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Edited by: Swati Phuljhele, MD
Annual Conference
Delhi Ophthalmological Society (DOS)
28th-30th March, 2008
at Hotel Ashok Samrat Complex, Chanakya Puri, New Delhi
Dear Friends,

Greetings once again! At the outset, I would like to thank all the delegates and DOS members whole heartedly for making the Mid Term Conference of Delhi Ophthalmological Society a grand success. I am glad that the Wet Laboratory in various fields had stupendous attendance and there were a total of 1,114 delegates who attended the wet labs in various halls. Live Surgeries on femtosesecond laser and coaxial micro phacoemulsification were also well attended and appreciated. We hope to continue this trend of live surgeries not only in Cataract & Refractive surgeries but also in other fields such as Ophthalmoplasty, Cornea, Glaucoma and Retinal surgeries as well.

Squint is a difficult topic to understand and comprehend and various luminaries in this field have answered many unsolved questions for us to focus on “squint”. I would like to thank Prof. Pradeep Sharma and Dr. Rohit Saxena for all the help in compiling this issue on Strabismus. They were instrumental in getting international and national experts in strabismus on the forum of DOS Times. Dr. Swati Phuljhele has worked very hard in compiling the squint surgeries in a CD-ROM.

Telemedicine in ophthalmology is something which we have heard of, but are not aware of completely. Dr. Helveston from Orbis International has elucidated in details the scope, indications and limitation of telemedicine. Various other issues on 6th nerve palsy, childhood blindness, and management of essential infantile esotropia are also highlighted.

I wish you all ‘A Merry Christmas and a Very Happy and a Prosperous New Year’.

Thanking you,

Namrata Sharma
Secretary,
Delhi Ophthalmological Society
To stereopsis and beyond!

The latest 3D movie coming to an IMAX theatre near you creates quite a rage, adding yet another dimension to the level of entertainment. In reality it is just technology catching upon nature- we naturally enjoy a 3D world and a 2D movie is actually a compromise. The previous 2 decades have seen attempts to restore monocular eye vision to near perfection. With increasing interest in binocular vision, depth perception and stereopsis, the coming years may see similar development for restoration of binocular vision. The word ‘stereo’ comes from the greek work ‘stereos’ which means firm or solid. With stereo vision you see an object as solid, in three dimensions, making stereovision rich and special. ‘The focus’ on strabismus has some (nowhere near all!) of the questions I wanted to know but didn’t know who to ask. The answers given by some of the leading strabismologists, I hope will help to clear the doubts in the minds of our readers. The basis of three dimensional vision depends on improved binocular vision if performed before 6 months of age as stereopsis develops at 3-5 months of age. This implies that it is not just necessary to operate early but to ensure proper alignment early. The optimum result is deviation within 8 prism diopters of orthotropia with or without binocularity. In intermittent exotropes distance stereocuity is affected more and earlier than stereoacuityand be a determinant of surgery. Consecutive eso or exotropia occurs more commonly in the presence of deep uncorrected amblyopia or high hyperopia and cylindrical errors.

Appropriate term, ‘reconstructive surgery’ has been suggested, since the process involves re-establishing the natural alignment and not just changing cosmesis. An interesting study in children showed that they can discriminate strabismus even in dolls that they play with, and actually become abusive against such dolls as early as 5 years of age. This highlights the negative influences that an uncorrected strabismus has on their psyche. Our concept that amblyopia is best treated with full time occlusion therapy, been challenged by some multicentric studies in US that have highlighted that part time occlusion (even 2hours) and penalization with atropine 1% may be as good. While these alternatives do work in mild to moderate amblyopia, occlusion is the still the better alternative as the recovery is faster! And amblyopia needs to be treated fully before surgical correction. The role of levodopa–carbidopa has been reported as a facilitator of amblyopia therapy not an alternative of occlusion.

Recent interest has focused on the role of topical anesthesia for surgery and single-stage adjustable in addition to two-stage adjustable as also the same for pediatric patients. In a pilot study, Ropivacaine was reported to reduce the pain of postoperative suture adjustment, and post operative adjustment of sutures has also been performed immediately at completion of surgery with co-maintenance of anesthesia using propofol and fentanyl-midazolam. Several techniques for exposure have been described. The small incision ‘fornix’ incision is becoming more popular as it is cosmetically better though a bit difficult to learn in the beginning.

