View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by Elsevier - Publisher Connector

position corrections observed with one, three, or five imaging sessions.

Results: Statistical analysis showed that only the difference between normal and coarse modes of imaging was significant, which allowed to merge the supine and prone position sub-groups as well as the prostate and prostate bed patients. In the normal and coarse imaging groups, the PTV margins calculated using systematic and random errors in the medio-lateral and cranio-caudal directions (5.5 mm and 4.5 mm, respectively) were similar, but significantly different (5.3 mm for the normal mode and 7.1 mm for the coarse mode) in the anterio-posterior direction.

Conclusions: The normal (4 mm) mode of the helical tomotherapy megavoltage scans performed during the treatment of patients with prostate cancer was shown to produce smaller systematic error in anterior-posterior direction compared to the coarse (6 mm) imaging mode. Based on this study, the referencing scheme based on the first three fractions can be recommended.

[1] Piotrowski T, Rodrigues G, Bajon T, Yartsev S, Method for data analysis in different institutions: Example of image guidance of prostate cancer patients. Physica Medica 2014; 30(2): 249-251.

EP-1499

Compatibility and artefacts on two different respiratory management systems for use in RT treatment planning

P. Carrasco de Fez[1], A. Ruiz[1], N. Jornet[1], A. Latorre-Musoll[1], T. Eudaldo[1], M. Ribas[1]

[1]*Hospital de la Santa Creu i Sant Pau, Servei de Radiofísica i Radioprotecció, Barcelona, Spain*

Purpose/Objective: We often find different respiratory management systems (RMS) in different stages of the radiation therapy (RT) process. Consistency would enable patient irradiation monitored with one system for patients planned with another system. This work aims to determine the suitable parameters of operation when performing 4DTC studies and to study the compatibility of two of such systems.

Materials and Methods: We compared two RMS: the Varian RPM based on a reflector marker block position, and the Philips Bellows based on a pressure belt. The former is present in our centre both in a 4DCT and in the treatment radiation unit; and the latter in a PET/CT unit. This study was performed using a QUASAR™ phantom equipped with the respiratory motion device. A 3 cm diameter water-equivalent sphere was inserted inside the lung-equivalent insert and several cranial-caudal movements were applied with 2 cm amplitude. 4DCT studies were obtained for sinusoidal movements with a slice thickness of 3 mm. 10 phases were reconstructed. To determine the suitable operating parameters 5 pitches (0.06, 0.079, 0.100, 0.129 and 0.167) for a 3 s period and 3 periods (3, 4 and 5 s) for the 0.06 pitch were studied. In addition, one periodic non-sinusoidal movement was explored. Three parameters were recorded for every phase: the first and last axial slices where the sphere was visible and the length of the reconstructed sphere in a coronal slice. To study the compatibility of the two RMS the default pitch (0.06) was used for both systems. We used the Jaccard and Søresen-Dice indices to measure similarity in every reconstructed phase for sinusoidal, irregular and real patient recorded breathing patterns.

Results: -Suitable parameters: A systematic 5% phase displacement had to be applied to match the theoretical positions (see fig. 1a). The dependence of the geometrical artefacts on the pitch is shown in figure 1b for the RPM system (the theoretical pitch was 0.167). The average, minimum, maximum and standard deviation of al phases are shown.

