insight

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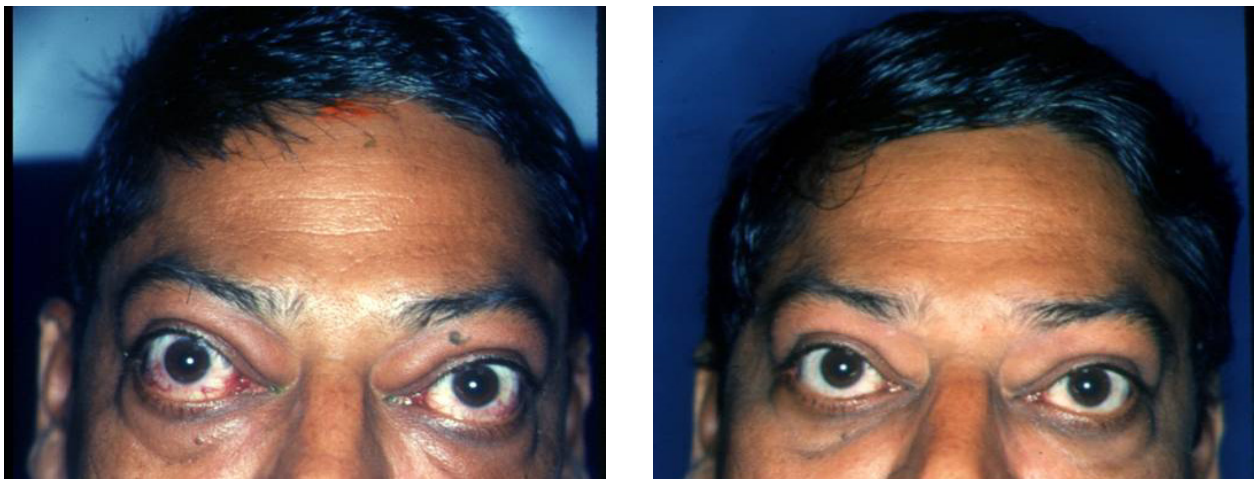


Thyroid associated orbitopathy before and after orbital decompression

EDITORIAL

Thyroid orbitopathy, a multiantigenic disease can be a challenge to manage. It calls for a team approach involving multiple disciplines. This is elaborated in the Perspective article on Thyroid associated orbitopathy. Scleral contact lenses are gaining in popularity as they help manage difficult fitting situations. Indications, advantages and disadvantages are elucidated in the article from the Contact Lens department. With increasing awareness, ROP and ocular surgery in premature children have become the responsibility of both the ophthalmologist and the anaesthesiologist, making monitoring for apnoea an important priority. This is elaborated in the article on apnoea monitoring. A challenging puzzle and a peek at nanotechnology, completes this issue.

Dr S Meenakshi
Editor

Perspective:

Thyroid Associated Orbitopathy - Challenges in Management

E. Ravindra Mohan, Department of Oculoplasty and Orbital Surgery

Thyroid Associated Orbitopathy (TAO) is an extra thyroidal manifestation of autoimmune thyroid disease with orbital tissues as targets. Expansion of the retrobulbar tissues in the fixed volume of the orbital cavity leads to the signs and symptoms of thyroid associated orbitopathy. (Figure 1) TAO causes a variety of ocular manifestations with a wide degree of severity, ranging from barely noticeable discomfort to grotesque disfigurement and blindness.

