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Short Communication

Theranostics as a Management Oral Cancer - A Ray of Hope

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Abstract

Nanotheranostics is a multimodal platform that comprises a combination of a therapeutic agent, an imaging agent (photosensitized nanoparticle), and a ligand or carrier molecule. This serves as both therapy and diagnosis for cancer treatments. Due to the distinctive nature of the tumor microenvironment, nanoparticle-based drug delivery systems have the added advantage of enhanced permeation retention. The conjugation of metal nanoparticles such as gold and titanium dioxide is promising as they have unique properties for cancer bioimaging and hyperthermia-based treatments. The conventional treatment modalities of cancer have limitations concerning high radiation and lack of specificity spanning to extensive side effects. In orofacial cancer, conventional treatments require surgical intervention due to late diagnosis leading to facial disfigurement, eating, and speech disability. Included in the approach is to target the cancer cells using a combination of photothermal and photodynamic therapy to develop a non-invasive technique.

Keywords: Oral Oncology; Nanotechnology; Nanotheranostics; Nanoparticles; Tumour

Hope for better life anticipation is the need of the hour. Nanotechnology deals with the creation of useful materials, devices and systems using the particles of nanometer length scale and exploitation of novel properties (physical, chemical, biological) at that length scale. Nanoscale devices can easily interact with biomolecules [1] on both the inside and outside of cells due to their small size. It has the ability to gain access to numerous parts of the body, allowing it to identify sickness and administer treatment. Drugs are delivered directly to sick cells in your body using nanoparticles. Nanomedicine is a branch of medicine that uses molecular-sized particles to deliver medications [2], heat, light, and other chemicals to specific cells in the human body.

The term "theranostics" refers to the integration of diagnosis and treatment at the same time. Nanomedicine and theranostics are combined in nanotheranostics. It's gaining popularity as a targeted, safe, and effective pharmacotherapy that emphasises patient-centered care. It is a mix of diagnosis and treatment options. The term "theranostics" was coined to describe scientific advances that have led to the development of more specific and individualised therapies for various pathologies, as well as the integration of diagnostic and therapeutic applications into a single agent, resulting in a promising therapeutic paradigm that includes diagnosis, drug delivery, and treatment response monitoring.

siRNA can also be included in theranostic nanomedicine as inhibitor of theranostic resistance [5]. The siRNA based theranostic has great improvement in the diagnosis and therapy as multimodality therapy.

Autophagy or autophagocytosis is a catabolic process in which intracellular degradation of dysfunctional cellular components[6] or foreign invaders. Also, autophagy affects nanomedicine after endocytosis and its therapeutic effect by changing intracellular pharmacokinetics of nanomedicine (i.e., absorption, distribution, excretion and metabolism of nanomedicine.

It marks the beginning of the shift from traditional medicine to customised treatment. It deals with creating a personalised treatment plan based on each person's unique characteristics, resulting in the appropriate drug for the right patient at the right time [2,3]. In theranostics, genetics plays an important part [4]. Theranostics offers a cost-efficient and highly effective therapy approach. It is built on pharmacogenetics, proteomics, and biomarker profiling. Theranostics has a wide range of applications, with a particular focus on cancer, where nano formulations such as liposomes, dendrimers, polymeric nanoparticles, metallic nanoparticles, quantum dots, and carbon nanotubes play a critical role. As a result, theranostics is a comprehensive transformation from trial and error medicine to predictive, preventative, and customised medicine, resulting in better pharmacological care. The goal is to make pharmacotherapy safer and more targeted by using theranostics to provide individual patients with the "correct" drug at the "right" dose as part of personalized medicine [4,5].

How theranostics works in treating cancer

Theranostics is a processes which encompasses the Theranostic molecule containing both organic and inorganic molecule. Theranostic molecule can be a single molecule like example gold nanoparticle [8] or multiple components for better and improved efficacy example gold nano particle conjugated with titanium oxide molecule. these molecules will be treated with photosensitizers which help laser to activate the theranostic molecule. Laser at 680 nm will be most commonly used for PDT activity, which releases reactive oxygen which interacts with cancer cells leading to cytotoxity/cell death [9,12]. The range of laser used to be selected according to molecule used and photosenitiser used.

Laser can develop heat in one molecule and PDT in one molecule in case of multiple molecule used [12]. The heat generated can also have cytotoxic effect leading to cell death. When laser comes in contact with photosensitiser [11] and sensitive molecule the cancer cells interact with them releasing reactive oxygen which will have cytotoxic effect on the cancerous cells.

The dye is also included in the theranostic molecule like example indocyanine green [13] which will not interact with the theranostic molecule. It will emit florescence when it reaches cancerous cells and this florescence will be captured with florescence imaging. Florescence imaging will give the real time imaging of the size and content of the mass. These will help us to further personalise the Theranostic molecule for early management of oral cancer.

Theranostics is a novel type of diagnostic therapy that tests individual patients for possible reactions to new medications and then tailors a treatment for them based on the test results. Theranostics will advance in "P4 medicine," which stands for predictive, preventative, personalised, and participatory medicine [7]. This field has the potential to improve the quality of clinical care and treatments while also lowering costs by assisting in the identification of the right medicine for the right patient at the right time. Advances in science is the need of the hour. Theranostics is one such advancement which is a futuristic chair side treatment option for oral cancer.

Figure 1: Theranostic triangle.

Figure 2: How theranostics works in treating cancer.

Conflict of Interest

Author has no conflict of interest.

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