Treating iatrogenic strabismus from scleral buckles, glaucoma hardware, orbital plates and after endoscopic sinus surgery

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Part I

Strabismus Following Retinal Detachment Repair with Scleral Buckle

Persistent strabismus and motility abnormalities may result from retinal detachment (RD) repair, especially with a scleral buckle (SB).

Etiologies

- Mechanical / Restrictive
  - Buckle placement or postoperative adhesions
  - Displacement or fibrosis of extraocular muscles
  - Superior oblique incarceration → suspect with limited downgaze + vertical diplopia
- Sensory
  - Reduced vision (e.g., macula-off RD) → sensory strabismus

Motility Assessment

- Measure deviations in primary & secondary gazes
- Forced duction testing
- Torsion
- Free space prism test
- Use synoptophore to determine fusion
- Rule out dragged fovea syndrome (retinal misregistration / central-peripheral rivalry)

Surgical Management

1. Scleral Buckle–Related Strabismus

- Buckle removal not routine; consider if:

    - Significant mechanical restriction
    - Buckle impinges on a muscle
    - Prior strabismus surgery failed

2. Extraocular Muscle (EOM) Surgery

- Larger recessions due to scarring/restriction
- Muscle transposition/repositioning if anatomy distorted
- Surgical exposure challenging (fibrosis)
- Techniques: adjustable sutures, hang-back
- Multiple surgeries often required
- Buckle removal may help access but not routinely done
    - Buckle removal rarely restores alignment alone
    - Risk of retinal re-detachment

Outcomes & Prognosis

- Motor success: 72% (Horizontal deviation < 10 PDVertical deviation < 4 PD)
- Primary position diplopia-free: 62%

Prognostic Factors

Favorable:

- Smaller preoperative horizontal deviation
- Minimal restriction on forced ductions

Less favorable:

- Large deviations
- Significant mechanical restriction
- Multiple prior surgeries

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Part II

Strabismus Associated with Glaucoma Surgery

Strabismus following glaucoma surgery may result from sensory disruption, anesthetic myotoxicity, or—most commonly—mechanical factors related to glaucoma drainage devices (GDDs).

Epidemiology

- Mayo Clinic Diplopia Questionnaire Study (2017):
    - Diplopia after GDD: 23%
    - Diplopia after trabeculectomy: 3%
- Tube Versus Trabeculectomy (TVT) Study (2009):
    - New persistent motility disturbance:
        - 5% after GDD
        - 0% after trabeculectomy

Mechanical Mechanisms

- Bulk effect: Limitation of movement → eye deviates away from implant
- Muscle stretching by GDD or bleb → eye deviates toward implant
- Posterior fixation effect: Scarring of muscle to sclera posterior to implant → underaction of affected muscle in its field of action

Superotemporal implants most commonly produce exotropia with ipsilateral hypertropia.

Surgical Management Options

- Mild restriction → consider strabismus surgery in the contralateral eye

- Anteriorly positioned GDD with duction limitation → reposition GDD
- Large cystic bleb → reduce bleb size
- Strabismus surgery:
    - Recess tight/restricted muscles
    - Resect or plicate antagonists
    - Consider adjustable sutures

Outcomes

- Surgical outcomes are often suboptimal, with or without removal of the glaucoma implant or surrounding fibrous capsule.

Pearls & Pitfalls

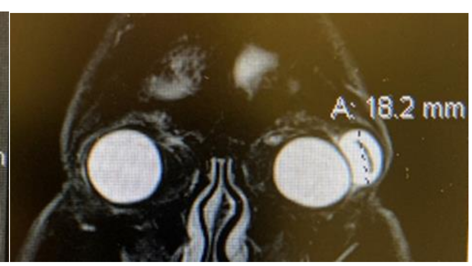
Remember:

- Evaluate for mechanical restriction preoperatively
- Counsel patients regarding realistic expectations

Avoid:

