Improved Patient Positioning and Reduced Treatment Time with Mask-and-Nose-Piece Immobilization for Frameless Stereotactic Radiosurgery

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Objectives: This study evaluated the impact of a modified thermoplastic mask with a custom thermoplastic nose piece on patient immobilization and treatment efficiency for frameless multi-source cobalt-based stereotactic radiosurgery (SRS). We hypothesize that the addition of the nose piece would improve immobilization and reduce patient intrafraction motion, leading to higher quality treatment and decreased overall treatment time.

Methods: Patients were assigned on a rotating basis to 1 of 3 immobilization groups: 1) manufacturer's recommended mask formation method with no modifications (control), 2) manufacturer's method with the addition of the nose piece, 3) an alternative mask formation method with increased contact in the chin and neck region with the addition of the nose piece. Patient motion was tracked via High-Definition Motion Monitoring (HDMM). The time factor was defined as the actual patient treatment time divided by the estimated plan "beam on" time plus 5 minutes for the initial required cone beam CT.

Results: There were 21 pts in group 1, 49 in group 2, and 65 in group 3. The average maximum HDMM deviation from baseline for groups 1, 2, and 3 was 0.9mm, 0.5mm, and 0.5mm, respectively ($p < 0.001$). The median time factor for groups 1, 2, and 3 was 1.24, 1.18, and 1.13, respectively ($p=0.03$). There was no significant difference in time factor between groups 1 and 2 ($p=0.3$), but there was a significant difference comparing groups 1 and 3 ($p=0.01$).

Conclusion(s): The results of this study indicate that the addition of a custom thermoplastic nose piece to masks offers improved patient intrafraction positional stability and reduced overall treatment time for frameless SRS. This was true regardless of mask formation technique (manufacturer's recommended or alternative). The custom thermoplastic nose piece is an accessible solution for most clinics that may improve both productivity and treatment quality.