A mixture of microscopic gold particles as a fiducial marker in image-guided radiation therapy: phantom study

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Purpose: The feasibility of using the microscopic gold particles as a fiducial marker is examined to solve the problems of conventional macroscopic gold markers, such as, the dose reduction and the artifact generation due to the markers in image-guided radiation therapy.

Method and Materials: In order to investigate the feasibility of replacement of a conventional macroscopic gold fiducial marker by a mixture of microscopic gold particles, two kinds of fundamental interactions were examined; one is the interaction of a macroscopic gold marker or a mixture of microscopic gold particles with diagnostic X-rays, and the other is the interactions of them with a more energetic photon beam or a charged particle beam. The effects of each interaction were compared for each radiation.

Results: The mixture of microscopic gold particles could extremely reduce the distortions of depth-dose distribution behind it as well as the artifact generation around it, in comparison with the macroscopic marker. The composite of gold particles interacts with diagnostic X-rays well so as to be distinguished from high density organs, i.e. bones, while the proton beam arrives at behind the composite easily, so a cold spot disappears.

Conclusion: The mixture of microscopic gold particles can solve the problems of conventional gold markers and feasible to be used as a tumor marker in proton therapy of prostate cancers.

Conflict of Interest (only if applicable):

Key words: IGRT, Fiducial marker, Microscopic gold particle, Depth-dose distribution