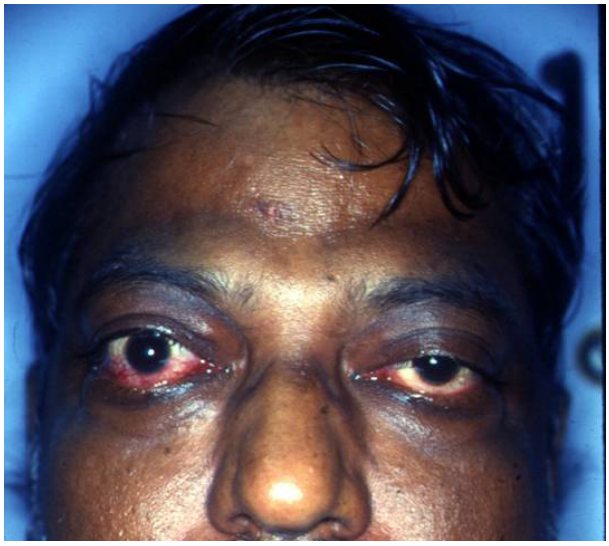


Figure 1

The majority of patients with TAO have mild, self limited disease needing supportive therapy and simple measures for treatment. It is the smaller population of patients with moderate and severe disease who need aggressive management. TAO is one of the few conditions in ophthalmology where most of the subspecialties of ophthalmology have to work in tandem for optimal management. The oculoplastic and orbital surgeon, neuro-ophthalmologist, glaucomatologist, strabismologist, and corneal surgeon need to be variably involved in the management of this complex, ill understood disorder. This need for a team care approach with close co-ordination poses one of the challenges in the management of moderate to severe TAO.

Since the underlying cause of TAO is only slowly being unraveled, with a still unclear understanding of the exact pathophysiology of the disease, the management remains essentially symptomatic. Being so, patients need close follow up, particularly during the active phase of the disease. The steps of management are hence, in a manner of speaking, reactive rather than proactive. The lag between disease damage onset, and appropriate steps in management determines tissue injury and complications of TAO. The avoidance of this lag, and consequent complications, poses yet another challenge in the management of TAO.

A third, and a serious challenge posed by the disease concerns the treatment modalities available. Moderate and severe TAO is treated with oral or intravenous steroids, antimitotic chemotherapy, radiation therapy or orbital decompression surgery or a combination of these forms of treatment. Each of these poses hazards to the patient in the form of serious systemic side effects or local (orbital) problems or a combination. Judicious selection of the modality of treatment importantly involves the weighing in of this factor of potential risks.

Yet another challenge is the unpredictability of treatment outcome. In addition to disease severity, the individual response to treatment also varies greatly and hence, the need to customize and individualize treatment.

The fifth challenge in the management of TAO of moderate to severe nature is the inevitability of sequelae. These range from functional problems like diplopia to a cosmetic appearance of a 'stare' and 'bulgy eyes'. Hence patients with sequelae need prolonged follow up, long after the active phase of TAO is over.

Lastly, and importantly, patients with the more severe forms of TAO are seriously affected psychologically. The striking changes in their facial features, double vision and the real risk of loss of vision and blindness, is seriously disturbing to the patient and close family. Added to this are the difficulties in continuing with gainful employment, and in fruitful social interactions. The side effects of treatment, frequent need for hospital visits and financial loss compounds the psychological problems. Serious depression is a real risk. The treating ophthalmologist needs to provide a caring and supportive role for these disturbed patients.

In reviewing the recent literature certain newer treatment modalities as well as insights into pathophysiology have emerged. Here is a brief review of a few key ones.

Wemeau et al [1] reported the clinical results of a randomized, controlled study on the effect of long acting somatostatin analog, octreotide in patients with Grave's orbitopathy. Somatostatin analogs inhibit lymphocyte proliferation and activation and accumulate in the orbital tissues of patients with Grave's orbitopathy. The study conducted in 51 patients with mild active disease revealed no significant mitigating effect on activity but significantly reduced proptosis.

Ben Simon et al [2] evaluated the efficacy of transconjunctival Muller muscle recession and graded levator disinsertion for eyelid retraction in patients with thyroid related orbitopathy. The study was a large one, a retrospective consecutive case series of 107 eyelid retraction surgeries on 78 patients. The operation was found to be a safe and effective one in the correction of mild, moderate or severe eyelid retraction with a failure rate of less than 10%

Goh et al [3] reported thyroid autoantibody profiles in ophthalmic dominant Grave's disease to be different from thyroid dominant Grave's disease. The study, a prospective one, was conducted over 3 years and involved a total of 102 patients. Based on the different profiles of antibodies in the two groups, the authors conclude that ophthalmopathy is a multigenic disease.

The Sankara Nethralaya Super Speciality clinic:

The basic understanding of eye diseases as also the development in technology and treatment modalities has seen an explosive growth in the recent past, and is likely to accelerate further in the future. From an era of tertiary health care being the final port of call for complex and challenging disease entities, we are now entering the era of super tertiary care.

