

Refinement of treatment setup accuracy using stereotactic system for paediatric immobilization



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Purpose
The purpose of the study was to investigate if stereotactic system for paediatric immobilization (SSPI) can decrease setup deviations.



Figure 1. SSPI supports Moldcare custom deformers

Material/Methods
The last 7 paediatric patients treated with Elekta Synergy S 6-MV LINAC at our institution have been treated with tumours in the superior abdomen, lungs, head and neck, receiving 141 fractions of radiotherapy with a novel SSPI, designed for patients up to 1.20 meters in height. The device has custom deformers (figure 1) for the Moldcare, which achieve an excellent adaptation to the child's body (figure 2), thermoplastic mask (figure 3) and stereotactic references (figure 4). Therefore, we do not use classic clinical setup of in-room lasers and skin/cradle marks placed at simulation. The patient position was evaluated with CBCT registered to the planning CT. A total of 101 cone-beams were analyzed. Averages, systematic errors, standard deviations, and root mean square values of observed setup error were calculated.

SSPI incorporates a smartphone holder which enhances the collaboration of the patient. Children's experience at simulation is critical for the success of any radiation therapy treatment. Seven technologists were surveyed to assess their high, medium high, medium low, and low satisfaction with children's experience, indexing, positioning, and learning curve of the system.

Results
The mean translational displacement per patient, which is the systematic displacement, ranged from **x (-0.21 to 0.19 cm), y (-0.23 to 0.25 cm), z (-0.01 to 0.2 cm)**. Additionally, the SD of absolute random displacement for individual patient ranged from **x (0.07 to 0.25 cm), y (0.06 to 0.2 cm), z (0.07 to 0.25 cm)**. For patients receiving stereotactic treatment, **82.2%** of those treatment sessions were within our clinical tolerance of $\leq 3\text{mm}$ in any direction.

Technologists rated the children's experience simulation, learning curve, set up, and positioning more highly for SSPI versus classic clinical setup of skin/cradle marks.

Conclusions:
SSPI significantly improves localization of pediatric tumors in comparison to classic setup of skin/cradle marks. This reduction in the setup margin treated with SSPI could also have significant clinical implications for second malignancies and acute and late radiation induced toxicities.

Better results are expected once the learning curve flattens. A larger prospective trial is ongoing using a robotic couch for correcting setup errors in six degrees of freedom.



Figure 2. Moldcare achieve an excellent adaptation to the child's body



Figure 3. SSPI supports thermoplastic mask

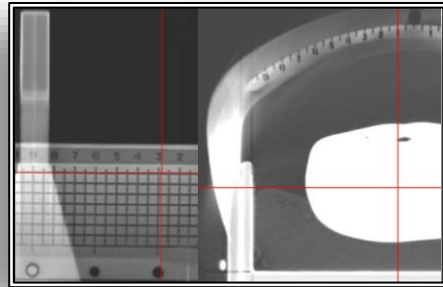


Figure 4. SSPI provides stereotactic references