Success has also been reported with the split vertical rectus muscle transpositions for sixth nerve palsy modified with Foster sutures, whereby posterior fixation sutures are applied 8mm behind the insertion. Congenital third nerve palsy is as much a challenge for surgical correction A simplified procedure of fixation to the nasal periosteum for third nerve palsy, through the DCR skin incision as also the retrocaruncular incision have been found to be safe and effective. It is important to bear in mind, however, that the practical limits for tolerance of torsion is limited to about 4 degrees, and that for cyclofusion about 11 degrees only, and therefore surgery should be performed in a manner such that the torsional deviations are not unduly changed. Obliques like wild animals need to be tamed and not shot down! The characterization of nystagmus has improved with videonystagmography but the comprehension of the underlying oculomotor control process still remains elusive. Its treatment with gabapentin, memantine, acupuncture, and in surgery augmented Anderson procedure for eccentric null shifting and supramaximal horizontal recti recession or Hertle Dell’Osso procedures for cases without eccentric null are all getting hot. The newer surgical adjuvants include ADAL-1, fibrin glue and an experimental agent, ADCON-L. ADAL-1 bioshesive is said to be equivalent to Dexon 6/0 suture group in terms of resistance to traction force between muscle and sclera one week after surgery. Other materials include viscoelastics like hyaluronate, and antiproliferative agents like Mitomycin C and Daunorubicin. Fibrin glue has been reported to be as effective as vicryl for conjunctival closure. Among the suture materials, Vicryl is the least slippery and is the one used most often, but Biosorb –C and Dexon-S are also in use. Botulinum toxin has been found to be of benefit for the management of infantile sixth nerve palsy, diplopia, and may even obviate the need for surgery. It has been used with success in infantile esotropia upto 7 months of age, but since general anesthesia is required the supposed benefits are marginal.

Finally to conclude the critical time limits in life in a cricket friendly nation can be remembered by the rule of fours and sixes thus: Detect evaluate and treat: unilateral cataract by 4-6 weeks, infantile esotropia by 4-6 months and amblyopia, exotropia and infantile nystagmus by 4-6 years of life!

Pradeep Sharma, MD
Dr. R. P. Centre for Ophthalmic Sciences
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What’s New In Strabismus Management

Our understanding of the physiological processes concerning vision and ocular alignment are constantly being revised in the light of newer information. An increased risk of early onset strabismus, especially infantile esotropia, has been related to prematurity, family history, refractive error, poor neurodevelopmental error orROP. Several studies have highlighted the role of genetics. But surely early surgery for infantile esotropia, results in improved binocular vision if performed before 6 months of age as stereopsis develops at 3-5 months of age. This implies that it is not just enough to operate early but to ensure proper alignment early. The optimum result is deviation within 8 prism diopters of orthotropia with or without binocularity. In intermittent exotropes distance stereocuity is affected more and earlier than stereoacuityand be a determinant of surgery. Consecutive eso or exotropia occurs more commonly in the presence of deep uncorrected amblyopia or high hyperopia and cylindrical errors.

Positive psychosocial outcomes of correction of strabismus and amblyopia have been emphasized in recent publications. Instead of ‘cosmetic’ a more appropriate term, ‘reconstructive surgery’ has been suggested, since the process involves re-establishing the natural alignment and not just changing cosmesis. An interesting study in children showed that they can discriminate strabismus even in dolls that they play with, and actually become abusive against such dolls as early as 5 years of age. This highlights the negative influences that an uncorrected strabismus has on their psyche. Our concept that amblyopia is best treated with full time occlusion therapy, been challenged by some multicentric studies in US that have highlighted that part time occlusion (even 2hours) and penalization with atropine 1% may be as good. While these alternatives do work in mild to moderate amblyopia, occlusion is the still the better alternative as the recovery is faster! And amblyopia needs to be treated fully before surgical correction. The role of levodopa–carbidopa has been reported as a facilitator of amblyopia therapy not an alternative of occlusion.

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Pradeep Sharma, MD
Dr. R. P. Centre for Ophthalmic Sciences
All India Institute of Medical Sciences, New Delhi, India
Strabismology is an important aspect of paediatric ophthalmology. It may not be a sight threatening problem, but definitely affects the overall psycho-social development of a growing child. With the ever changing concepts of neurophysiology and development of binocular vision, the management of strabismus and amblyopia has also evolved. This questionnaire is focused on the conditions which are confusing/in the gray zone. The list of panelists includes strabismologists from national and international fraternity who have tried to clear the scenario.

Dr. Sherwin Isenberg (SI) MD, Professor & Vice Chairman, Lantz, Professor of Paediatric & Ophthalmology, Jules Stein Eye Institute. University of California, Los Angles School of Medicine, Los Angles, California, Dr. Eugene M. Helveston (EMH) MD, Ophthalmologist-in-Chief ORBIS International. Dr. R. Hanumantha Reddy (HR) Consultant, Apollo Hospitals, Hyderabad, India, Dr. Vimla Menon (VM), MS, Professor & Head of Unit Squint & Neuro-ophthal Services, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi. Dr. Pradeep Sharma (PS), MD, Professor, Squint & Neuro-ophthal Services, Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi. Dr. B Venkateshwar Rao (BVR) MD, Pediatric Ophthalmology, Strabismus and Neuro-Ophthalmology, Shreya Eye Care Center, Hyderabad.

