Orbital Osteotomy
For Hypertelorism

Prof. Dr. Dr. Srinivas Gosla Reddy
MBBS, MDS, FRCS (Edin.), FDSRCS (Edin), FDSRCS (Eng.), FDSRCPS (Glasg.), PhD

Dr. Likith Ram Reddy MD DDS
Dr. Sri ramechandra Damaraju MS MCh
Dr. Rajgopal R. Reddy
MBBS, BDS, FDSRCPS (Glasg.)
Dr. Ashish Fanan M.D.S.
Dr. Avni Pandey M.D.S.

GSR Institute of Craniofacial Surgery
Hyderabad India

www.craniofacialinstitute.org
GSR Institute of Facial Plastic Surgery

- Non-profit hospital established in 1996
- Dedicated Cleft & Craniofacial Centre of Excellence
- Presently 1,600 cleft and craniofacial surgeries are done every year
- 3 surgeons and 4 fellows with full support team
- More than 30,000 documented cleft & craniofacial surgeries have been performed since 1996
- 600 primary new born cleft children are registered every year

www.craniofacialinstitute.org
D. M. Grieg first described hypertelorism in 1924.
I. T. Jackson et al first defined Hypertelorism and Teleorbitism as Lateralization of the total orbital complex with resulting increases in the interorbital distance and intercanthal width. The intercanthal and interpupillary distances are increased and may be symmetric, asymmetric, or unilateral.
Further modified the definition to include lateral orbital wall distance.

Increase in the distance between the lateral orbital walls and the interorbital distance to denote true hypertelorism.

Intercanthal distance measurement should be done clinically for aesthetics.
Measuring Orbital Hypertelorism

Interorbital distance = distance between the right and left dacryon points

These points correspond clinically to the bony anterior lacrimal crests
Classification

Hypertelorism is a physical finding, that may or may not be a part of a syndrome.

It is usually secondary to another deformity

I. T. Jackson et al. classified the cause of Orbital Hypertelorism as one of the following

- Cleft related
- Traumatic
- Frontonasal encephalocele
- Ethmoidal and frontal sinus pathology
- Nasal pathology
- Craniosynostosis, Apert’s and Crouzon’s syndromes

We have developed our own classification based on this classification to help us plan hypertelorism correction
Sailer’s Classification

**Medial Hypertelorism**

- Caused by pathology that leads to hypertrophy, hyperplasia or derangement of the fronto-nasal-ethmoidal complex.

  Eg. Cleft related, Naso/frontal encephalocele, nasal/ethmoidal bone hyperplasia.

**Lateral Hypertelorism**

- Caused by pathology that causes synostosis of the cranial-zygomatic-maxillary complex

  Eg. Craniosynostosis, Apert/Cruzon syndromes
Classification: Cleft Related Bilateral Orbital Hypertelorism

Hyperplasia of Bilateral Ethmoidal sinus
Classification: Cleft Related
Unilateral Orbital Hypertelorism

Hyperplasia of Left Ethmoidal sinus

www.craniofacialinstitute.org
Classification: Traumatic

Increase in the volume of Ethmoidal sinus
Classification: Fronto-Nasal Encephalocele (Pseudohypertelorism)

Increase in the volume of Ethmoidal sinus
Classification: Nasal Pathology

Increase in the volume of Ethmoidal sinus
Classification: Aperts Syndrome

Lateral orbital wall distance is increased.
Paul Tessier

Classified the severity of orbital hypertelorism into three categories of increased interorbital distance.

