

Response to reviewers of manuscript #30626 “Three-dimensional radiation dosimetry using polymer gel and solid radiochromic polymer: From Basics to Clinical Applications”

By Yoichi Watanabe, Ph.D.

Reviewer No: 00742454

We have made extensive revisions to clarify the scientific presentations by implementing the changes suggested by other reviewers of the initial manuscript.

Reviewer No: 00068723

We added three figures for this revision. Figures 1 and 2 show the photos of the actual 3D dosimeters after irradiation. Figure 3 presents the process flow of the dose evaluation using the 3D dosimeters when those are applied to evaluate the treatment planning system for its dose calculation accuracy.

Reviewer No: 00289418

GENERAL COMMENTS

This paper is a very interesting review of 3D dosimetry in radiotherapy. Though in its present form is not ready for publication, I think that it has the potential to become an excellent review paper, indeed. Almost all the information needed is already there; it only needs better presentation. I feel that the authors attempted to cover the whole subject of 3Ddosimetry, not only gels, in a single article, making it at some point difficult for me to follow. Probably this is due to the fact that the authors did not limit the conversation to gels as the title suggested but expanded the conversation to other dosimeters as well. Also at some points they started to make comparisons of gels with other dosimeters, in some fields where the other dosimetry systems (e.g. water tank and ionization chamber dosimetry) are both well established and better suited.

We discussed the 3D dosimetry techniques currently used in clinic to emphasize the needs of new 3D dosimeters.

What I also feel is missing, is information concerning the possibility of the different kind of gels to be read more than one time or whether some or all of the reading procedures affect in some way the information contained. Also some information whether some of these gels could be reused after some processing would be interesting.

This is an excellent point. I agree the importance of the reusability of the 3D dosimeters by considering the price and overall cost for implementing these tools in the clinic as I discussed in the discussion section. There is on-going developmental work for fabricating reusable phantoms. I quoted one reference on this topic, Ref.[56].

Concerning the language, the paper is in general well written, but at some points there is room for improvement. Overall, my proposal is “Major Revision”

Abstract

1. These are available in the gel form, polymer gel dosimeter (PGD) or ferrous gel dosimeter (FGD) and in the solid form, solid radiochromic polymer, or solid plastic, dosimeter (SPD). An abbreviation for the radiochromic polymer is needed or is it also considered SPD. There are too many commas and is a little confusing.

We revised the abstract.

Introduction

2. The introduction has to be rewritten for better focus. For treatment planning purposes, in order to build the beam model in a treatment planning system data collection is made point-by-point using a water phantom and an appropriate dosimeter. Scanning to all three axis is used to acquire information adequate to build the 3D model of the beam. Both relative and absolute dosimetry is required and there is some limitation concerning the accuracy of the measurements due to errors that start from the calibration factor of the instrument and many more. Now the use of 3D dosimeters application field is the comparison of the 3D dose distributions calculated by the TPS with the actually dose delivered in the patient or in a phantom that mimics the patient or is used as a surrogate of the patient.
3. stereotactic abrasive radiation therapy (SART). I think you mean “ablative”
Corrected.
4. Also I don't understand why you use multi-dimensional and not 3D. Do you imply any 4th or other dimension?
The word ‘multi-dimensional’ is used to indicate both 2D and 3D.

3D DOSIMETER

5. If I've understood well, the first two paragraphs should serve as a secondary introduction to the types of 3D dosimeters available or under investigation. So there is no need to get into details for those dosimeters that would be analyzed later. For the 2nd paragraph I would prefer a bullet like presentation structure.
We agree and we revised the paragraph accordingly.
6. “Therefore, we focus the 3D dosimeters of PGD, SPD, and FGD in the rest of this article.”
Rephrase; you focus on specific dosimeters.
Revised.

Water equivalency

7. “This definition of water equivalency also applies to heavier charged particles such as protons and heavy ions. In other words, the equivalency often depends on the radiation energy”. The second sentence is not arising from the first. The energy dependence when we talk about photons or electrons is one thing and another thing is when we talk about other types of radiation like protons or alpha particles.
We revised the paragraph.

DOSE QUANTIFICATION TECHNIQUES

8. I feel that in the first paragraph you want to say that these dosimeters have to be calibrated; this is both valid for absolute dosimetry but also for relative dosimetry purposes also, especially if their response to dose is not linear.

We added a sentence.

X-ray computed tomography (XCT)

9. “If it works, it is the”. Do you mean that i

We revised the sentence for clarity.