EP-021

하내측 안와골절의 해부학적 재건에서 단일 구조 환자맞춤형 PEEK 임플란트의 임상적 유용성: 증례-대조 연구

(One-Piece Milled Patient-Specific PEEK Implants for Anatomical Reconstruction of Inferomedial Orbital Blow-Out Fractures: A Case–Control Study)

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Purpose: Inferomedial orbital blow-out fractures present significant reconstructive challenges due to the complex three-dimensional curvature of the medial wall–floor junction and the functional importance of the inferomedial buttress. Conventional implants often rely on intraoperative contouring, which may result in geometric distortion and suboptimal orbital volume restoration. This study evaluated whether customized one-piece milled polyetheretherketone (PEEK) patient-specific implants (PSIs) improve anatomical accuracy and surgical outcomes compared with conventional implants.

Methods: A retrospective case–control study was conducted including patients who underwent primary reconstruction for unilateral inferomedial orbital fractures between 2016 and 2025. Patients were divided into a PEEK PSI group(n=18) and a non-PEEK group reconstructed with conventional implants(n=26). Orbital volume restoration was assessed using CT-based three-dimensional segmentation to calculate the Volumetric Restoration Ratio and Absolute Volumetric Deviation relative to the mirrored contralateral orbit. Operative time, postoperative complications, and patient-reported satisfaction were also analyzed.

Results: The PEEK PSI group demonstrated significantly improved anatomical reconstruction, achieving a mean Volumetric Restoration Ratio of 100.4±6.4% compared with 106.9±4.0% in the non-PEEK group($p<0.001$). Absolute Volumetric Deviation was significantly lower in the PEEK group(1,360±1,004 mm^3 vs. 1,945±766 mm^3; $p=0.023$). Clinically successful volume restoration(<1,000 mm^3 deviation) was achieved in 55.6% of PEEK patients versus 11.5% of controls. PEEK PSI reconstruction was associated with shorter operative time, stable implant positioning, and high patient satisfaction without implant-related complications.

Conclusion: One-piece milled PEEK PSIs enable precise anatomical reconstruction of inferomedial orbital fractures, providing improved volumetric accuracy and operative efficiency compared with conventional implants, supporting their role as a reliable reconstructive option for complex orbital defects.

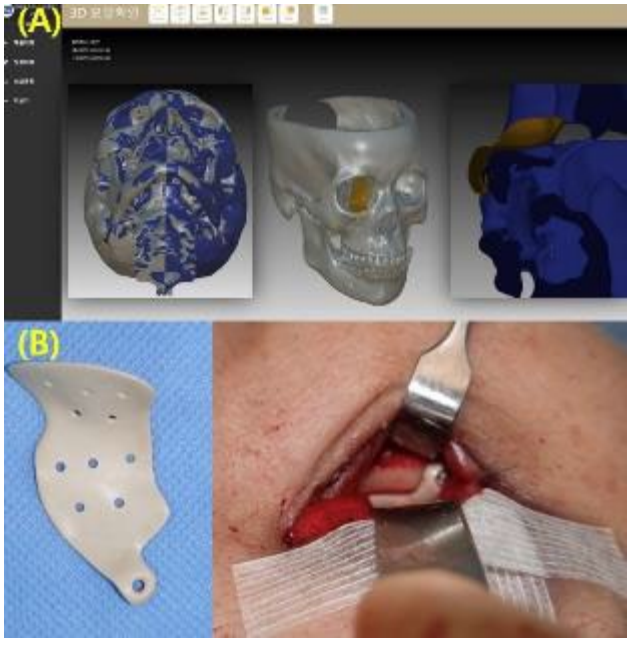

Figure. 1
(A) Virtual planning and fabrication of a one-piece milled PEEK PSI using mirrored contralateral orbital anatomy.
(B) Intraoperative placement of the customized implant.