

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

Young Kyung Lim, Jungwon Kwak, Dong Wook Kim, Dongho Shin, Myonggeun Yoon,
Soah Park, Jin Sung Kim, Jongwook Shin, Se Byeong Lee, Sung Yong Park,
and Kwan Ho Cho

Proton Therapy Center, National Cancer Center, 111 Jungbalsan-ro, Ilsandong-gu, Goyang-si,
Gyeonggi-do, 410-769, Republic of Korea

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