The concept of super tertiary care as envisioned by our chairman, Dr. S. S. Badrinath, involves the highly focused developments of key areas of skill and expertise, with an aim to deliver the very best to our patients who come from every part of our vast country and from many other countries. The stress is on development of niche areas, based on the available resources, and expertise, and building on the strengths and experience.

Two super speciality clinics – the thyroid eye clinic and the ocular surface clinic have started offering their services. The Clinic is located at No. 29, Jayalakshmi Estate, Haddows Road, Chennai 600006.

References:

1. *Wemeau JL, Caron P, Beckers A, et al Octreotide (long-acting release formulation) treatment in patients with Graves' orbitopathy: clinical results of a four-month, randomized, placebo-controlled, double-blind study. J Clin Endocrinol Metab. 2005 Feb;90(2):841-8. Epub 2004 Nov 23.*
2. *Ben Simon GJ, Mansury AM, Schwarcz RM, Modjtahedi S, McCann JD, Goldberg RA. Transconjunctival Muller muscle recession with levator disinsertion for correction of eyelid retraction associated with thyroid-related orbitopathy. Am J Ophthalmol. 2005 Jul;140(1):94-9.*
3. *Goh SY, Ho SC, Seah LL, Fong KS, Khoo DH.Thyroid autoantibody profiles in ophthalmic dominant and thyroid dominant Graves' disease differ and suggest ophthalmopathy is a multiantigenic disease. Clin Endocrinol (Oxf). 2004 May;60(5):600-7.*

Muscle Puzzle

M. Ram Prakash and **S. Meenakshi,** Sankara Nethralaya ORBIS Pediatric Ophthalmology Learning and Training Centre

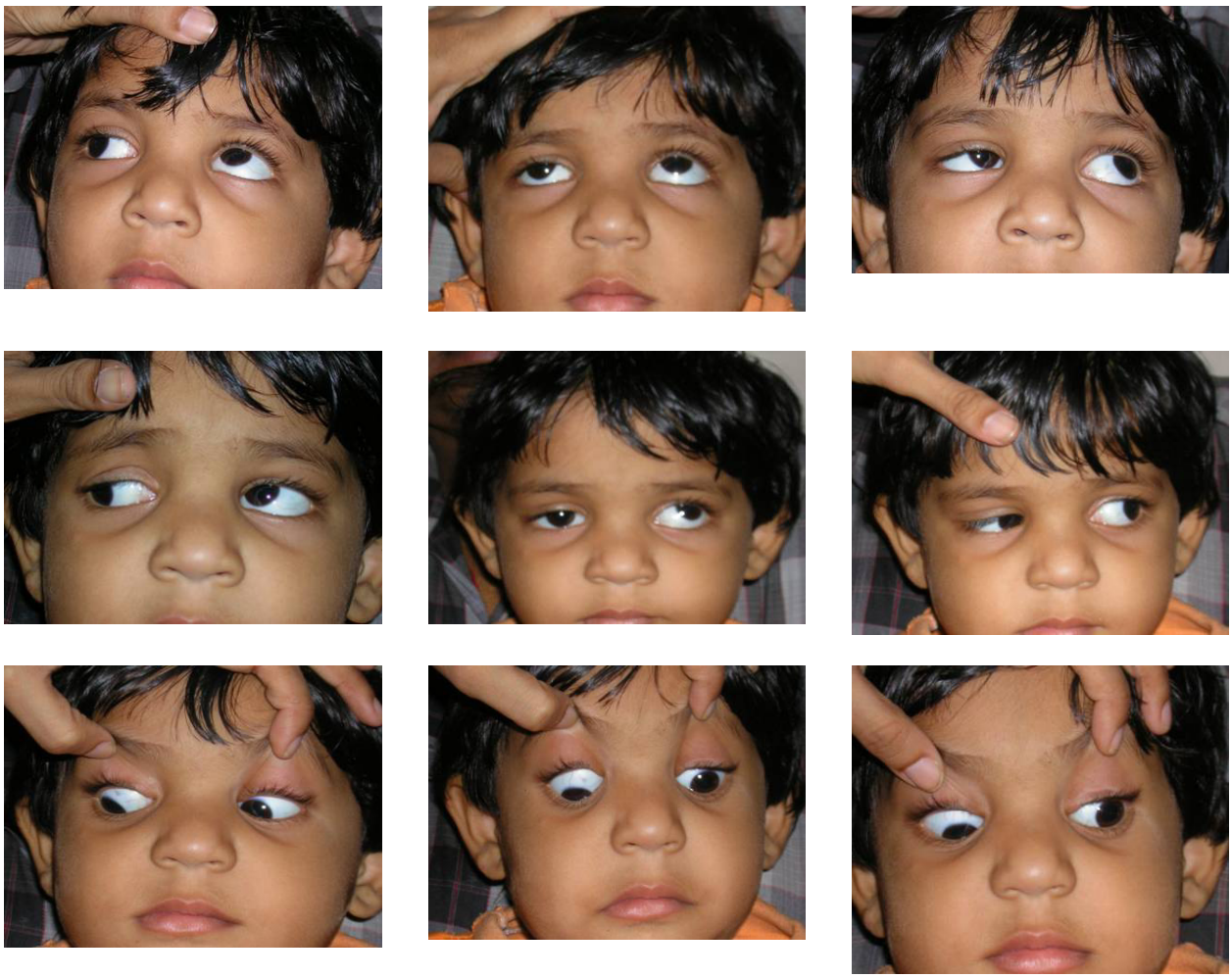
This is a three year old female child brought for squinting upwards of left eye since birth. She was an otherwise normal child with no prior history of glasses or surgery.

