ORIGINAL RESEARCH PAPER

Maxillofacial Surgery

NANO-TECHNOLOGY:- CANCER THERANOSTICS

KEY WORDS:

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ABSTRACT

Oral cancer is a multifactorial disease, but tobacco is considered as the most predominant attribute for its advancement. It can be preventable by the interruption of risk factors. Its early detection can minimize its detrimental effects and can improve the quality of life as well as morbidity and mortality of the patients. Nanotechnology is a very different field that has transformed the industry and is setting new directions in the treatment of oral cancer. Nanotechnology conversed methods can be used in cancer treatment. They can aid to have a better diagnosis with limited injurious substance. Nanotechnology is a very different field that has revolutionized the industry and is setting current directions in the management of oral cancer. The application of Nanotechnology significantly benefits clinical practice in diagnosis, treatment, and management of cancer. Hence, Nanotechnology can be also accustomed to molecular imaging accompanied by tomography and photoacoustic imaging of tumors and management of cancer as photothermal and radiotherapy. Nanotechnology a succeeding generation techniques have numerous advantages to treat patients of cancer from diagnosis to treatment.

INTRODUCTION

Head and neck cancers come under the group of Epithelial malignancies out of which most seen is squamous cell carcinomas (oral cavity, nose, pharynx, salivary glands, pharynx, larynx) [1].

It is the seventh most common type of cancer worldwide[1]. The associated risk factors include long -term and excessive tobacco smoking, alcohol drinking, betel quid chewing, Human papillomavirus[2]. Prognosis of HNSCC depends on early detection [3]

The available detection methods are usually invasive procedures like biopsy which is the gold standard. Some non-invasive procedures include toluidine blue (tb) staining, auto-fluorescence (vescope) and chemiluminescence. Exfoliated cells, serum, and saliva are most commonly used non-invasive samples as they are easily accessible, convenient, and cost-effective.

Some noninvasive imaging techniques done in real-time include MRI, CT, CBCT, PET scan.

Raman spectroscopy, elastic scattering spectroscopy, diffuse reflectance spectroscopy, narrow-band imaging, and confocal reflectance microscopy are also used commonly as optical diagnostic methods.

But these techniques have several limitations. Biopsy itself is invasive that can lead to anxiety and discomfort. Resection margins result in biopsy are usually affected by the quality of the specimens and pathologists' subjective judgments and it is unable to detect small numbers of genetically abnormal cells at the margin so there is risk of recurrence.

Visual tools are highly subjective and depend on the expertise of the investigator

Exfoliative cytology technology has low detection specificity because of collection of disaggregated cells.
Imaging methods have provided real-time cancer cell morphology, but their sensitivity for detecting small, earlier intraepithelial lesions is insufficient.

Novel detection methods need to be explored that can help in accurately predicting the malignant risk, specifically detects oral cancer, Ultrasensitive detection strategies at nano-scale

Real-time suggestions that can detect the extent of surgical resection margins and monitoring oral cancer prognosis in a convenient way after treatment.

Nano technology allows direct manipulation of materials at the nanoscale.

Nano particles have extremely large surface area to the volume ratio and small dimensions so there is ability to arrange atoms according to our desired effectiveness and can have complete control on the structure of matter.

Theranostics includes simultaneous diagnostic and therapeutic management.

The techniques that can be used are Persistent luminescence nanoparticles[4], Theranostic Magnetic Nanostructures [5] (MNS), Gold nanorods[6] conjugated upconversion nanoparticles for simultaneous bioimaging, local temperature sensing and photothermal therapy.

Persistent luminescence nanoparticles Nanoparticles can be excited by multiple excitation source which overcome the poor imaging quality and the poor penetration depth caused by short-wavelength excitation

They can be easily doped so helps in multimodal imaging of live subjects which is more sensitive and provides accurate information for disease diagnostics.
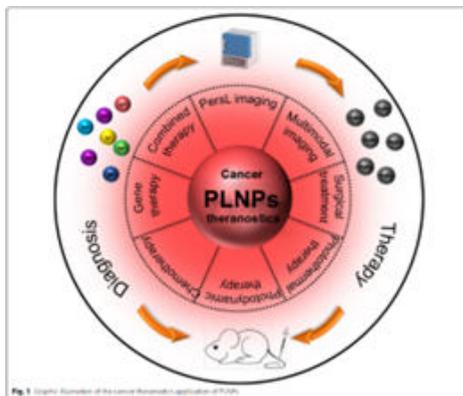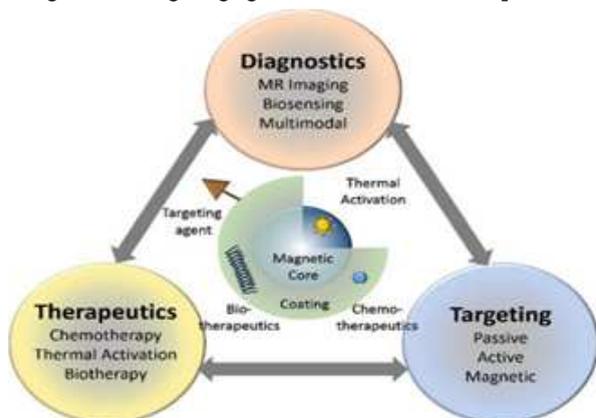

Fig. 1 Graphic illustration of the cancer theranostic application of PLNPs.

MNS are comprised of thermally active magnetic core and biocompatible coating and/or functionalization that allows integration of targeting agents and bio/chemotherapeutics.

T2 contrast enhancement in water due to MNS When water molecules diffuse into the periphery of the induced dipole moment by MNS, the T2 relaxation time of the water protons is shortened which enhances the negative contrast
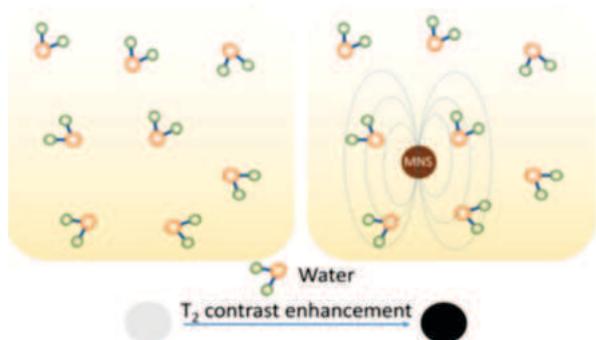
Safety Issues of Nanotechnology
More reactive due to increased rate of absorption through skin, lungs and digestive tract. In lungs it can cause inflammation of the alveoli and subsequent cell damage.

According to Upadhyay (2013), nanoparticles can react with DNA, RNA, and other intracellular components, and thereby can cause mutations.

Benefits as well as possible threats and safety concerns of nanotechnology, are not yet completely recognized, as it is a relatively newer field.

CONCLUSION
Nanoplatform exhibits superior synergetic therapeutic outcomes compared to chemotherapy or PTT alone.

The theranostic nanoplatform exhibits excellent dispersibility, tracing performance, great photothermal properties and PH/NIR responsive release processing.

Future Perspectives
The increasing trend toward in vivo studies in animals and subsequent escalation to clinical trials are expected to help translate MNS from the laboratory to the clinic

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