PO-0992
Is surface based setup preferable to conventional setup for breast cancer patients?
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Purpose/Objective: Common clinical practice for patient positioning during radiotherapy is to position patients according to skin marks and room lasers, so-called laser based setup (LBS). We investigated if surface based setup (SBS), using the commercially available optical scanning system Catalyst (C-rad, Uppsala, Sweden), could reduce inter-fractional setup deviations. An optical scanning system provides patient setup daily without an extra dose contribution. Our main hypothesis was that the optical scanning system could replace the lasers as a positioning tool as well as reducing the need for verification images for breast cancer patients.

Materials and Methods: Two patient groups were included in the study to enable a comparison between LBS and SBS. The breast position for the two groups was verified with a field image (MV). Clinical tolerance was a shift of 4 mm in the left-right (L-R), inferior-superior (I-S) and posterior-anterior (P-A) directions, respectively. At the treatment machine, all patients were initially positioned in supine position on a breast board (Posiboard™-2 Breastboard, CIVCO Medical Solutions) with their arms raised over the head. Twenty patients were enrolled in the first group. The patients were positioned with room lasers and verification images were acquired according to the NAL-protocol. The first three treatment sessions were excluded in the results of this study. The second group (twenty-four patients) was positioned with SBS. Structure set and isocenter was imported from the TPS (Eclipse version 10.0.28, Varian medical systems; CA Varian), through import of the industry standard DICOM format. Correction for postures was performed with the help of a color map back-projected live onto the patients’ skin and the couch shift was then given. The couch was manually adjusted and isocenter was positioned ±2 mm in the L-R, I-S and P-A directions from reference setup. The spatial vector offset (V) between planned setup and daily setup from verification imaging was calculated using the residual error (RE) in each direction, L-R, I-S, P-A according to equation (1):

\[ V_{dev} = \sqrt{RE_{L-R}^2 + RE_{I-S}^2 + RE_{P-A}^2} \]
Eq. (1)

A statistical test, Students t-test for two independent mean, was performed. The null hypothesis was that there is not a difference between the two setup methods.

Results: The mean spatial vector offset was of 3.6 ± 3.4 mm (1SD) for LSB and of 2.4 ± 1.8 mm for SBS (p=0.01). The maximum shift was 12.2 and 8.0 mm for LBS and SBS, respectively. For LBS and SBS, 73,8% and 94,1 % of the treatments sessions were within clinical tolerance.

Conclusions: SBS provides more information of patient postures and an easy way to correct for them with the help of the back projected color map. By introducing Catalyst as a positioning tool instead of LBS verification imaging can be reduced in the clinical routine. The SBS supplies with daily operator independent setup which improves the patient position and increase patient safety.

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A national database solution for radiotherapy quality registries and clinical studies
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Purpose/Objective: Many radiotherapy (RT) databases are generated in the clinics in treatment planning systems (TPS) and oncology information systems (OIS). So far, much of the work to retrieve and coordinate RT-data has been done manually. Swedish quality registries for cancer are presently diagnose specific with very sparse and varying information on RT. Access to structured RT-databases and quality registries containing relevant quality parameters is necessary for efficient research, clinical evaluation and reporting.

Materials and Methods: An IT-solution designed to facilitate a national quality registry for radiotherapy is implemented. The solution consists of a local storage of DICOM RT data in a structured database, Medical Information for Quality Assessment (MIQA), and an application for recalculation of the data from the 4D representation to dose-volume parameters for each fraction. These parameters are then sent to the platform that hosts most of the Swedish quality registries for cancer, Information Network for Cancer Care (INCA). MIQA is a multipurpose system that provides data to the RT-registry and can also be used as a local quality database and research database. MIQA includes basic functionality to monitor the status of the treatment for patients in order to send only data sets for complete treatment courses. It also includes functionality to map structure names to a national standard naming convention for RT. The national quality registry for radiotherapy follows the
same principles for users as the already existing diagnose specific registries under INCA. The primary use is regular comparison between different clinics. These comparisons include both dose-volume parameters and volumes of targets and organs at risk. The aim in a longer perspective is to achieve an increased consistency in radiotherapy on a national level. The quality registry will also be open for research, provided ethical permit for the study.

Results: A national Swedish naming convention has been published. The convention is adapted to international standards and is currently implemented in the Swedish RT clinics. The technical infrastructure has been verified, with transfer of information from clinical systems to the MIQA data base through DICOM and direct reading in the information systems, to the calculation of volumes and dose volume descriptors for target volumes and organs at risk to the national INCA database. The installations of MIQA throughout Sweden have begun and according to plan it will be installed at all university hospitals during the first half of 2015. A national quality registry for RT has been established and collects relevant quality parameters from most Swedish RT clinics.

Figure 1. Configuration of the national IT-solution for RT-information.

Conclusions: A national IT solution for a structured registration of RT-data is a powerful tool for research, clinical evaluation and reporting.

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Human error analysis in radiotherapy: first steps towards a prospective and quantitative method
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Purpose/Objective: Guidelines and recommendations implemented as safety and quality assurance measures ensure patient safety in radiotherapy (RT) (ESTRO 1995). However, a disproportionate focus of these measures on equipment is a concern (Huq et al 2008) as analyses of adverse events consistently indicate human errors as dominant contributors (WHO 2008). In addition, the need of prospective analyses with quantitative risk assessment (QRA) is stressed to evaluate the effectiveness of the measures and patient handling procedures (ICRP 2009, Thomadsen 2008).

QRA techniques have been used in RT and have produced useful results (IAEA 2006). However, a major impediment is to analyze human errors as available methods for Human Reliability Analysis (HRA) are not suited to RT domain (Lyons 2004). In HRA, human performance is assessed by identifying the possible errors, analyzing possible contributing factors and assessing their probabilities.

This work addresses the first steps towards the development of a new RT-specific HRA method, tailored for external beam radiotherapy. It presents the method’s framework for the qualitative error analysis, which relates to the identification of the possible errors and the analysis of the factors influencing the personnel performance. The purpose is to develop a taxonomy of the tasks (referred as Generic Task Types, GTTs, term from HEART 1986) possibly resulting in errors and the influencing factors (Performance Influencing Factors, PiFs).

Materials and Methods: Taxonomies are developed based on:
• Task analysis, observations and talk-through
• Analyses of incident databases e.g. SAFRON
• Review of cognitive models of human performance in technical environment
• Existing HRA databases from other domains for PIF categorization

The combination of retrospective sources and prospective analyses allows considering both occurred and potential events.

Results: Identified 9 GTTs and 12 PiFs. A subset of the derived GTTs and PiFs is shown in Figure 1. GTTs are mapped to specific example tasks belonging to that type, Table 1. PiFs are defined with anchor questions, used to characterize the reference conditions under which the tasks are carried out, Table 2.

Review of cognitive models shows the need to adapt these models to incorporate characteristics of RT for support identification of PiFs. E.g. Cognitive function ‘Team Coordination’ needs to incorporate patient-personnel interaction and communication when the team is not physically together.