Dr. Rohit Saxena (RS), MD, Assistant Professor at Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, interviewed them on the controversies in strabismus.

A Intermittent Divergent Squint (IDS)

RS: What are the indications for surgery in a case of IDS?

SI: There is no urgency to perform surgery as long as the deviation remains intermittent since the potential for good binocularity remains. The choice to perform surgery is usually made if the patient or parents are uncomfortable about the appearance and frequency of exotropia. Also, if the patient’s friends are commenting on the exotropia, surgery is probably indicated for the patient’s self-image.

EMH: Surgery is indicated more for how often the eye is deviated than how far it is. For example a 20 PD intermittent exotropia present 90% of the time is more likely to require surgery than a 50 PD exotropia present 19% of the time. But, these are extreme examples and as it is with much of strabismus we must be influenced by the wishes of the patient and depend on the experience of the surgeon.

RHR: This is touchy one with many gray zones. It needs team effort with parents very much involved in decision making. Strabismologist disagree on best time for surgery for intermittent exotropia. Some prefer "Early Surgery" to avoid suppression, deterioration of fusion; while others believe it is safe to follow-up the patient as over correcting in very young will result in small angle esotropia with loss of Stereo Aucuity.

VM: The surgery should be done for a symptomatic patient i.e. patient has eye stain, diplopia, in younger patients if child manifests squint for more than 50% of waking hours or if there is suppression and binocular vision is affected.

PS: The indications depend on age of presentation, presenting complaints, fusion range and baseline stereopsis. In children upto 4 years of age, I would defer surgery till the manifestation is at least 50% of time. If stereopsis is assessable I would do that too. I would follow such children 3-6 monthly depending on these parameters to decide for surgery. However in adults an IDS manifesting for distance and/or having affected distance/ near stereopsis would be an indication for surgery.

BVR: One should do surgery if he or she is manifesting XT for distance, poor control after active convergence therapy or more than 50% of waking time. Or else if patient wants surgery irrespective of control, and can be done for asthenopic symptoms as in cases of pure convergence insufficiency with exotropia for near only.

All our panelists tend to agree that caution is the better part of valor especially in very young children.

RS: Are stereoacuity levels (distance or near) required for the decision for surgery?

SI: By the time that stereoacuity at distant gaze is compromised, the exotropia is generally frequent enough to warrant surgery even if one did not measure the stereoacuity. Since a decrease in near stereoacuity is indicative of the patient losing control of a exophoria at near, surgery is again indicated.

EMH: No. If there is measured, good, but it is not required.

RHR: This is gray zone situation. Even if the child has equal vision, stays out intermittently at distance sometimes
with a blink with reduced "Stereo Acuity". Probably Surgery is indicated.

VM: Stereoacuity tests are required particularly for distance, as the squint is usually manifest for distance.

PS: As mentioned above I do assess these, for near always and distance whenever possible to help in the decision of timing of surgery. They are helpful in cases when the working parents are unable to decide about the 50% manifestation rule.

BVR: The decision for surgery in IDS is not based on distance stereo acuity. However worsening near stereoacuity does hasten up surgery.

Most of our panelists do not appear to be very enthusiastic about the role of measuring stereoacuity levels. They feel that though measuring stereoacuity levels may be helpful in certain conditions, it is not essential to decide about timing of surgery.

RS: Any preference for BL LR recession or a R & R (Recession-Resection) procedure?

SI: In general (with frequent exceptions), bilateral lateral rectus recessions are indicated in children and an R & R in adults.

EMH: Yes. R&R for deviations equal at distance and near or greater at near and bilateral lateral rectus recession for deviations greater at distance.

RHR: No strong support exists one technique over the other. The recession technique is more physiologic and for cosmetic post op appearance. However, R & R Surgery is preferred if the child prefers with one eye all the times and not with either eye.

VM: The preference should be for bilateral lateral rectus recession. When deviations are large (more than 30 p.d.) recession - resection procedure will be required.

PS: For a free alternation with equal vision in each eye I would do bilateral recessions if two muscle is indicated. In unilateral cases, vision being poor in the deviating eye, especially adults who are being operated under LA, I would choose unilateral recess-resection procedure. Any oblique overaction is tackled as per the need.

BVR: My preference is a LR recession in both eyes. However R & R in one eye is preferred in cases of convergence insufficiency type of exotropia and also in eyes with Anisometropic Amblyopia with exotropia. For basic exotropia >50 PD, I do R & R in one eye as BLR does not give the desired effect (I do not recess LR beyond 9 mm from insertion) as it results in Abduction limitation and inconstance in side gaze.

It tends to appear that the choice of surgery depends on the fixation preference of the patient (either eye/one eye) though operating under LA does tend to limit B/L surgery. Larger deviation will require R & R surgery.