Fig. 1a

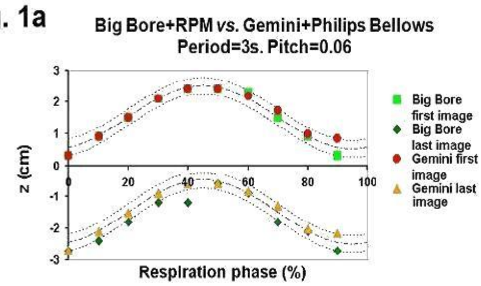


Fig. 1b

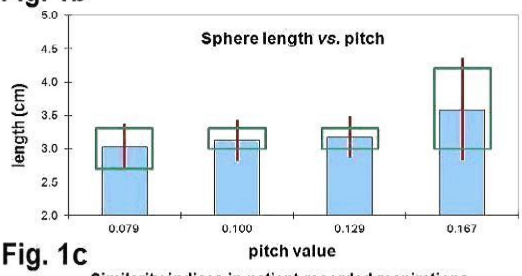
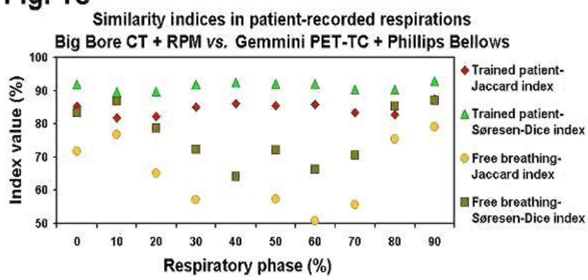


Fig. 1c



-Compatibility: The MIP for all movements was identical within the slice thickness uncertainty. For non-sinusoidal movements both systems were only consistent for phases near 0% and 50%. Table I shows a summary of the phase results. The results for patient-recorded respiration movements are shown in Figure 1c.

			Periodic movement	
			Sinusoidal	Non-sinusoidal
Simmilarity index (%)	Jaccard	Max.	86,1	81,1
		Phase	0%	80%
		Min.	72,7	21,4
		Phase	30%	10%
	Søresen-Dice	Max.	86,1	68,0
		Phase	0%	80%
		Min.	72,7	11,0
		Phase	30%	10%
Displacement (mm) between two intersecting spheres leading to the reported indices		Min.	1,5	3,3
		Max.	3,2	4,2

Conclusions: The n^{th}% phase is assigned to the middle of the interval [n%, n+10%]. The pitch should be lower than that resulting of the theoretical calculation but not much further. Differences between both systems were lower than the slice thickness provided the movement be consistent and periodic. For non-sinusoidal movements phases far from 0% and 50% may introduce significant discrepancies. Both systems are compatible but respiratory training would be necessary to guarantee consistency for a gating strategy while it would not for a MIP-based ITV strategy.

This work was financed by grant FIS PI12-00521

EP-1500

3D versus 4D cone beam computed tomography for lipiodolñguided radiotherapy of hepatocellular carcinomas

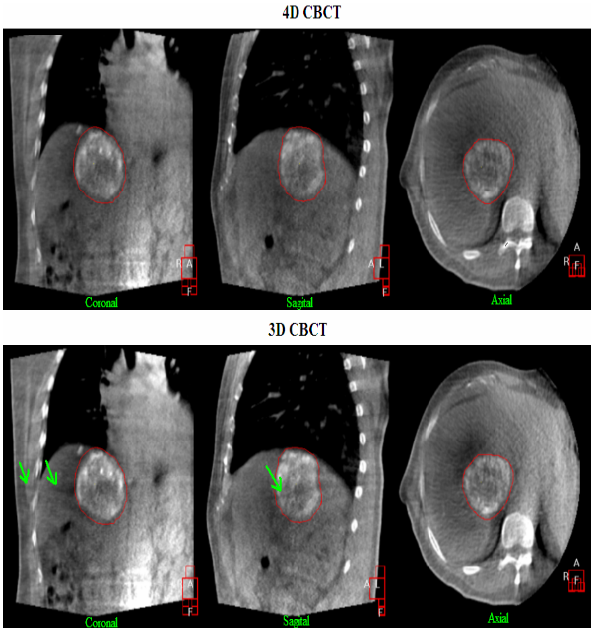
M.K.H. Chan[1], A.C.C. Chiang[1], F.A.S. Lee[1], R.W.K. Leung[1], M.Y.P. Wong[1], G.M.L. Law[1], K.H. Lee[1], S.Y. Tung[1], V.W.Y. Lee[1]

[1]Tuen Mun Hospital, Clinical Oncology, Hong Kong, Hong Kong (SAR) China

Purpose/Objective: Evaluate the positional uncertainty of hepatocellular carcinomas (HCC) guided by lipiodol on respiratory-correlated (4D) and uncorrelated (3D) cone beam computed tomography (CBCT).