The left eye had a poor fixation while the right eye was fixing normally. There was significant astigmatism of -3.25 DC at 180 deg in OS. Her anterior and posterior segment was normal in both eyes. The ocular alignment and motility are as shown in the photograph.

The limited infraduction of OS on version testing was seen to persist with closure of the right eye.

YOUR DIAGNOSIS AND PLAN OF MANAGEMENT ?

(Answer in page 11)



"When Breathing Stops!"
(Apnoea And The Apnoea Alarm Monitor)

Usha Somanathan and Pradnya Senthil, Department of Anaesthesiology

Apnoea is the cessation of respiration.

Apnoea is considered significant if 15 seconds or more in duration, or less than 15 seconds but associated with bradycardia (heart rate < 100/mt or oxygen saturation < 90%). The tendency to develop apnoea is a manifestation of the instability of respiratory drive of the preterm infant. The frequency and duration of apnoea decrease between 1 and 20 weeks postnatal age.

1. The Incidence of postoperative apnoea

The reported frequency of postoperative apnoea varies from zero to 82%. However, most prospective studies show that **approximately 20% to 30%** of otherwise healthy former preterms under general anaesthesia have one or more apnoeas in the postoperative period.

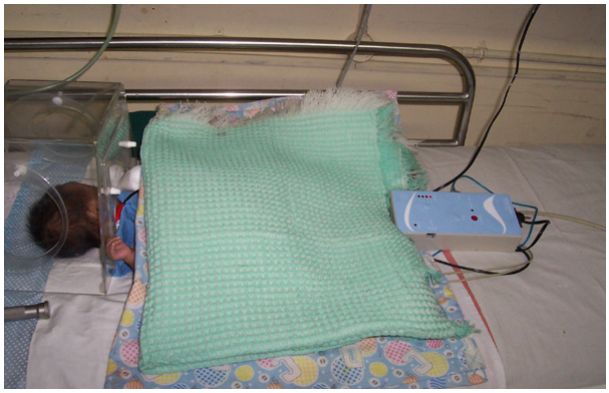
(Monitoring infants for apnoea preoperatively is not a reliable test for predicting postoperative apnoea)

2. Some facts about postoperative apnoea

- Apnoea can occur at any time from the intraoperative period through to many hours later. Younger infants also tend to continue to have apnoea for a longer period of time. Apnoea in the older infants occur much sooner after surgery compared with younger infants. In full term infants, the incidence of postoperative apnoea is very low.
- Episodes of apnoea begin at any time in the first 12 hours after surgery. Apnoea can then continue until 48 hours, and even 72 hours, after surgery.
- The incidence of apnoea after general anaesthesia *is* ***inversely related to postconceptual age.***
- No patient characteristic apart from **postconceptual age** has enough sensitivity and specificity to identify a high-risk group.
- Neurological illness and especially former preterm infants with neurological disease, appear to have an increased risk of postoperative apnoea. This continues until a greater postconceptual age than otherwise healthy former preterm infants.
- Anaemia increases the frequency of apnoea in preterm infants. Whether or not it increases the risk of postoperative apnoea in *former* preterm infants is not known.