RS: Does stereoacuity reach normal levels post operatively?

SI: Usually, as long as the exotropia remained intermittent.

EMH: Yes it can, but this is likely to occur only if normal or near normal values are determined preoperatively.

RHR: If surgical alignment done before he/she starts suppressing with correction of refractive errors, prevention of suppression is keystone for stereopsis. Otherwise even though they have good stereopsis for near there will be loss of stereo acuity for distance.

PS: The postoperative stereopsis definitely shows improvement and in some case where the defect is less it reaches normal levels. I recollect a case that had V-exotropia with 60pd in primary position with no binocularity elicited preoperatively. After bilateral lateral rectus recession, right MR resection and inferior oblique recessions post-operatively he achieved 4-6 pd exotropia with 120secs of arc stereopsis with moderate fusion range.

BVR: Yes it does. The stereoacuity will improve and more so even in some cases of constant exotropia the patient stands to get stereoacuity after alignment of eyes.

Our panelists agree that stereopsis does improve provided surgery is timed before excessive loss of stereopsis occurs.

RS: What is the desired deviation in the early post operative period?

SI: A study that we are about to submit to a journal indicates that, in the long term, exotropic deviations tend to under-correct. Thus, an overcorrection is desirable in the immediate post-operative period.

EMH: In the early postoperative course a small esodeviation either manifest or intermittent is just fine.

RHR: Herein lies the challenge of surgical treatment for IDS. Parents should be informed of surgical decisions ahead of time and insisted on regular follow-up in the post-op period. Whatever be your plan of correction if reliable parameters are available.

VM: In younger children I aim at optimal correction rather than overcorrection as consecutive esotropia in a young child is a much worse outcome than a residual exotropia.

PS: In children I plan for orthotropia or slight under correction. In adults I plan for an overcorrection of about 10 pd.

BVR: The desired deviation in early post op period is small angle eso depending on the age of the patient.

Small overcorrection in early post-operative period appears to be the desired aim of all the panelist. Professor Menon & Professor Sharma believe caution should taken to avoid consecutive esotropia in small children.

B Infantile esotropia

RS: What is the ideal timing of surgery?

SI: While the answer to this question may be changing, I prefer to operate between 5 and 9 months of age. Before that time, I cannot obtain an accurate measurement. I prefer to operate based on alternative cover measurements rather than a Hirschberg or Krimsky value. The former can not reliably be obtained before 5 or 6 months of age.

EMH: I like to do surgery early! If an infant has a constant
esotropia of 40 PD or greater by 4 months then I would operate. Otherwise I operate as soon as I see a child after the diagnosis is established. For practical purposes the ophthalmologist sees a child initially at a year or so. You could say I am an "early surgeon". In my opinion there is no good reason for waiting unless the surgeon lacks confidence (experience) or if proper anesthesia is not available. I have seen no convincing evidence that waiting is to the patient’s advantage.

RHR: Early treatment allows self-adjusting sensorimotor mechanism to support binocular alignment once the motor system has been suitably modified. Surgery is no problem after developmental window of 2 months to 4 months has passed as the axial length averages to 18.7 mm. Botulinum toxin gives better results at early age of about 7 months being interventional procedure is gaining acceptance as first choice as it does not change the arc of contact of the muscles.

VM: The child should be operated at the earliest, when a complete examination and assessment has been possible, preferably within the first year of life, in order to give the best chances for development of binocular functions.

PS: If the child presents early that is around 6 months! I would initially ensure the refractive correction and free alternation and then operate as early as possible. Following surgery the glasses have to be titrated to ensure alignment. I also believe that surgery is more predictable than botulinum toxin.

BVR: The ideal timing for surgery in congenital ET is around 5 – 6 months of age.

The consenses for the time of intervention is not yet established but all the panelist agree that surgery should not be delayed for more than 9 months, or earlier if adequate examination of the child is possible.

RS: What are the common associations seen? If operated early, are re-surgeries more common than when operated at 8 to 12 months of age?

SI: The common associations are inferior or, occasionally, superior oblique muscle overactions with "V" or "A" patterns. Also one can often find dissociated deviations, usually vertical, and later development of accommodative esotropia. Rotary nystagmus may be found. These can arise regardless of the age of operation.

EMH: I do not think that early surgeries result in more follow up surgeries. In response to suggestions that early surgery was more likely to result in DVD, we did a retrospective study and determined that the rate of DVD surgery was the same in patients operated early and somewhat later. The interesting finding was that the DVD developed in about 18 months after surgery for both groups.

RHR: The so called ‘baggage’ of Congenital Esotropia considers in the feedback loop scheme are D.V.D. latent Nystagmus, OKN asymmetry and inferior oblique dysfunction Ciancia Syndrome, Langs Congenital E.T, Nystagmus blocking Nystagmus are all variants of Infantile Esotropia.