Materials and Methods: Elekta XVI v4.5 (Elekta, Crawley, UK) was used to acquire 4D CBCT of 15 HCCs treated by hypofractionated radiotherapy after single trans-arterial chemoembolization (TACE) with lipiodol. 1320 x-ray projections per 4D CBCT scan were sorted into 10 CBCT dataset (132 projections per CBCT dataset). A 4D registration workflow was followed to register the reconstructed time-weighted average CBCT with the planning mid-ventilation CT by an initial bone registration of the vertebrae and then tissue registration of the lipiodol. For comparison, projection data of each 4D CBCT were used to synthesize 3D CBCT images without motion extraction. Uncertainties of the treatment setup estimated from the absolute lipiodol position and the interfractional lipidol drift relative to vertebrae were analyzed separately from 4D and 3D CBCT images.

Results: Qualitatively, 3D CBCT showed better lipiodol contrast than 4D CBCT primarily because of a tenfold increase of projection data applied to the reconstruction. Some motion artifacts were observed on the 3D CBCT but not on 4D CBCT (Fig. 1). Group mean, systematic and random errors estimated from 4D and 3D CBCT are similar, agree to within 0.7 mm in the cranio-caudal (CC), and anterior-posterior (AP) directions, and 0.3 mm in left-right (LR) direction. Systematic and random errors are largest in the CC direction, amounting to 4.7 mm and 3.9 mm from 3D CBCT and 5.5 mm and 4.0 mm from 4D CBCT in terms of the absolute lipiodol position, and 3.7 mm and 3.0 mm from 3D CBCT and 4.3 mm and 2.8 mm from 4D CBCT in terms of the lipiodol baseline drift relative to vertebrae, respectively. Margin calculated from 3D CBCT and 4D CBCT differed by less than 1.9 mm, 0.2 mm and 0.1 mm in the CC, AP, and LR directions in the patient cohort.



Conclusions: 3D and 4D CBCT were found equivalent in localizing HCCs guided by lipiodol, resulting in similar safety margin. 4D CBCT offers the advantage of measurements of the changes of tumor motion for assessing the adequacy of the planning margin.

EP-1501

nfluence of prostate rotation on dose distribution in the target volume

E. Dabrowska[1], B. Brzozowska[2], B. Chaber[3], P. Kukolowicz[1], J. Starzynski[3], A. Zawadzka[1]

[1]Maria Sklodowska-Curie Memorial Cancer Center, Department of Medical Physics, Warsaw, Poland

[2]University of Warsaw, Department of Biomedical Physics, Warsaw, Poland

[3]Warsaw University of Technology, Faculty of Electrical Engineering, Warsaw, Poland

Purpose/Objective: The inter-fraction prostate motion can have a significant impact on dose distribution in the target volume. However, the concept of the PTV was developed to minimize the influence of all uncertainties of target position on dose distribution, the problem of rotations is not entirely analyzed. The aim of this study was to investigate the influence of the prostate rotation on delivered dose for three different techniques.

Materials and Methods: For 10 prostate cancer patients previously treated in our hospital 3D-CRT, IMRT and SIB-IMRT treatment plans were prepared. Internal rotations of the prostate in the range from -27° to +27° relative to the apex in anterior-posterior direction were introduced. Rotations in rectum direction was defined as a negative angle. Based on originally prepared plans, the DVH for rotated prostate was calculated and compared with the DVH obtained for non-rotated structure. Changes of D_{min}, D99%, D_{max}, D1%, D_{mean}, standard deviation and V95% as a function of the rotation angle were analyzed. For each treatment planning technique the influence of rotation on the TCP was also determined.