- Aggressive resections without addressing restriction

Assuming deviation is purely sensory



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Part III

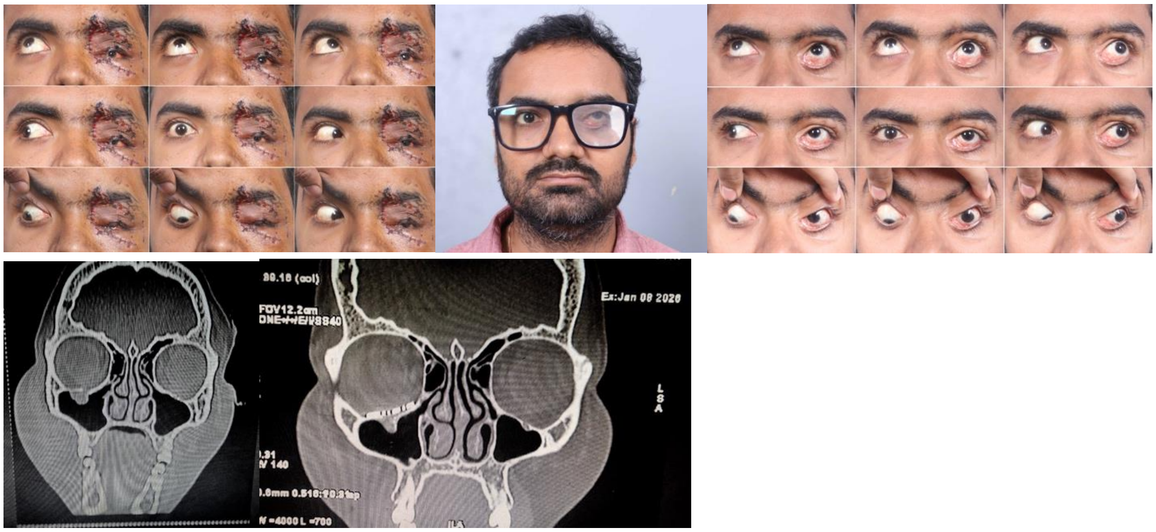
Strabismus related to orbital plate implants in orbital wall fracture

Orbital wall fracture repair using implants is an established procedure for restoring orbital volume and preventing late enophthalmos and diplopia. Despite advances in implant design and surgical techniques, implant-related iatrogenic strabismus remains a clinically important complication, often presenting as persistent or delayed-onset binocular diplopia and motility limitation.

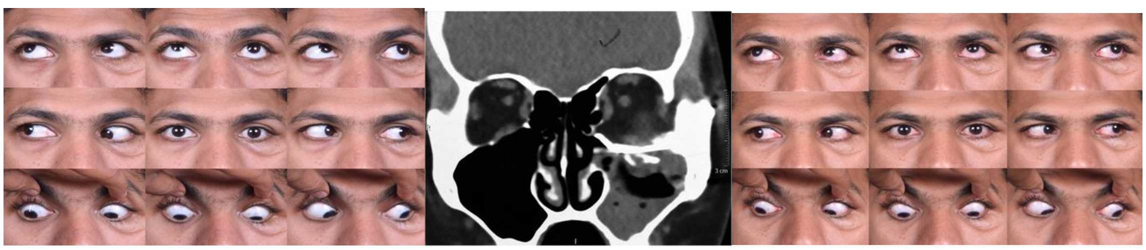
We present a set of clinical cases who developed persistent binocular diplopia following orbital floor fracture repair with a titanium implant.

Clinical features included abnormal head posture, incomitant deviation, and limitation of elevation or depression , suggestive of either a restrictive process or paretic etiology. Imaging did not reveal gross implant displacement.

Case-1:



Case 2:



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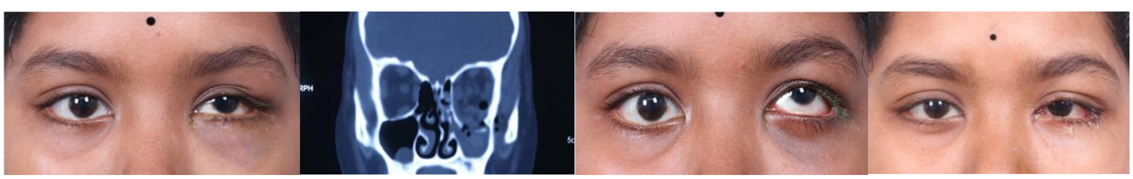

This case series also discusses various surgical approaches, including muscle transposition procedures, plication or resection techniques, and implant removal, highlighting their role in achieving favorable surgical outcomes.