3. Causes of apnoea

1. Idiopathic apnoea
2. Hypocapnia



3. Drugs (muscle relaxants, opioids)
4. Hypothermia
5. Electrolyte disturbance
6. Hypoglycaemia
7. Intracranial pathology

Short apnoea can also occur in conjunction with startles, movement, defaecation, or swallowing during feeding.

Apnoea alarm monitor was introduced mainly for avoiding the Sudden Infant Death Syndrome. It's most useful application is in the postoperative period to detect post-operative apnoea in babies.

This device monitors breathing and sounds an alarm if no breathing is detected for more than a preset time limit (e.g.15-30s)

The two main applications for such devices are:

1. Monitoring the breathing of preterm babies
2. Monitoring the correct action of ventilators in the operating theatre and intensive care unit

Working Principle

An apnoea alarm for use on babies may operate in one of several ways:

1. *Impedance plethysmography*: The electrical impedance of the chest is measured via skin electrodes. The impedance falls as the chest expands and so a signal roughly corresponding to the breathing pattern is obtained. This signal is applied to a circuit to identify when chest movement is insufficient to indicate breathing. In its simplest form this might be a rectifier level. The whole device may be incorporated into an ECG monitor using the same electrodes.
2. *Chest wall movement detectors* may be used which detect the expansion in the chest circumference during breathing. These may be simple strain gauges included in a thread or tape around the chest, or mercury in elastic tubes which varies in electrical resistance as the tube is stretched. The term 'pneumograph' is often used to describe a wider bore air-filled tube around the chest in which the pressure will vary with the breathing movement.
3. *General movement* of the infant may be a suitable substitute for actual chest wall movement since the apnoeic episodes experienced by young babies are normally associated with cessation of all movement. This may be detected with a crude form of radar device which directs a 10 GHz electromagnetic wave at the baby and detects changes in the phase of the returning echo and converts this into an activity signal to trigger the apnoea detecting circuit.
4. Movement may also be detected by a variety of sensing systems such as a *pressure mattress* using thermocouples to detect the flow of air which occurs between segments of an air mattress during movement, or a small air-filled bulb may be taped to the abdomen of the baby and the variations of pressure in the bulb be detected.

   Apnoea monitoring should be continued for at least *12 hours after surgery* or the last recorded apnoea.

Drawbacks

Most apnoea monitors in current use rely on impedance pneumography. This measures the transthoracic impedance via electrodes on the chest wall. Patient movement (such as rolling over) and chest wall movement in the presence of airway obstruction will both be detected as a normal breath. *This monitor therefore does not detect obstructive apnoea.* The electrocardiograph and heart rate are measured through the chest wall electrodes, allowing detection of bradycardia that may accompany either central or obstructive apnoea.

False alarms are common as with other electronic devices.

The following infants should be considered for *apnoea monitoring*:

1. Preterm infants with chronic lung disease discharged on home oxygen, or having recently (within the last two weeks) come off oxygen.
2. Preterm infants of narcotic and polydrug abusers.
3. Infants exposed to opioids
4. Infants who have an Apparent Life Threatening Event (ALTE) in Hospital, with no remediable cause identified.
5. Infants with respiratory obstruction.(E.g, Infants with Pierre Robin Syndrome, upper airways anomalies, abnormalities of tone contributing to feeding and swallowing difficulties).
6. Some infants with apnoea continuing beyond the normal period of prematurity, e.g beyond 36 weeks gestation.
7. Siblings of infants with SIDS who have additional risk factors such as prematurity, apnoeas, or chronic lung disease.
8. Infants of parents having bad obstetric history.
9. Presence of serious coexisting disease (Bronchopulmonary dysplasia)

Risk Factors for Developing Postoperative Apnoea

Postconceptual age

Postoperative apnoea becomes more common as postconceptual age decreases. Infants less than 44 weeks postconceptual age had a 26% incidence of postoperative apnoea, compared with zero in infants aged 44 weeks and over.

