

Role of Photodynamic Therapy (PDT) for Oral Cancer



Rajkumari P Khatri*

Senior Otolaryngologist and laser consultant, DAVV, India

Submission: November 28, 2023; **Published:** December 15, 2023

***Corresponding author:** Dr Rajkumari P Khatri, Senior Otolaryngologist and laser consultant, DAVV, Indian Institute of Head and Neck Oncology, Rau, Indore, India

Abstract

Cancers of the oral cavity are the sixth most common cancer in the world. Oral cancer represents a third of all malignant tumors of the head and neck, though the incidence continues to increase with moderate survival rates. Surgery, radiotherapy, or chemotherapy are recommended modalities for the treatment of oral cancer, but these therapies are associated with significant complications that impair the quality of life. Therefore, there is a need for alternative therapy for the supportive care of the patients. Although Photodynamic therapy (PDT) is not an alternative to conventional cancer therapy, it is used as a successful and clinically approved treatment for the management of benign lesions, precancerous lesions, and early carcinoma affecting the oral mucosa. The advantages of photodynamic therapy are that it is simple, non-invasive, cost-effective, highly acceptable to patients, and can be done as an outpatient procedure. It can be used due to its sensitivity and specificity for tumor cells, which improves the quality of life drastically. It has less morbidity, better functionality, and an excellent cosmetic outcome. In the future, PDT has the potential to become integrated into the mainstream of cancer treatment as well as non-malignant lesions. More research work is needed to establish it.

Keywords: Photodynamic therapy; Oral cancer; Premalignant lesion; Radiotherapy; Oral lesion

Abbreviations: PDT: Photodynamic Therapy; PS: Photosensitizer; ROS: Reactive Oxygen Species

Introduction

Photodynamic therapy (PDT) is a minimally invasive surgical tool successfully targeting premalignant and malignant disorders in the head and neck, gastrointestinal tract, lungs, and skin with greatly reduced morbidity and disfigurement. The technique is simple, can be carried out in outpatient clinics, is highly acceptable to patients, and has minimum side effects. While the majority of patients with oral cavity cancer are in the advanced stage, which requires extensive surgical resection and reconstruction, which leads to facial disfigurement, functional defects related to the maxilla-mandibular complex, and loss of vital organs like the tongue, this leads to considerable psychological and emotional effects.

Conventional radiotherapy and chemotherapy are frequently associated with serious complications that may require interruption of the oncotherapy, thereby affecting the prognosis and survival. The term photodynamic was coined by Joddlaner and Von Tappeiner in 1904. In 1903, Von Tappeiner & Jesionek were probably the first to use PDT in oncology. and more widespread use in the therapeutic application of PDT started

in the seventies with the experiments of Dougherty et al. [1-3]. Photodynamic therapy (PDT), defined as “the light-induced inactivation of cells, microorganisms, or molecules,” combines the use of a photosensitive agent or photosensitizer (PS) activated by irradiation with a light of a specific wavelength to produce reactive oxygen species (ROS) and highly reactive singlet oxygen.

Mechanism of Action

Photodynamic therapy is a multistep process that requires the selective uptake and retention of photosensitizer in target tissue. The photosensitizer is activated by non-thermal light of the appropriate wavelength, which is capable of triggering photochemical reactions. The photosensitizer undergoes a transition from its ground state to an excited singlet state. The excited singlet state molecule may follow two pathways:

a) The molecule may decay back to its ground state, emitting fluorescence light. This fluorescence property has been used for the diagnosis of tumors in tissues. photodynamic diagnosis (PDD).

b) For the photodynamic reaction, the molecule must convert to an excited triplet state which react with endogenous oxygen present in the tissue to produce

1. oxygen-free radicals
2. intracellular singlet oxygen, which causes tumor cell death by intracellular oxygenation and vascular shut-down mechanisms. PDT also results in activation of the immune system, while conventional RT and CT have Immunosuppressive effect.

Clinical Application

PDT is a cold photochemical process, without any thermal injury to the target tissue; connective tissue like collagen and elastin remains largely unaffected, therefore there is functional integrity of the underlying structures [4,5]. PDT can be used in combination with surgery as a neoadjuvant, adjuvant, or repetitive adjuvant treatment therapy. It has also been successfully combined with chemotherapy and radiotherapy. This combined therapy has shown enhanced anticancer effects. Photodynamic therapy is an effective treatment option for human precancerous lesions like leukoplakias and erythroplakias, lichen planus, and early cancers because it can be used repeatedly without cumulative side effects and results in little or no scar formation. However, the results in invasive cancers and bulky tumors are less satisfactory, mainly because the PDT effect is too superficial.

Conclusion

PDT can be used as a curative and palliative treatment modality for an early lesion to late-stage malignancy without compromising the health of the patient. It is simple, non-invasive, with minimum side effects, and improves the quality of life of cancer patients. It can be used successfully in the treatment of oral precancerous and cancerous lesion by preserving normal tissue and vital functions such as speech and swallowing.

References

1. Fan KF, Hopper C, Speight PM, Buonaccorsi G, MacRobert AJ, et al. (1996) Photodynamic therapy using 5-aminolevulinic Acid for Premalignant and Malignant Lesions of the Oral Cavity. *Cancer* 78(7): 1374-1383.
2. Velpula N, Maloth KN, Kodangal S, Chappidi V, Goyal S, et al. (2014) Photodynamic therapy: A new modality treatment in pre-cancer and cancer patients. *International Journal of Case Reports and Images* 5(4): 250-257.
3. VG Schweitzer (2001) Photofrin - Mediated Photodynamic therapy for treatment of Early Stage Oral Cavity and Laryngeal Malignancies. *Lasers Surg Med* 29(4): 305-313.
4. Colin H (2000) Photodynamic therapy: A clinical reality in the treatment of cancer. *Lancet Oncol* 1: 212-219.
5. Patrizia A, Kristian B, Keith AC, Thomas HF, Albert WG, et al. (2011) Photodynamic Therapy of Cancer: An Update. *CA Cancer J Clin* 61(4): 250-281.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/GJO.2023.26.556188](https://doi.org/10.19080/GJO.2023.26.556188)

Your next submission with Juniper Publishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats

(Pdf, E-pub, Full Text, Audio)

- Unceasing customer service

Track the below URL for one-step submission

<https://juniperpublishers.com/online-submission.php>