<table>
<thead>
<tr>
<th>Type</th>
<th>Distance (mm)</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>30 to 34</td>
<td>Mild</td>
</tr>
<tr>
<td>II</td>
<td>35 to 39</td>
<td>Moderate</td>
</tr>
<tr>
<td>III</td>
<td>&gt; 40</td>
<td>Severe</td>
</tr>
</tbody>
</table>
The best investigations to assess hypertelorism are axial section CT scans of the facial bones.
The best way to plan hypertelorism correction is with stereo lithographic models.
## Treatment
**Intracranial Hypertelorism Corrections**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>03</td>
</tr>
<tr>
<td>2007</td>
<td>05</td>
</tr>
<tr>
<td>2008</td>
<td>06</td>
</tr>
<tr>
<td>2009</td>
<td>05</td>
</tr>
<tr>
<td>2010</td>
<td>06</td>
</tr>
<tr>
<td>2011</td>
<td>04</td>
</tr>
<tr>
<td>2012</td>
<td>06</td>
</tr>
<tr>
<td>2013</td>
<td>05</td>
</tr>
<tr>
<td>2014</td>
<td>06</td>
</tr>
<tr>
<td>2015</td>
<td>05</td>
</tr>
<tr>
<td>2016</td>
<td>03</td>
</tr>
<tr>
<td>2017</td>
<td>01</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
</tr>
</tbody>
</table>
Principles of Treatment

- **First principle** Combine as many small procedures as is safe and practical into one operation.
- **Second principle** Decrease infection rates by limiting combined intraoral and intracranial procedures.
- **Third principle** Decrease the number of revisionary and redo procedures.
- **Fourth principle** Maximize the overall long-term functional and aesthetic results.
Treatment

Mild Hypertelorism
• Caused by trauma or nasal pathology.
• Conservative management.

Severe Hypertelorism
• Caused by encephalocele, facial clefting or in Apert’s and Cruzon’s syndrome.
• Management through Intra Cranial or Trans Cranial approach.

Indications for intracranial approach
- Moderate to severe orbital hypertelorism
- Encephalocele
- Cribriform plate lower than the level of the naso-frontal suture.
Correcting a functional defect vs. cosmetic defect

- Most hypertelorism corrections are cosmetic defect corrections.
- Even in patients with severe craniosynostosis, frontal monobloc advancement without hypertelorism correction will treat the raised intracranial pressure.
- Naso/frontal/ethmoidal encephaloceles are the only functional defects that will be helped with hypertelorism correction.
## Treatment

### Osteotomy Cuts for Box and Spectacle Osteotomy

<table>
<thead>
<tr>
<th>Box Osteotomy</th>
<th>Spectacle Osteotomy</th>
<th>Facial Bi-partition</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Box Osteotomy</strong> done in older children and adults</td>
<td>• <strong>Spectacle osteotomy</strong> done in young children because of better fixation area</td>
<td></td>
</tr>
<tr>
<td>• Done for patients with <strong>Medial Hypertelorism</strong> <em>(Nasal pathology)</em></td>
<td>• <strong>Spectacle osteotomy</strong> cannot be done in patients with frontal encephalocele</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Orbits need medial and mostly parallel movement</td>
<td></td>
</tr>
</tbody>
</table>

In infants **Spectacle and Box osteotomy** is not preferred because of tooth buds in infra orbital region.
Treatment

Osteotomy Cuts for Facial Bi-partition

- **Facial Bi-partition** done in both children and adults
- Done for patients with **Lateral Hypertelorism (Cranio-maxillary Defects)**
- Orbits that need medial and rotational movements
- Mid palatal maxillary splitting is done to flare the constricted maxilla

Also done in all hypertelorism corrections in infants as this technique ensures no cuts are placed in the region of tooth buds
Box Osteotomy
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia
Skin Incision

- The skin incision for the intracranial correction of orbital hypertelorism consists of bicoronal incision with the dissection as far forward and anterior as possible.
Raising Bicoronal Flap

- Sub pericranial dissection is done and the pericranial layer is preserved to use if a flap is required
- Dissection is continued temporally to keep temporalis adherent to the bone.
Orbital Hypertelorism: Treatment

*Craniofrontonasal Dysplasia*

Raising Bicoronal Flap

- Dissection is done in such a way to expose the zygomatic arches.
Orbital Hypertelorism: Treatment

*Craniofrontonasal Dysplasia*

**Transfrontal Craniotomy**

- Frontal Cranial Flap is raised to facilitate retraction of the brain while orbital osteotomy is being performed
Orbital Hypertelorism: Treatment