Based on the higher incidence of postoperative apnoea in *former* preterm infants with low postconceptual age, monitoring has been recommended for infants younger than 44-46 weeks postconceptual age. However, the risk in older infants is still not known with any certainty.

In studies done in infants up to 51 weeks postconceptual age, it was found that 31% and 33% of infants had apnoea after general anaesthesia. Postoperative apnoea in former preterm infants up to 48 weeks postconceptual age has also been reported. Based on these studies, healthy former preterm infants younger than 52 weeks postconceptual age are likely to be at risk of postoperative apnoea after even minor procedures.

Healthy former preterm infants older than 52 weeks postconceptual age do not appear to have episodes of apnoea beyond the immediate postoperative period. Healthy infants older than 52 weeks having *minor procedures* were monitored for a minimum of two hours before discharge. Two such patients, aged 52 and 54 weeks, had apnoea only in the recovery room.

What are the precautions that may prevent postoperative apnoea?

1. Use of methylxanthines :

   MethyIxanthines aminophylline and caffeine have been used as respiratory stimulants to reduce the frequency of apnoea in the preterm neonate. Caffeine has fewer cardiovascular side-effects and a greater therapeutic index. Intravenous doses of 5 and 10 mg/kg were used in separate studies, and both were effective. Intravenous aminophylline 5-10 mg/kg has been used to prevent apnoea in preterm infants, but has not been studied in the postoperative setting.

2. Postoperative monitoring:

   Skilled nursing observation supplemented by electronic monitors forms the basis of postoperative apnoea monitoring.

To summarise

1. Postoperative apnoea is particularly likely if the postconceptual age is 44 weeks or less. About 30% of former preterm infants below this age will have

postoperative apnoea. This risk decreases as the infant ages.

2. Healthy infants older than 52 weeks appear to be at a very low risk of postoperative apnoea beyond the early recovery period. Elective surgery is therefore better delayed in healthy infants 52 weeks or younger.

3. Infants older than this are suitable for minor surgical procedures on a day-stay basis, but should be monitored for a minimum of *two hours* postoperatively. If the infant is younger than 52 weeks at the time of surgery, the infant must be monitored for a minimum of *12 hours*, or 12 hours after any apnoea.

4. Infants younger than 44 weeks should be considered particularly at risk. There may be a role for the prophylactic use of aminophylline in this group.

5. Infants of any age with neurological illness should also be considered particularly at risk, and assessed and managed on an individual basis. Neurological disease makes post-operative apnoea more likely at older postconceptual ages, and may also increase the incidence. Hence caution should be taken even with infants beyond 52 weeks postconceptual age if they have neurological disease.

6. The effect of perioperative barbiturates and opiates on the incidence of postoperative apnoea is not known with certainty, and special care must be taken after their use.

7. An impedance monitor, supplemented by nursing observation, must be used postoperatively. Monitoring must be done in an area with staff skilled in the care and resuscitation of young infants, with resuscitation equipment readily available.

8. Observation or postoperative ventilation preferably in a neonatal intensive care unit should be considered for infants with frequent early apnoeas, particularly if poorly responsive to stimulation or associated with arterial oxygen desaturation.

9. Oxygen therapy may reduce the arterial oxygen desaturation associated with apnoea, but will *not reduce* the frequency of apnoea.

10. Continuous positive airways pressure via a nasopharyngeal airway and intravenous aminophylline may be helpful.

11. Infants who continue to have apnoea associated with desaturation despite these treatments require intubation and intermittent mandatory ventilation.

12. An upper post-conceptual age beyond which there is no risk cannot be given. Term infants may also develop apnoea. A lower limit of 44-45 weeks post-conceptual age takes into consideration the oldest reported case of apnoea in a term infant.