VM: Common associations seen with infantile esotropia are amblyopia, overaction of inferior obliques, dissociated vertical deviations, nystagmus (manifest latent or latent) and abduction deficits. Essentially, there is no difference in number of resurgeries, when operated early.

PS: Commonly we encounter Inferior oblique overactions, sometimes superior oblique overactions and latent nystagmus. DVD usually develops in about 10 -20% irrespective of early, late or no surgery. The chances of under and overcorrection do bother in early surgery but that is no more than 10%. It should be clarified that one should operate the associated oblique muscles in the same sitting and in very large esodeviations, I would do three horizontal muscle surgery in the primary surgery itself. The chance of consecutive exodeviations is more in higher hyperopes, those with cylindrical corrections or those with superior oblique overactions, and should be kept mind whole planning surgery as also the age and the limbus-insertion distance.

BVR: The common associations are V pattern, IOOA and DVD. Some cases have Latent Nystagmus, Abduction limitation and large ET (Ciancia Syndrome)

IOOA, DVD, nystagmus are common associations which may require resurgeries regardless of time of first surgery.

RS: What is the average number of surgeries per case needed and what is the expected outcome with respect to binocularity?

SI: The average number is about 2. If straightened early enough in life, some binocularity, usually demonstrated by stereopsis of 60 seconds of arc stereopsis or worse ("Monofixation") can develop.

EMH: I followed 10 patients operated in the fourth months for 8.8 to 10 plus years. All were aligned immediately post operatively with a bimedial rectus recession. The deviations were all 40 PD or more. These children were seen a total of 221 times, all by me. They needed an average of 2.1 surgeries. This was skewed by one child with a DVD problem who needed four. All children were aligned to 10 PD at distance or near and all were cosmetically excellent. Four of the 10 had measurable stereo, but the best was on the order of 100 sec. One patient had very mild amblyopia. During the course of follow up children were aligned after each surgery but some drifted off or developed DVD. I am not sure that this very early surgery created better binocularity. I think children with congenital ET are like boats in a windy harbor with too light an anchor. Both will drift if external conditions are conducive.

RHR: The alignment in turn depends on accuracy of surgery. Which is the armchair analysis of surgery and age of child. In an effort to sort out some of the possibilities surgically in present day practice measure the distance from the limbus to medial rectus insertion and arbitrarily 8.5 mm from limbus as minimum and 11.5 mm as maximum.

VM: The commonest outcome is a small angle esotropia and
rarely a microtropia with subnormal binocular vision. Resurgeries are not so frequent, if proper evaluation and plan of surgery is done.

**PS:** In about 85-90% cases, a single surgery suffices. It should be understood the single surgery is planned to tackle as many muscles that are considered necessary in the first instance, rather than doing the task in “uneasy instalments” I do not have definite objective data on the binocular outcome. Though I have seen infants operated and aligned earlier getting fair to good stereopsis.

**BVR:** There is no correlation with regards to resurgeries being common if operated at 5 – 6 months or between 8 – 12 months of age (Based on the literature / studies)

**Even in experienced hands, multiple surgeries appear to be needed in cases of infantile esotropia.**

### C Amblyopia

**RS:** In a case of infantile esotropia, if surgery has to be delayed due to medical reasons Or due to a waiting list, what is the type and duration of occlusion that is given?

**SI:** None, unless amblyopia is demonstrated. Dr. Malcolm Ing and co-workers showed that no benefit was gained by occlusion in non-amblyopic cases.

**EMH:** If surgery for congenital esotropia is delayed, I would patch carefully only if there was a fixation preference. I do not adhere to the “keep the slate clean” philosophy.

**RHR:** If surgery in a case of infantile esotropia has to be delayed for various reasons, a lengthy discussion with the parents about alternate occlusion to prevent developing preference, however the target date for surgery is 8 months to 10 months.

**VM:** During the waiting period, an alternate occlusion of 1:1 is given to prevent recurrence of amblyopia as well as prevent ARC and it is better to continue to call the child and review every month or so.

**PS:** After having obtained alternation/ equal vision by age dependent occlusion, the regression of amblyopia is prevented by maintenance occlusion which is 1:1 occlusion for a few months, in the waiting period. In case of long waiting the child is reassessed and occlusion schedule modified, if need be.

**BVR:** Alternate occlusion is preferred method until the eyes are aligned by surgery

*Dr. Isenberg and Dr. Helveston have the opinion that occlusion should be give only if fixation preference is there, while the other panelists opine that it should be given to prevent the development of fixation preference.*

**RS:** In a case of BL congenital cataract operated by 4 to 6 weeks of age, what is the best way to rehabilitate such a child? What are expected vision and binocular outcomes?