_Craniofrontonasal Dysplasia_

Medial wall of orbit osteotomy

- Central block of bone between the orbits is removed and medial wall osteotomy is done.
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia

Medial and inferior wall of orbit osteotomy
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia

Orbital roof osteotomy

- Bony cuts of the orbital roofs are performed with intracranial visualization

www.craniofacialinstitute.org
Lateral Orbital Wall Osteotomy

- Initially extracranially, through the fronto-zygomatic region
- Final cut superiorly is done intracranially
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia

Zygomatic Arch Osteotomy
Finishing osteotomy/Inferior wall osteotomy

- Wedge of bone is removed from either side of piriform fossa so that the nasal airways are not constricted when the orbits are moved medially
- If the osteotomies have been performed to their full depth, the orbits can be approximated by finger pressure alone
Fixation and bone grafting

• Bone graft material harvested from the calvarium can be split into the two cortices and

• One cortex can be used to graft bone in the defects and the other can be used to close the original defect
Fixation and bone grafting

• The orbits are positioned and held in place with wires or micro-or miniplates.

• Bone graft material harvested from the clavarium, iliac crest, or rib is then used to fill in the resulting gap defects at the lateral orbital walls and zygomatic areas.
Orbital Hypertelorism: Treatment

*Craniofrontonasal Dysplasia*

Medial Canthus and Temporalis muscle sling
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia
Orbital Hypertelorism: Treatment

*Tessier 0-14 Craniofacial Cleft*
Orbital Hypertelorism: Treatment

Tessier 0-14 Craniofacial Cleft
Orbital Hypertelorism: Treatment

Tessier 0-14 Craniofacial Cleft
Orbital Hypertelorism: Treatment

Tessier 14 Craniofacial Cleft
Orbital Hypertelorism: Treatment

Encephalocele
Orbital Hypertelorism: Treatment

Encephalocele

Encephalocele Resection
Orbital Hypertelorism: Treatment

Encephalocele

Transfrontal Craniotomy
Orbital Hypertelorism: Treatment

Encephalocele

Finishing osteotomy, fixation and closure
Orbital Hypertelorism: Treatment

Encephalocele
Orbital Hypertelorism: Treatment

Encephalocele
Spectacle Osteotomy
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia
Orbital Hypertelorism: Treatment

Craniofrontonasal Dysplasia

Transfrontal Craniotomy

- The frontal bar results from parallel osteotomies that are at least 1 cm from the supraorbital rims
- Permits orientation of the orbits once they have been mobilized
Orbital Hypertelorism: Treatment

*Craniosynostosis*
Orbital Hypertelorism: Treatment

*Craniosynostosis*

Frontal craniotomy
Lateral, Medial and Superior orbital osteotomies

- These osteotomies are done to separate the naso-orbital complex from the temporal and sphenoid bones and also the skull base
- Osteotomy is also done at the zygomatic bone.
Orbital Hypertelorism: Treatment

Craniosynostosis

Pterygo-maxillary and mid palatine osteotomies

- Pterygo-maxillary osteotomy done to separate the zygomatico-maxillary complex from the pterygoid bone.
- Mid-palatine osetotomy is done to flatten the maxilla.
Approximation and fixation

- If the osteotomies are complete the segments will medialise with finger pressure
- Medial and lateral canthal ligaments are re-suspended
- Fixation is done
Orbital Hypertelorism: Treatment

*Craniosynostosis*
Orbital Hypertelorism: Treatment

*Unilateral coronal Craniosynostosis (plagiocephaly)*
Facial Bipartition

- Right coronal Craniosynostosis release done along with facial bipartition
Orbital Hypertelorism: Treatment

*Unilateral coronal Craniosynostosis (plagiocephaly)*

**Fixation**

- Cranial bone fixation after craniosynostosis release is done with bio-resorbable bone plates
Orbital Hypertelorism: Treatment

