Technical and clinical assessment of the Mobetron autodocking system

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Introduction

Since 2021, a new method for applicator soft docking in IOERT procedures is optionally available. Instead of the classical system based on laser and mirror, a second system is based on embedded cameras that track the images of three white circles on a target fixed on top of the applicator. If the cameras measure in the images a deviation in pixels shift bigger than a threshold value, a beam interlock is triggered. This new system permits also an assisted automatic docking (Autodocking).

The objective of the study is to determine the pertinence of the default interlock pixel shift settings in terms of beam quality and clinical 'dockability' for the patients.

Materiel and Methods

Beam quality has been determined with profiles measurements in a solid water phantom with EBTXD Gafchromic films, for all beam energies (6, 9 and 12 MeV). Applied displacements were measured by micrometer (LR and GT translations), by laser telemeter (SSD translations) and by digital spirit level (Gantry and Tilt rotations). The first step was to identify the displacements that trigger the beam interlock for the 5 liberty degrees (3 translations and 2 rotations). Based on these values, displacements were applied corresponding to 1 time, 2 times, 3 times, 5 times and 10 times the interlock triggering value. Profiles were also acquired for two extreme positions for which all 5 interlocks were just activated. Finally, profiles were measured with movements, generated with an anesthesiology respirator, that were similar to those encountered during clinical treatments.

On the clinical point of view, the number of interlocks during 119 unselected breast patient treatments were recorded together with their respective breathing parameters (ventilation volume and frequency).

Results

Translations did not impact too much the profile quality and their corresponding interlock settings could be relaxed (doubled). On the other hand, rotations can have a very significant impact on the beam quality and their interlock settings should not be changed. Default interlock settings are presently safe since only limited deviations are seen when all interlocks are just activated (worse case scenario). In case of respirator-generated movements, the profiles are almost identical to the reference ones. In the breast patient series, 74% were interlock free during treatment and no correlation could be found between the number of interlocks and the ventilation parameters.

Conclusion

The default settings for interlock triggering for the Autodocking system are safe and the values for translation could even be relaxed. This will also increase the percentage of interlock free treatments as most interlock happening during treatment are due to LR or GT translations.