**SI:** Place a contact lens on the eyes as soon as possible after surgery, usually less than 2 weeks after surgery. The ultimate visual acuity depends on many factors and is difficult to predict. The presence of nystagmus, microcornea, or glaucoma worsen the prognosis.

**EMH:** For very early cataract surgery you remove the lens before the onset of nystagmus and select a lens that the infant can “grow” in to regarding power. This usually is an under correction. In that case plus spectacles can be given. Thereafter the child should be followed with determination of fixation and later vision. Patching is done as needed.

**VM:** Child operated for cataract at 4-6 weeks of age should be given aphakic correction for near as the child’s interest is in its immediate surroundings initially. The prognosis however for both vision and binocularity is poor.

**PS:** The method of choice, at present, is aphakic spectacles. Expected vision depends on the density, asymmetry of extent of opacities, and the timing and rehabilitation. Children have had 6/9 vision on Snellen. Patching is scheduled if esotropia is associated, or amblyopia suspected from fixation behaviour. After alternation the esotropia is operated upon.

**BVR:** In B/L operated cong cataract cases the best way to give visual rehab is by SILSOFT CL (Bausch & Lomb) continuous wear 3 nights or 6 night s depending on the availability. If CL is not available or parents not motivated then glasses are the best means.

Expected vision in B/L cong cataract operated cases.

a) Best results are obtained if surgery for B/L cataracts is done <2 months of age – 20/50 or better

b) If surgery in B/L cataract is done after 4-6 months, uniformly poor visual outcome in most of the cases with vision ranging up to 20/100 or worse

c) Children with B/L cong cataract operated prior to 2 months with good aggressive visual rehab and follow up usually result in favorable binocular vision with fusion and measurable stereopsis.

*The job of an ophthalmologist is not over after extraction of lens and is the beginning of long and tedious process of visual rehabilitation and follow up, however the preferred method of refractive rehabilitation is different with different surgeons.*

**RS:** If associated esotropia with congenital cataract, operate how soon after cataract surgery?

**SI:** Not before 6 to 8 weeks. Some ophthalmologists have operated both under the same anesthesia, first on the extraocular muscles and then on the cataract.

**EMH:** As soon as the angle is stable, but there is no great hurry.

**VM:** The child can be operated as soon as possible for squint, after visual rehabilitation. As there is usually nystagmus associated, occlusion treatment if required for amblyopia is not possible.

**PS:** Soon after alternation is established, usually after child is about 4-6 months age.

**BVR:** Associated ET if it is constant (measured with proper refractive correction) Needs to be corrected within 3-6 months after the cataract surgery.
However in patients where the Et is variable and dense amblyopia in one eye, than can wait for longer time before the eyes are aligned.

U/L cataract operated at 4-6 months of age, the best method of optical visual rehab is CL (however if non availability of CL or poor parental compliance then one can consider an IOL acrysof foldable with necessary under correction of power for that age with PPC + AV after discussing with parents in detail)

The best time to operate U/L cataract is < 1-month preferable 2 weeks after birth to achieve better visual and binocular vision outcome.

It appears that surgery is not an emergency though early surgery should be planned once free alternation is established.

RS: In UL cataract operated at 4-6 weeks of age, what is the best method of optical rehabilitation? What will be the duration & type of occlusion therapy to be given?

SI: Until the full results of the clinical trial of intraocular lens implantation in infants is published, a contact lens should remain the standard of care for aphakic infants. The normal eye should be patched at least 4 hours a day and then tapered for 3 to 6 months.

EMH: These cases are difficult. Patching of the good eye should be no more than a few hours a day. I had one unfortunate case with an epikeratophakia in a microphthalmic eye where the family patched to the extent that the vision was better in the operated eye.

RHR: Operated at 4-6 weeks of age for unilateral cataract the optical rehabilitation for aphakia are contact lens as it is easy to comply in an infant and recently intra ocular lenses. Occlusion : 4 - 6 weeks child needs patching half of waking hours which can be increased to 80% of waking hours.

VM: Rehabilitation with contact lens would be the best option. Occlusion at a ratio 1:2 or 2:1 as the case may be if the right or left eye is involved.

PS: At present our lens surgery colleagues would still do lens aspiration with posterior ccc and an anterior vitrectomy. Optical rehabilitation with contact lens is preferable or else spectacles can be given initially followed rehabilitation with contact lenses or IOL is poor and results are generally very poor. Occlusion is given only if operated early. Otherwise when they come late, prognosis is explained. Occlusion is instituted if presenting vision is at least 6/60.

BVR: U/L cataract operated at 4-6 months of age, the best method of optical visual rehab is CL (however if non availability of CL or poor parental compliance then one can consider an IOL Acrysof @foldable with necessary under correction of power for that age with PPC + AV after discussing with parents in detail).

The best time to operate U/L cataract is < 1-month preferable 2 weeks after birth to achieve better visual and binocular vision outcome.

