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Current Study Suggests Further Development Needed for NI-PAM-based Gel Dosimetry with X-Ray CT Imaging in Radiation Therapy Applications

Asghar Mesbahi*
Department of Medical Physics, Medical School, Tabriz University of Medical Sciences, Tabriz, Iran

Abstract

Polymer gel dosimetry is a technique that is used to measure the radiation dose in three-dimensional space. This technique uses a gel that is sensitive to radiation and can be used to create a detailed map of the dose distribution within a volume of tissue. The gel used in polymer gel dosimetry is typically made up of a water-based solution containing a radiation-sensitive polymer.

Keywords: Polymers • Radiation therapy • MRI

Introduction

The polymer gel is usually transparent, allowing radiation to pass through it without attenuation. When radiation interacts with the polymer, it causes changes in the physical and chemical properties of the gel, which can be measured and used to determine the radiation dose [1]. The principle behind polymer gel dosimetry is based on the concept of radiation-induced polymerization. When ionizing radiation interacts with the polymer, it causes the polymer molecules to crosslink, resulting in changes in the physical properties of the gel. These changes can be measured using a variety of techniques, including magnetic resonance imaging (MRI), optical CT (computerized tomography) and ultrasound. The use of polymer gel dosimetry has several advantages over traditional dosimetry techniques. One of the main advantages is its ability to provide detailed dose distribution maps in three-dimensional space. This can be particularly useful in situations where the radiation field is complex or irregular, such as in radiation therapy treatments for cancer [2].

Another advantage of polymer gel dosimetry is its ability to provide accurate dose measurements in areas where traditional dosimeters may not be able to measure accurately. For example, in high-dose-rate brachytherapy treatments, traditional dosimeters may not be able to measure the dose accurately due to the rapid fluctuations in dose rate. Polymer gel dosimetry can provide accurate dose measurements in these situations.

Description

Polymer gel dosimetry has been used in a variety of applications, including radiation therapy treatment planning and verification, radiation safety studies and quality assurance programs for radiation equipment. It has also been used in research studies investigating the effects of radiation on tissue and the development of new radiation therapies. Polymer gel dosimetry is a powerful technique for measuring radiation dose in three-dimensional space. Its ability to provide detailed dose distribution maps and accurate dose measurements in complex radiation fields makes it a valuable tool in radiation therapy treatment planning and verification, as well as in radiation safety studies and research. As technology advances, polymer gel dosimetry is likely to become even more important in the field of radiation oncology [3].

X-ray computed tomography (CT) is a medical imaging technique that uses X-rays and computer processing to create detailed images of the inside of the body. CT scans are widely used in medical diagnosis, treatment planning and monitoring of various medical conditions. In this article, we will explore the basics of X-ray computed tomography, its applications, benefits and limitations. The principle behind X-ray computed tomography is relatively simple. The X-ray machine emits a beam of X-rays that pass through the body and are detected by a series of detectors on the other side. The information collected from the detectors is then processed by a computer to create a cross-sectional image of the body part being scanned. The process is repeated from various angles, producing multiple cross-sectional images, which are then combined to form a 3D image. X-ray computed tomography has numerous applications in medical diagnosis and treatment planning. It is used to detect abnormalities in the brain, chest, abdomen and pelvis. CT scans can detect tumors, cysts, bone fractures, blood clots and other medical conditions. They can also be used to guide minimally invasive procedures, such as biopsies and needle aspirations [4].

One of the significant benefits of X-ray computed tomography is its ability to produce highly detailed images of the body. CT scans can detect subtle changes in the body that may not be visible in other imaging techniques, such as X-rays or ultrasound. CT scans can also provide information about the size, shape and location of a tumor, making it easier for doctors to plan treatment. Another advantage of CT scans is that they are noninvasive and relatively painless. Patients undergoing a CT scan lie on a table that moves through the CT machine and the scan is completed in a matter of minutes. There is no need for anesthesia or recovery time, making it a convenient and accessible diagnostic tool. Despite its many benefits, X-ray computed tomography does have some limitations. One of the most significant limitations is that it exposes patients to ionizing radiation, which can increase the risk of cancer. To minimize this risk, doctors must carefully consider the benefits of a CT scan against the potential risks and weigh the risks of radiation exposure against the risks of not having the scan

X-ray computed tomography is a valuable tool in medical diagnosis and treatment planning. It provides highly detailed images of the body, making it easier for doctors to detect and treat medical conditions. However, it is important to remember that CT scans do expose patients to ionizing radiation and the benefits of the scan must be weighed against the potential risks. As technology

***Address for Correspondence:** Asghar Mesbahi, Department of Medical Physics, Medical School, Tabriz University of Medical Sciences, Tabriz, Iran, E-mail: mesbahi-a@gmail.com*

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advances, CT scans are likely to become even more powerful diagnostic tools in the future. Radiation therapy is an important cancer treatment modality that uses high-energy radiation to kill cancer cells. The accurate measurement of radiation dose is critical to ensure that cancer cells are adequately targeted while minimizing damage to healthy tissues. Polymer gel dosimetry, a technique that uses radiation-sensitive gels to measure radiation dose, has shown great promise in radiation therapy applications. However, a current study suggests that further development is needed for NIPAM-based gel dosimetry with X-ray CT imaging [5]

NIPAM-based gel dosimetry is a type of polymer gel dosimetry that uses N-isopropylacrylamide (NIPAM) as the radiation-sensitive polymer. When exposed to radiation, NIPAM-based gels undergo changes in their physical properties that can be measured using X-ray CT imaging. X-ray CT imaging is a widely used imaging technique that uses X-rays and computer processing to create detailed images of the body. The current study, published in the Journal of Applied Clinical Medical Physics, evaluated the accuracy and feasibility of NIPAM-based gel dosimetry with X-ray CT imaging in radiation therapy applications. The study found that while NIPAM-based gel dosimetry with X-ray CT imaging showed promise in measuring radiation dose, it needs further technical development and formulation refinement before it can be used in clinical practice [6].

Conclusion

One of the main challenges with NIPAM-based gel dosimetry with X-ray CT imaging is the need for accurate calibration. The study found that variations in gel formulation and imaging parameters could significantly affect the accuracy of the measurements. This highlights the need for further refinement of gel formulation and imaging protocols to ensure accurate and reproducible results. Another challenge with NIPAM-based gel dosimetry is the sensitivity of the gel to temperature changes. The study found that variations in temperature during imaging could lead to inaccuracies in the measurements. This highlights the need for improved temperature control during imaging to ensure accurate and consistent results. NIPAM-based gel dosimetry with X-ray CT imaging has shown great promise in radiation therapy applications. However, the current study suggests that further development and refinement are needed before it can be used in clinical practice. The development of more accurate calibration protocols and improved temperature control during imaging are critical for the accurate and reproducible measurement of radiation dose using NIPAM-based gel dosimetry with X-ray CT imaging.

Acknowledgment

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Conflict of Interest

None.

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