**COMPARISON AMONG 4 IMMOBILIZATION DEVICES FOR WHOLE BREAST IRRADIATION WITH HELICAL TOMOTHERAPY**

**Background and purpose:** Tomotherapy improves treatment results of conformal radiotherapy in the treatment of whole breast thanks to a higher homogeneity and a better dose conformality. However, to be safely delivered, highly conformal dose distributions necessitate patient immobilization with reliable and accurate device. The goal of this study was to evaluate the repositioning accuracy of 4 immobilization devices (ID): arm float with VacFix (Par Scientific, Denmark), all-in-one (AIO) system (Orfit, Belgium), MacroCast thermoplastic (Macromedics, Nederland) and blueBAG system with Arm-Shuttle (Elekta, Sweden). Investigations were performed by analyzing pre-treatment MVCT images and examining translations and rotations obtained in all directions for different selected regions of interest (ROIs) for registration. The multiple ROIs registration method helped establishing which of the ID enabled local deformations to be minimized. Setup margins were finally calculated and compared in function of the selected IDs and ROIs.

**Materials and methods:** Twenty three women with breast cancer with PTV including the breast/chest wall, internal mammary chain (IMC), supraclavicular and axillary lymph nodes were involved in this study. IDs were randomly attributed: 6 women were included in each group except for the blueBAG group where 5 patients were included. Pretreatment registration results were first collected on the basis of a reference automatic bone-registration. Registrations on the basis of representative ROIs of the above mentioned PTVs were subsequently performed by a skilled technologist. Each ROI was alternatively considered as the reference ROI for registration and relative shifts were calculated for other ROIs by subtraction of each shift obtained with each ROI along the 3 axis. Margins resulting from setup uncertainty alone were finally estimated from the systematic and random variations according to van Herk margin equation [1].

**Results**: On the basis of the reference ROI, calculated margins were significantly lower for the blueBAG system (Table 1). Registration on axillary nodes showed less deviation compared to other ROIs. Margins were then recalculated for all ROIs relative to axillary nodes registration. For the blueBAG device margins range from 0.13 mm (cranial-caudal direction) for the supraclavicular nodes to 7 mm (anterior-posterior direction) for the breast/chest wall.

**Conclusion:** The blueBAG system is more reproducible for the whole breast irradiation. Using axillary nodes as a reference positioning volume should allow having reduced margins compared to registration based on other ROIs.

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|  | Arm float | AIO | Thermoplastic | BlueBAG |
| IMC | 4,34±5,4 | 1,89±1,49 | 1,59±1,49 | 1,72±1,71 |
| Axillary | 3,87±3,18 | 4,38±3,17 | 4,12±2,54 | 2,84±1,80 |
| Chest/breast | 4,28±2,96 | 4,55±2,91 | 5,53±2,81 | 3,06±2,23 |
| supraclavicular | 2,74±1,73 | 3,34±2,55 | 3,15±2,32 | 3,40±2,31 |

*Table 1: Comparison* of translation vectors (millimeters) for different IDs

**Reference:** [1] van Herk, [Seminars in Radiation Oncology](http://www.semradonc.com/article/S1053-4296(03)00084-5/abstract), 2004