D Nystagmus: What will be the surgical management plan of a case of:

RS: Alternate Convergent Squint (35 pd) with INS without null

SI: I would simply recess the medial rectus muscles. I would be concerned that posterior fixation sutures may overcorrect at near causing an exotropia.

EMH: I would treat the esodeviation with a bimedial rectus recession.

VM: A 35 p.d. of convergent squint can be corrected by a bilateral M.R. recession or a recession – resection procedure in one eye.

PS: A bimedial rectus recession would be my choice.

BVR: ACS with INS without null point the surgical management would be MR recession in both eyes, I do BMR 10.5 mm from limbus for 35 PD ET.

Probably no confusion over this one as all panelist agree with B/L MR recession surgery of choice.

RS: INS with LCS (35 pd) with Lt. Amblyopia with face turn to Lt.

SI: This is a very unusual case since the non-amblyopic right eye prefers to fixate in abduction to dampen the nystagmus. Usually, the preferred eye goes into adduction which then drives the head to the same side.

In this case, I would recess the right lateral rectus and resect the right medial rectus an amount determined by the magnitude of the face turn. I would also recess the left medial rectus and resect the left lateral rectus muscles proportionately more to compensate for the esotropia. I would also consider a posterior fixation suture to the right lateral rectus muscle to further correct the face turn.

EMH: You could do a large R&R OS and a small right lateral rectus recession, but in these cases it is hard to offer a plan without seeing the patient.

RHR: This child having esotropia OS face turns to left. Must be fixing with ABDUCTING eye with OS being amblyopic. surgery to correct face turn the non-fixing eye i.e. OS Recess MR and Resect LR (over correction) with OD LR recession on the fixing eye to neutralize over correction.

VM: Since the child has a face turn to (L) with null, an Anderson's procedure or Kestenbaum's procedure can be done. When there is associated strabismus, one way is to perform 2 stage surgeries that is correcting the head posture first and then correcting the residual deviation. The other option is adjusting the surgical dosages in the non dominant eye for the deviation.

For example in Anderson's procedure, the (R) L.R. and (L) M.R. would be recessed. By increasing the recession of the (L) M.R it could adjust for the deviation or after the Anderson's procedure, the deviation could be corrected.

PS: One should ensure the fixating eye. In the situation given the right eye is preferred in abduction as left eye is amblyopic one would have to recess the right eye in and
do augmented recess resect procedure on left MR and LR to correct the esotropia, existing plus that will be enhanced by right eye nystagmus surgery.

**BVR:** In case of INS with LCS with left face turn I would do left eye MR recess + left LR resection which would correct the ET and also shift the null point, into primary position, there by correcting the face turn. In case of residual head turn I would do the right MR resection.

**E. Patient of DRS type 1 with esotropia 30 pd.**

**RS:** This 20 year old girl presented with face turn to the left and a vision of 20/20 either eye. She had a cross response on Bagolini striate glasses. What will be the surgical plan in this case?

**SI:** The most important of the gaze positions in figure 1 is the depiction of direct dextroversion. The left eye can only adduct about 10 degrees. One should be cautious about recessing the left medial rectus muscle since that could eliminate adduction and essentially make the eye immobile. I would recess the left medial muscle, no matter how restrictive it is, only 3 mm to reduce the fissure narrowing on adduction. Importantly, I would recess the right medial rectus muscle 5 to 7 mm depending on the face turn magnitude. In addition, I would place a posterior fixation suture on the right medial rectus to further reduce adduction to somewhat match the reduced abduction in the left eye.

If a second surgery is needed (almost always for undercorrection), I would consider a full or half tendon transposition of the left superior and inferior rectus muscles to the lateral rectus muscle.

**EMH:** I would recess the left medial rectus to approximately 9.5 mm from the limbus (4 mm). Some would add a faden to the right medial rectus. I would not do a muscle transfer on the left eye to “enlarge” the single binocular vision field! This girl looks good in the primary position and therefore I suspect her face turn is small. You cannot cure Duane, only change it and hopefully for the better.

**RHR:** Recess L.M.R. and L.L.R. trading one bad defect with another Or no Surgery.

**VM:** The patient has an esotropia, as well as retraction of the globe. A recession of both medial and lateral recti (6 mm and 8 mm respectively) could be done as this would take care of the deviations as well as the retraction. The lateral rectus is recessed a little less in view of the esotropia.

**PS:** Since there appears to be no upshoot or downshoots, it may be presumed that the co-contraction is mild. FDT should be done preferably under topical anesthesia, or else at least prior to surgery to assess the tightness. MR Recession alone is done in such cases and adjusted by intra-operative FDT. FDT is always confirmed postoperatively at closure for older cooperative cases a two stage adjustment may be planned. If a more severe co-contraction is observed the differential LR recession is added, MR recession more than LR recession.