Take-Home Messages

1. Mono-rectus transposition and Inferior Oblique Nasal Transposition (IONT) helps to acheive good surgical outcomes in the paretic etiology of implant-related strabismus.
2. Implant-related strabismus may have a restrictive, paretic, or combined mechanism.

3. Radiologically acceptable implants can still cause clinically significant motility restriction; therefore, intraoperative exploration is essential to determine the appropriate surgical plan.

4. Fresnel prisms help buy time before surgical intervention and alleviate diplopia

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Part IV

Iatrogenic Strabismus following Functional Endoscopic Sinus Surgery (FESS)

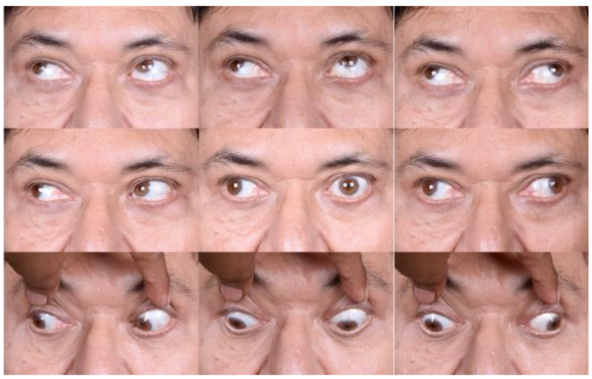
Managing Strabismus following endoscopic sinus surgery (ESS) is challenging.

Endonasal sinus surgery is often used to treat chronic rhinonasal sinusitis, nasal polyposis and other sinonasal disorders.

- Medial Orbital wall is in close proximity to the ethmoidal sinus and the medial rectus muscle is particularly at risk of injury.

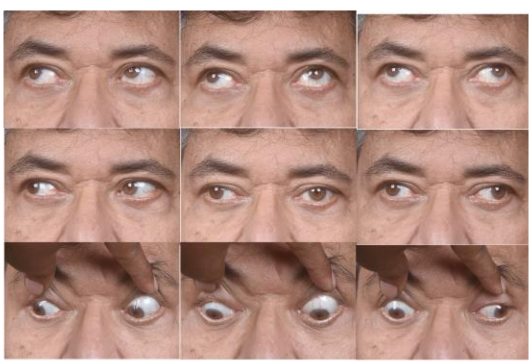
- Presentations include a large angle exotropia with limitation of adduction on the affected side. Associated diplopia and abnormal head posture (face turn) is often noted

- Other reported complications include medial orbital wall damage,optic nerve trauma, central retinal artery occlusion and other extraocular muscles (inferior rectus injury)
- Orbital +/- brain CT/MRI is crucial for detecting orbital wall and muscle/nerve injury.
- Management needs to be individualized, staged strabismus surgical procedures may be required and may include transpositions.
- Realistic expectations regarding outcomes based on the presentation need to be discussed with the patients.



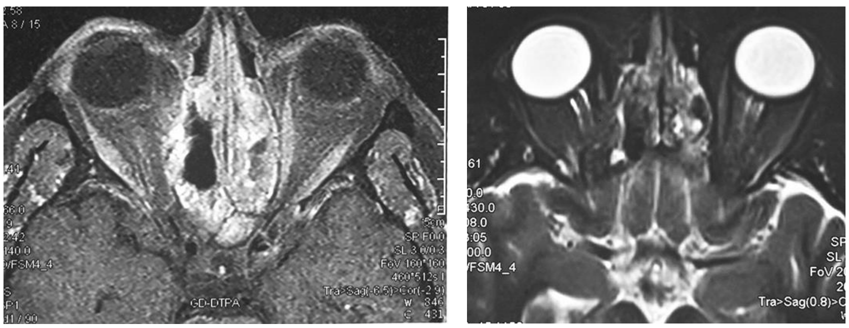
CASE 1

Preoperative photographs show XT 60PD with -5 adduction limitation in right eye



Postoperative photographs after 1st Surgery show XT 60 PD with -4 Adduction limitation in Right eye

Postoperative photographs after 2nd Surgery show XT 20 PD with -4 adduction limitation in Right eye



Axial MRI (T1 and T2) scan demonstrating anterior part of right Medial Rectus can be traced but mid to posterior part of right MR cannot be identified clearly, transected MR seen beyond the equator of globe

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