamic therapy: A case report. *Photodiagnosis Photodyn Ther* 2019; **26**: 134-136 [PMID: 30890459 DOI: 10.1016/j.pdpdt.2019.03.011]

9 **Betsy J**, Prasanth CS. Can photodynamic therapy be repurposed to treat oral lesions of COVID-19? *Photodiagnosis Photodyn Ther* 2021; **33**: 102175 [PMID: 33422697 DOI: 10.1016/j.pdpdt.2021.102175]

10 **Freire F**, Ferraresi C, Jorge AO, Hamblin MR. Photodynamic therapy of oral Candida infection in a mouse model. *J Photochem Photobiol B* 2016; **159**: 161-168 [PMID: 27074245 DOI: 10.1016/j.jphotobiol.2016.03.049]

11 **Javed F**, Samaranayake LP, Romanos GE. Treatment of oral fungal infections using antimicrobial photodynamic therapy: a systematic review of currently available evidence. *Photochem Photobiol Sci* 2014; **13**: 726-734 [PMID: 24686309 DOI: 10.1039/c3pp50426c]

12 **Boltes Cecatto R**, Siqueira de Magalhães L, Fernanda Setúbal Destro Rodrigues M, Pavani C, Lino-Dos-Santos-Franco A, Teixeira Gomes M, Fátima Teixeira Silva D. Methylene blue mediated antimicrobial photodynamic therapy in clinical human studies: The state of the art.

Photodiagnosis Photodyn Ther 2020; **31**: 101828 [PMID: 32473398 DOI: 10.1016/j.pdpdt.2020.101828]

13 **Martins Jda S**, Junqueira JC, Faria RL, Santiago NF, Rossoni RD, Colombo CE, Jorge AO. Antimicrobial photodynamic therapy in rat experimental candidiasis: evaluation of pathogenicity factors of Candida albicans. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011; **111**: 71-77 [PMID: 21176823 DOI: 10.1016/j.tripleo.2010.08.012]

14 **Wiench R**, Skaba D, Matys J, Grzech-Leśniak K. Efficacy of Toluidine Blue-Mediated Antimicrobial Photodynamic Therapy on Candida spp. A Systematic Review. *Antibiotics (Basel)* 2021; **10** [PMID: 33806003 DOI: 10.3390/antibiotics10040349]

15 **Tavangar A**, Khozeimeh F, Razzaghi-Abyaneh M, Sherkat S. Sensitivity of Four Various Candida Species to Photodynamic Therapy Mediated by Indocyanine Green, an *in vitro* Study. *J Dent (Shiraz)* 2021; **22**: 118-124 [PMID: 34150948 DOI: 10.30476/DENTJODS.2020.81817.0]

16 **Afroozi B**, Zomorodian K, Lavaee F, Zare Shahrabadi Z, Mardani M. Comparison of the efficacy of indocyanine green-mediated photodynamic therapy and nystatin therapy in treatment of denture stomatitis. *Photodiagnosis Photodyn Ther* 2019; **27**: 193-197 [PMID: 31185323 DOI: 10.1016/j.pdpdt.2019.06.005]

17 **Azizi A**, Amirzadeh Z, Rezai M, Lawaf S, Rahimi A. Effect of photodynamic therapy with two photosensitizers on Candida albicans. *J Photochem Photobiol B* 2016; **158**: 267-273 [PMID: 27064379 DOI: 10.1016/j.jphotobiol.2016.02.027]

18 **Costa AC**, Rasteiro VM, Pereira CA, Rossoni RD, Junqueira JC, Jorge AO. The effects of rose bengal- and erythrosine-mediated photodynamic therapy on Candida albicans. *Mycoses* 2012; **55**: 56-63 [PMID: 21668520 DOI: 10.1111/j.1439-0507.2011.02042.x]

19 **Freire F**, Costa AC, Pereira CA, Beltrame Junior M, Junqueira JC, Jorge AO. Comparison of the effect of rose bengal- and eosin Y-mediated photodynamic inactivation on planktonic cells and biofilms of Candida albicans. *Lasers Med Sci* 2014; **29**: 949-955 [PMID: 24013675 DOI: 10.1007/s10103-013-1435-x]

20 **Costa AC**, de Campos Rasteiro VM, Pereira CA, da Silva Hashimoto ES, Beltrame M Jr, Junqueira JC, Jorge AO. Susceptibility of Candida albicans and Candida dubliniensis to erythrosine- and LED-mediated photodynamic therapy. *Arch Oral Biol* 2011; **56**: 1299-1305 [PMID: 21704304 DOI: 10.1016/j.archoralbio.2011.05.013]

21 **AlGhamdi AS**, Qamar Z, AlSheikh R, Al Hinai MTA, Abdul NS, Aljoghaiman EA, Ali S. Clinical efficacy of 5-aminolevulinic acid-mediated photodynamic therapy *vs* topical antifungal agent and surgical excision for the treatment of hyperplastic candidiasis. *Photodiagnosis Photodyn Ther* 2023; **41**: 103258 [PMID: 36592782 DOI: 10.1016/j.pdpdt.2022.103258]

22 **Dovigo LN**, Carmello JC, de Souza Costa CA, Vergani CE, Brunetti IL, Bagnato VS, Pavarina AC. Curcumin-mediated photodynamic inactivation of Candida albicans in a murine model of oral candidiasis. *Med Mycol* 2013; **51**: 243-251 [PMID: 22934533 DOI: 10.3109/13693786.2012.714081]

23 **Daliri F**, Azizi A, Goudarzi M, Lawaf S, Rahimi A. In vitro comparison of the effect of photodynamic therapy with curcumin and methylene blue on Candida albicans colonies. *Photodiagnosis Photodyn Ther* 2019; **26**: 193-198 [PMID: 30914389 DOI: 10.1016/j.pdpdt.2019.03.017]

24 **Casu C**, Orrù G, Scano A. Curcumin/H2O2 photodynamically activated: an antimicrobial time-response assessment against an MDR strain of Candida albicans. *Eur Rev Med Pharmacol Sci* 2022; **26**: 8841-8851 [PMID: 36524503 DOI: 10.26355/eurrev_202212_30556]

25 **Casu C**, Mannu C. Atypical Afta Major Healing after Photodynamic Therapy. *Case Rep Dent* 2017; **2017**: 8517470 [PMID: 29085681 DOI: 10.1155/2017/8517470]

26 **Scano A**, Casu C, Orrù G, Coni P. Editorial - Epigenetic mechanisms in oral cancer: new diagnostic and therapeutic strategies. *Eur Rev Med Pharmacol Sci* 2022; **26**: 7318-7320 [PMID: 36314301 DOI: 10.26355/eurrev_202210_30000]

Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
Telephone: +1-925-3991568
E-mail: office@baishideng.com
Help Desk: https://www.f6publishing.com/helpdesk
https://www.wjgnet.com