

# Cranial Remodeling (Techniques)

Updated: October 10, 2009

POSITIONING & ACCESS.....	1
CRANIOTOMY.....	1
REMODELING.....	1
CLOSURE.....	2
INDICATIONS, CONTRAINDICATIONS, PRINCIPLES, POSTOPERATIVE CARE → see p. Dev9 >>	

- cranial remodeling operations are associated with *significant blood loss* (secure at least 3 units of suitable cross-matched blood before surgery)!
- significant midface deformity may be problem for intubation.

## POSITIONING & ACCESS

- depends on which fused suture needs correction:

- SUPINE POSITION** with head supported on neurosurgery horseshoe - access to anterior cranium and frontoorbital region - for **METOPIC** and **UNICORONAL** craniosynostoses.
- PRONE POSITION** - access to occipital area - for **LAMBDOID** craniosynostosis.
- MODIFIED PRONE POSITION** with cervical spine extended - access to both anterior and posterior cranium (i.e. both frontoorbital area and occipital area) – for **SAGITTAL** and **BICORONAL** craniosynostoses:



N.B. ensure proper fixation of endotracheal tube - this position can be dangerous if patient is accidentally extubated during procedure!

## CRANIOTOMY

- zigzag bicoronal **INCISION** (prevents parting of hair along straight line, and scar tends to spread less because of redistribution of forces) - begins slightly anterior and superior to helix of ear.
  - do not extend incisions too far anterior or inferior (injury to temporal branch of facial nerve).
- *dissection in subgaleal plane* - flaps are developed anteriorly and posteriorly if needed.
- as orbital rims are reached, incision through periosteum is completed (do not injure supraorbital **neurovascular bundle**, exiting from supraorbital foramen or notch, in medial aspect of superior orbital rim - bundle is translocated forward and out of foramen or notch with coronal flap).
- **temporalis muscle** is dissected from bone and reflected inferiorly (access to lateral wall of orbit).
- high-speed craniotomy with small burs, calvarium is carefully elevated from dura.
- if orbital osteotomies are needed, periorbita is separated carefully and ocular globe is retracted with malleable retractor.

## REMODELING

### FIXATION PRINCIPLES

- **titanium plates** (associated with migration from ectocranium to endocranium → plates and screws came in contact with dura and brain) have been replaced by **absorbable plates** made of *polyglycolic and polylactic acid* (absorb by hydrolysis in 1-3 years).

### SAGITTAL SYNOSTOSIS

- frontal, parietal, and occipital **bones are removed** and transferred to side assembly table.
- **radial osteotomies** are performed on each bone to normalize contours.
- shortening of AP dimension is accomplished by **ostectomy of sagittal suture**.
- **out-fracturing base of temporal bones** aids in increasing lateral dimension of calvarium.
- **bones are molded** into shape and subsequently **replaced** into position.
- **fixation of bones** with absorbable plates & sutures.

### BICORONAL SYNOSTOSIS

- **FRONTO-ORBITAL ADVANCEMENT** - increasing volume of constricted anterior cranial fossa and reducing exorbitism:

- 1) independent **mobilization** of **supraorbital (s. frontoorbital) bar** with series of facial osteotomies (in appropriate sites of medial, superior, and lateral orbital walls and frontal bone);
- 2) subsequent **advancement and stabilization** of **supraorbital bar** in new more anterior position (so that supraorbital rim is 3 mm ventral to vertical plane of cornea);
- 3) lower border of frontal bones is resected (decrease in vertical dimension of calvarium and reduction of turriccephaly)
- 4) new forehead is reconstructed with frontal bone flaps (simple resection and remodeling).
- 5) fixation is achieved at nasion, pterion, and frontoorbital junction.

**Variations** (differ mainly on alternative fixations of lateral ends of supraorbital bar on adjacent temporal or zygomatic bones):

- a) **"floating forehead" technique** - completely disconnects supraorbital bar and forehead from temporal bones (with goal of allowing complete freedom of growth of forehead from skull base).
- b) **"tongue-in-groove" technique** - purposely attaches supraorbital bars to adjacent temporal bones with internal fixation (with goal of maintaining synchrony of growth between realigned forehead and skull base).

### UNICORONAL SYNOSTOSIS

- correction of asymmetry within frontoorbital bar, frontal bone, and orbits.

- frontal bone is removed by performing craniotomy 10 mm above supraorbital rim, thus separating it from orbital bar.
- advancement of ipsilateral frontoorbital bar is accomplished by first creating osteotomy across floor of anterior cranial fossa and roof of orbit:

- osteotomy begins at pterion and extends across midline anterior to crista galli and onto pterion on other side.
- externally, osteotomy is made across lateral wall of orbit and onto frontozygomatic suture.
- frontoorbital bar is then excised.
- each orbit is remodeled and shaped to create symmetry:
  - bar is fixed at nasion with absorbable plates.
  - frontoorbital bar is advanced on ipsilateral side (position rim  $\approx$  3 mm ventral to vertical plane of cornea).
  - small bone grafts may need to be used as interposition grafts if overall advancement is large.
  - ipsilateral orbital rim is cephalad compared with uninvolved side; bone is removed from frontozygomatic and frontonasal sutures to correct this asymmetry; in addition, bone is added to contralateral side to aid in symmetry; bone is also added to ipsilateral orbit rim width and removed from contralateral rim width to correct transverse discrepancy.
- symmetric replacement of frontal bone, after molding, is completed.
- absorbable plate fixation - plates are positioned at lateral orbital rim at its junction with temporal bone, frontonasal junction, and on frontal bone at its junction with frontoorbital bar, parietal bones, and temporal bones.

### METOPIC SYNOSTOSIS

- increase in bifrontal diameter, increase in anterior cranial fossa volume, normalization of frontal bone shape.

- frontal bones and frontoorbital bones are excised and transferred to side assembly table.
- frontoorbital bar is advanced to create appropriate brow position.
- interdacyron distance is increased by placing bone graft between 2 halves of frontoorbital bars.
- bone is placed in tenon-and-mortise fashion to enhance stabilization.
- lateral aspects of orbital rims are also advanced.
- fixation via absorbable plates placed at lateral orbital rims at their junction with temporal bones + fixation at frontonasal junction.
- frontal bones are fixed to one another so that bifrontal diameter is increased.

### CLOSURE

- **temporalis muscle is repositioned** - temporalis is resuspended using absorbable sutures secured to previously placed fixation plate - provides cephalad suspension of muscle as it heals in place.
- **coronal flaps are reapproximated**, and galeal layer are sutured.
- hemostasis is paramount!
- resorbable sutures close **skin layer**.
- **suction drain** is recommended to reduce subcutaneous blood collection.
- firmly applied head dressing is secured in place with burn netting.

BIBLIOGRAPHY for ch. "Developmental Anomalies" → follow this [LINK >>](#)