13. All reported apnoeas have begun within 12 hours of surgery, but may recur for a much longer time. *There should be an apnoea-free period of at least 12 hours before postoperative respiratory monitoring is stopped.*

14. E*x-premature babies should not be treated as day cases* until *after 60 weeks post gestational* age.

Suggested Reading:

1. John Roberts: Anaesthesia & Intensive Care, Australian Society of Anesthesia, 1994

2. Malcolm C Brown: Apnea Alarm Monitor – Medical Dictionary (http:www.mpd.org.uk/index.html)

3. Apnea Monitoring on Discharge from NICU: Newborn Services Clinical Guidelines Reviewed by Carolyn Dakin & Simpson Rowley.

(Answer to Muzzle Puzzle in page 6)

Here we are dealing with an incomitant strabismus with an obvious restriction of downward movement of the left eye. A closer look will reveal that this limitation is more in the abducted than in the adducted position, leading us to suspect an abnormality of the left inferior rectus. As the child was young for a forced duction test, CT scan of the orbits was done. Absence of the left inferior rectus was found. At the time of surgery, no restrictive component was found on forced duction test and the left inferior rectus muscle was found to be absent while the muscle sheath was found. The inferior half of left medial rectus and left lateral rectus was transposed to the site where a normal inferior rectus would have inserted.

Congenital absence of extraocular muscle is a rare cause of strabismus. Though the exact incidence is not known there have been several case reports. The extraocular muscle develops from the pre-optic mesodermal segments. In the early stages the extraocular muscles are formed in two groups-the superior and the inferior group. While the superior rectus, superior oblique, the superior half of medial and lateral recti and levator palpebrae superioris differentiate from the superior group, the others are formed from the inferior group.

This case stresses the need for a proper work-up to avoid surgical surprises and the need to use imaging techniques judicially and appropriately.

Corporate Matching Gifts & Payroll Deduction Schemes

An increasing number of American organizations are developing 'gift matching' programs whereby the corporation matches in whole or in part, any donation given to the charity by its employees. If you are an employer, consider making such a scheme available to your staff. To find out if your employer runs a Gift Matching scheme, speak to your Human Resources Department.

Many work places have payroll deduction schemes where an employee can choose to direct a set amount each pay period directly to a registered charity. Talk to your employer to see if your organization partakes in payroll deduction schemes.

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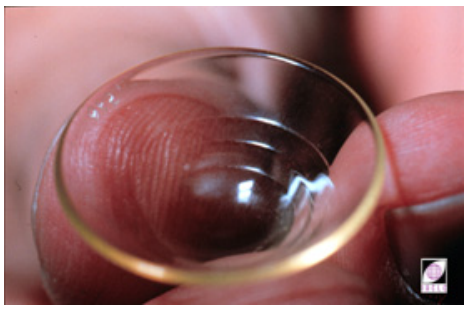
For additional information, please contact Mr. S.V. Acharya, Treasurer at (301) 529-7377 or snomtrustusa@yahoo.com

Scleral contact lens

M. Rajeswari, Contact lens department

Scleral contact lenses provide unique therapeutic and vision rehabilitative properties that overcome the gaps encountered with conventional contact lens therapies. Scleral contact lenses are an option for visual rehabilitation under some circumstances or specific therapeutic indications where wearing is often limited with PMMA lenses. Rigid gas permeable Scleral lenses offer physiological improvements as measured by the occurrence of less central corneal swelling.



Indications for Gas Permeable Scleral Contact lens (oxygen permeability 97) :

1. Advanced Keratoconus particularly those with decentered cone
2. Highly irregular cornea resulting from
    - Trauma
    - Corneal erosions
    - Corneal dystrophies
    - Corneal grafts which may have very marked irregular astigmatism

Other indications include extreme corneal irregularity after PK, RK, Post LASIK, corneal ulcer, dry eye syndrome, extreme keratitis and burns, Stevens Johnson syndrome, post trauma.

The scleral bearing surface eliminates the need for close alignment between the cornea and the lens. Therefore

- irregular corneal topography is less of a problem to fit
- High powered Scleral lenses remain static
- There is less lid sensation
- Foreign bodies are rarely trapped behind Scleral lenses
- There are no localized exposure areas due to a disrupted blink mechanism

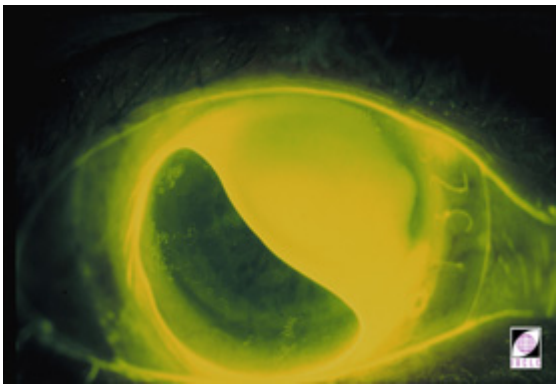
Presently available material is Poly flouro silicone acrylate with 81D hardness and 97 x 10-11 DK.

