smaller fractions have been safely performed. This means that the facility can be operated more efficiently in CIRT, permitting treatment for a larger number of patients than is possible with other modalities over the same period of time. In 2010, a new treatment facility with three rooms was completed with the beam lines being extended from the existing accelerators, in which CIRT with a pencil beam scanning became available. Recently, we have successfully begun treatment of moving organs using respiratory-gated irradiation with a pencil beam scanning. At the new facility a compact rotating gantry was constructed with its commissioning to be finished in the spring of 2016.
In order to exchange information and perform a prospective study for CIRT, we have recently established J-CROS (Japan Carbon-ion Radiation Oncology Study Group). Under the framework of J-CROS, we will conduct multi-institutional studies on such tumors as head and neck tumors, NSCLC (mainly T2 tumors), hepatoma, pancreas cancer, post-operative recurrence of rectal cancer, and bone & soft tissue sarcoma. These tumors are chosen based on the recognition that therapeutic techniques have not yet been fully established and treatment outcome should be further improved, as well as that reproducibility of NIRS clinical results should be evaluated by other groups. The J-CROS study will also include the study producing benchmark results in selected tumors, as well as a randomized study comparing CIRT with PBT or photon therapy.

Keywords: Carbon-ion, Proton, Hypofractionation, RBE, Dose distribution

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**Ocular Brachytherapy Dosimetry for $^{103}$Pd and $^{125}$I in The Presence of Gold Nanoparticles: Monte Carlo Study**
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Purpose: The aim of the present Monte Carlo study is to evaluate the variation of energy deposition in healthy tissues in the human eye which is irradiated by brachytherapy sources in comparison with the resultant dose increase in the gold nanoparticle (GNP)-loaded choroidal melanoma.
Material and method: The effects of these nanoparticles on normal tissues are compared between $^{103}$ Pd and $^{125}$I as two ophthalmic brachytherapy sources. Dose distribution in the tumor and healthy tissues has been taken into account for both mentioned brachytherapy sources. Also, in certain points of the eye, the ratio of the absorbed dose by the normal tissue in the presence of GNPs to the absorbed dose by the same point in the absence of GNPs has been calculated. In addition, differences of the absorbed dose in the tumor observed in the comparison of simple water phantom and actual simulated human eye in presence of GNPs are also a matter of interest that have been considered in the present work.
Result and conclusion: The difference between the eye globe and the water phantom is more obvious for $^{125}$I than that of the $^{103}$ Pd when the ophthalmic dosimetry is done in the presence of GNPs. Whenever these nanoparticles are utilized in enhancing the absorbed dose by the tumor, the use of $^{125}$I brachytherapy source will greatly amplify the amount of dose enhancement factor (DEF) in the tumor site without inflicting much damage to healthy organs, when compared to the $^{103}$ Pd source. Furthermore in Monte-Carlo studies of eye brachytherapy, more precise definition of the eye phantom instead of a water phantom will become increasingly important when we use $^{125}$I as opposed to when $^{103}$ Pd is considered.

Keywords: Brachytherapy, Gold nanoparticles, $^{103}$Pd and $^{125}$I

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**GEANT4 versus MCNP5: Monte-Carlo ophthalmic brachytherapy dosimetry in the presence of gold nanoparticles for $^{125}$I and $^{103}$Pd**
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Purpose: The emphasis of the present work is to compare the effects of gold nanoparticles (AuNPs) on healthy human ocular tissues in ophthalmic brachytherapy dosimetry, between water and eye phantoms by utilization of the two most noteworthy Monte-Carlo codes of GEANT4 and MCNP5.
Material and method: The intended study was based upon a simulated model of the human eye consisting different parts such as Lens, Cornea, retina, Choroid, Sclera, skull bone, Anterior Chamber and a melanoma tumor which was latticed to house AuNPs required for the dosimetry comparisons of two uniquely defined radionuclides of $^{125}$I and $^{103}$Pd. The effects of the presence of AuNPs on the absorbed dose by the tumor have been taken into account using both Monte-Carlo codes mentioned above; furthermore, the aberrations in dose calculations of the simple eye phantom and the realistic eye model were also an element of consideration. The importance of such evaluations on various compositions that are most common in Monte Carlo studies could prove to be rewarding, especially in presence of external anomalies such as AuNPs.
Result and Conclusion: With respect to the numerous distinctions between codes themselves, it is always fruitful to compare multiple of these programs with one another; hence, a rigorous inspection of the results has been executed, and dissimilarities have been highlighted for better understanding of the advantages and deficiencies of both codes. All in all, it is best stated that interdisciplinary methods of combining diverse therapeutic applications have gained much ground in our current era, and serve to significantly increase efficiency of cures worldwide.

Keywords: GEANT4, Gold nanoparticles, ophthalmic dosimetry brachytherapy

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**A novel method to predict *a priori* the toxicity reduction of a prostate-rectum spacer: Virtual Rectum Spacer**
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