Unilateral coronal Craniosynostosis (plagiocephaly)
Orbital Box Osteotomy

Likhith Reddy and Srinivas Golla

Ammonium
- #15 and #10 scalpel blades and handle
- 24-Gauge wire
- Appropriate sutures
- Bipolar cautery
- Bone rongeurs
- Curet, Force, and #9 periosteal elevator
- Curved Mayo or curved tenotomy scissors
- Fine side-cutting forceps, 1.2 mm
- Hair clippers and hair elastic
- Local anesthetic with vasoconstrictor
- Malleable retractors
- Mayfield headrest
- Midface titanium fixation devices
- Needle electrocautery
- Overturer retractors
- Reciprocating saw
- Sennul retractors
- Smith spreaders
- Telescop osteotomes

History of the Procedure

The orbital box osteotomy is used to correct vertical or horizontal malposition of the entire orbit and its contents. The orbital box osteotomy was first performed by Paul Tesfai to correct hypertelorism. He described osteotomies that separate the entire bony orbit from the skull and surrounding facial bones by combining both intracranial and facial approaches. Converse and Smith described substantial U-shaped orbital osteotomies to correct hypertelorism; however, these techniques produced limited results. Schmidt described circumferential orbital osteotomies to mobilize and translocate the orbits medially by an extracranial approach in patients with pneumatized frontal sinuses.

Indications for the Use of the Procedure

The orbital box osteotomy is used to correct malpositions of the zygoma, orbit, and its contents in all planes. It is primarily indicated to correct hypertelorism. However, the box osteotomy can be used to correct vertical or horizontal dystopia due to congenital, pathologic, or traumatic abnormalities.

Orbital hypertelorism is an abnormally increased distance between the orbits. In this condition, the distance between the medial canthi, medial, and lateral walls of the orbit and the pinnas is greater than normal. This is different from telecanthus, where the distance between the medial canthi is greater than normal and the distance between lateral walls of the orbit and pinnas is normal (Figure 47-1).

Orbital hypertelorism is an anatomic condition associated with a heterogeneous group of congenital disorders. This can occur as an isolated sporadic anomaly or with conditions such as Edwards syndrome (trisomy 18), basal cell nevus syndrome, craniofrontonasal dysplasia, DiGeorge syndrome, Apert syndrome, and Crouzon syndrome. A heterogeneous collection of frontoethmoid malformations is the group that most commonly displays hypertelorism (Figure 47-2). The clinical findings in this group are usually symmetric hypertelorism, exaggerated width's peak onto the forehead, abnormal and wide-set eyebrows, down-slanting eyes, epicanthic folds, amblyopia, strabismus, a wide nose with a short philtrum, increased intracranial distance, lateral and inferior positioned eyes, median cleft lip, and a high arched palate. Other congenital conditions associated with hypertelorism are frontoethmoidal clefts, and craniofrontonasal dysplasia (Figure 47-3).

The other pathologic process for orbital dystopia is a slow-growing tumor such as neurofibromatosis, frontoethmoid sinus mucocoele, and the like. Also, some of the high-energy injuries and inadequate corrections can cause orbital dystopia in vertical or horizontal positions (Figure 47-4).

The surgery to correct hypertelorism is usually done when the patient is between 5 and 8 years of age. This timing addresses the psychosocial aspects of the developing child in the early school years. The physiologic reasons include the fact that the majority of the interzygomatic width is established by 6 years of age and there is adequate descent of tooth buds into the maxilla, giving space to make an osteotomy below the infraorbital nerve. The disadvantages are that the orbital bones before 5 years of age are thin and fragile and
Post operative Complications

Common postoperative problems and complications specific to this challenging surgery include

• relapse,
• canthal drift,
• enophthalmos,
• injury to the nasolacrimal apparatus,
• disappointing aesthetics with an unnatural appearance of the upper face.
Post operative Complications

• Injuries to cranial nerves
• Brain injury
• Injury to blood vessels
• Eye injuries
• Postoperative infections
• Dural tears
• Cardiopulmonary complications
Bring the Smile Back

Thank You