Trial fitting procedure:

Trial is done with preformed trial lenses called Fenestrated Lens for Optical Measurement (FLOM) lenses and with a Scleral set for Scleral measurement. Initial trial is based on the shape of the cornea and by varying the sagittal relationship of the Scleral lens and the cornea.

1. Scleral fitting is evaluated using diagnostic lenses that ensure full corneal clearance. The radius and diameter of the Scleral portion is chosen to give as even and large bearing zone over the sclera as possible. The overall size of the lens is large enough, but not so large as to ride against the caruncle, forcing the lens to move temporally when patient looks in the nasal direction, that results in nasal corneal touch. Similarly it should not be so wide that it rests against the lower cul-de-sac causing vertical displacement or discomfort on down gaze.
2. The fit of the Scleral lens can be evaluated using white light. Any areas that appear excessively whiter than the surrounding conjunctiva is called bleaching. By using diagnostic lenses on the eye with different Scleral radii the lens that results in no bleaching gives proper radius.

3. The corneal fitting is evaluated using fenestrated lenses for optical measurement(FLOM) and flourescein. The bubble formed between lens and eye is observed to determine correct corneal height or the back optic height. The correctness of the back optic curve and diameter is predetermined by its clearance, position and alignment.
4. Digital pressure test is performed to assess minimum corneal clearance of not less that 5-7/100 mm and not more that 10-12/ 100mm.
5. Scleral lens completely clears the limbal area in all gazes.
6. Scleral lenses will have three evenly positioned fenestrations placed within the transitional curve of the lens.
7. Modifications can be done after the lens is ordered and tried on the patient's eye.
8. Details required for gas permeable Scleral lens order are Back optic radius / Back optic Diameter / Scleral Radius / Scleral diameter / lens power / material.
9. Initial trial lens will be ordered in PMMA material with fenestration and the fitting is observed for few days.
10. The final lens is ordered after testing for any modifications with the trial lens.



Ideal scleral fit

Advantages:

1. There is very good lens tolerance since the lens does not touch the cornea
2. No possibility of intolerance due to dust since lens is large
3. Less lens loss since it is big
4. Good visual acuity

Disadvantages:

1. Complicated fitting need good training in fitting
2. Long trial time
3. Greater cost
4. Marginal lens modifications are only possible
5. Limited availability

(Photos courtesy: Flexilens)

Last Page

Nanotechnology and health care

S. Krishnakumar, Department of Ocular Pathology

Nanotechnology, which has been called "the manufacturing technology of the 21st century," refers to the study and design of systems at the scale of the atom, or the nanoscale. At the most basic level, the manufacturing is actually the rearranging of individual molecules and atoms into complex "molecular machines." As you likely know, most disease begins at the cellular and molecular levels. However, the tools of modern medicine are too large and cumbersome to reach disease at this stage. With nanotechnology, we will be able to have computer-controlled machines that are much smaller than a human cell that can address disease at the cellular and molecular levels. No one is sure how long these innovations will take—it could be years or decades—but at some point nanotechnology will likely allow us to remove obstructions in the circulatory system, kill cancer cells, repair organs, create artificial mitochondrion and view tissue samples with extraordinary detail. Within a couple of years, scientists hope to use nanotechnology to detect the location of viruses in the body. The process would involve injecting magnetic nanoparticles into the bloodstream and would potentially allow more precise virus treatments to be developed.

However, some environmental groups say more caution is warranted for the new technology. For instance, little is known about how nanomaterials interact with living organisms, and nanomaterials are so small that they can easily be inhaled or absorbed through the skin. There are also some long-term ethical concerns over the potential development of "intelligent" nanobots. Thus only time will tell how mankind will use this awesome technology.

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