During a decompressive craniectomy performed for a severe cerebral infarction, sufficient coverage of the underlying bulging brain by converting the flat dura mater to a more domelike shape is essential. In this procedure, suturing to patch dural substitutes on the dural rifts occupies most of the operative time and is cumbersome. We present a new dural incision design that provides an appropriate volume of subdural space with minimal incisions.

METHODS: The ideal incision design was geometrically analyzed and verified by simulations using a physics engine.

RESULTS: Assuming a quadrilateral area on the dura mater surface termed S, expanding the entire area of S requires 2d (where d is the skull thickness) + a 30-mm extension of the shortest set of line segments connecting each vertex (LSCV) of S to cover the necessary volume of bulging brain. The shortest LSCV comprises 5 line segments connected with two 3-pronged intersections. The ideal incision design consists of a pair of curved line segments that maintain plane continuity along the LSCV, which automatically limits the maximum expansion. The ideal incision design of S consists of 5 uncinate line segments. Four of the line segments originate from each vertex of S and end by crossing over the LSCV, and one of the line segments crosses over 2 separate LSCV. A representative case is shown [1)]

1)
Nagai M, Ishikawa M. Exploration of the Most Effective Dural Incision Design in a Decompressive Craniectomy. World Neurosurg. 2017 Apr;100:224-229. doi: 10.1016/j.wneu.2016.12.134. Epub 2017 Jan 10. PubMed PMID: 28087433.