**BVR:** I would do left Medial rectus recession primarily. In case if the ET is more in primary position with head turn corrected, then right eye Medial rectus recession can be added with or without Faden of RMR depending on fixation pattern.

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Last date for submission of application for fellowship for Partial Financial Assistance to Attend International Conference: 31st January, 2008

Save time! Submit your registration & abstract online for the Annual DOS Conference at www.dosonline.org
ORBIS Telemedicine, Cyber-Sight
Experience with E-Consultation

Eugene M. Helveston MD

Telemedicine has been a part of the medical armamentarium for more than two decades. The earliest examples were "real time"; that is with the patient, his local doctor, and the consultant all present and functioning at the same time, separated by a distance and connected electronically with video transmission. This type of communication is essential if the consultation is being requested for a surgical procedure where the distant consultant is the virtual surgeon. Aside from this, there may be little legitimate reason for real time telemedicine for patient care. A possible exception to this exists in a diabetic retinopathy screening process as carried out by Sankara Nethralaya Hospital in Chennai India. With this program a van equipped with a fundus camera and telemedicine broadcasting capability sends the retinal image back from the countryside to the reader at the hospital. This enables an instant diagnosis and offering of recommendations while the patient remains in the presence of the screener. Using this novel technique, patients in a rural setting are less likely to be lost to follow-up as they might be if there was a delay in the diagnosis.

Real time telemedicine has distinct advantages for teaching if certain requirements are met. An example of this is the teaching of ophthalmic pathology as it is carried out in several U.S. residency training programs. An expert teacher in Chicago can give a course for residents in Indianapolis, St. Louis, Kansas City, Cleveland, etc. There is no limit to the number of students. With the proper use of cameras, the student sees the teacher and the teaching material, and the teacher can see the students. This latter requirement could be the main limiting factor in how many sites can be engaged at the same time. This type of program could also be used in other areas of resident training where faculty is not always available such as ophthalmic optics. The use of telemedicine for conferences or grand rounds has also been successful, but with this activity the cost-/benefit ratio must be carefully evaluated and the problem with time zones when connecting half way around the world is real.

As effective as some applications of real time telemedicine are, there are several drawbacks especially for patient care. These include: additional expense for equipment, a bigger demand for bandwidth, the need to have all participants available at the same time, and a lack of compelling reason to go to all of the trouble!

For the reasons noted above, and probably some others, we opted to use the store and forward method and will present our experience in the following.

ORBIS Telemedicine, Cyber-Sight

Beginning in 1998 we started a telemedicine program with partners in Havana Cuba, dealing with pediatric ophthalmology patients, most of whom had strabismus. The program used E-Mail and JPEG images sent as attachments. These were received by the mentor, arranged in the 9 diagnostic positions, and placed in a montage before printing out for study. The system was evaluated for four months by confirming that "in person" examinations were consistent with those done by telemedicine, and experts agreed in both diagnosis and management after studying the pictures. Success of the program led to new programs being established in Romania, Albania, India, and the Dominican Republic. Recognizing the need for more institutional support, the program was assumed by ORBIS International in 2002, called Cyber-Sight, and became operational in June 2003.

The Method

The ORBIS telemedicine program for patient consultation is called Cyber-Sight and is found on the world wide web at www.cybersight.org. There are two other Cyber-Sight educational components on the web site, E-Resources, and E-Learning, but our comments here will be limited to E-Consultation.

The E-Consultation process begins by identifying and training a partner. This is may be done during an ORBIS Flying Eye Hospital (FEH) visit, during a Hospital Based Program (HBP), through other ORBIS contact, or even after a partner finds the program on line. After this initial contact, the partner is trained; including how to take and upload pictures, and how to send them on the internet. This can be done initially in the practice mode using the user name “partner” and password “test,” a process free for all to use on the web site. It is used “for real” after the partner is given a unique user name and password. At this time the partner is assigned to a mentor team with up to thirteen experts representing the subspecialty areas of ophthalmology. From here the partner can send the history and images of patients to a specific mentor selected according to the needs of the patients. These include: strabismus, cataract, oculo-plastics, neuro-ophthalmology, etc. A detailed description of how the system works can be seen by going to the web site, clicking on E-Consultation and then selecting the option to see the Mentor/Partner Manual that can be read online or downloaded.
Results

More than 3,484 cases have been seen in consultation as of Oct. 30, 2007. These cases have been submitted by 159 partners in 23 countries with the majority of them coming from Eastern Europe, India, Vietnam, and Latin America. Countries like Ethiopia, Nigeria, and Tanzania have participated, but slow or absent internet connection has been a limiting factor. While there has been a great deal of interest in China, language barriers have slowed the process. Consultations have been answered by 40 ORBIS volunteer faculty mentors from 5 countries.

**Strabismus**: A total of 2157 strabismus and pediatric ophthalmology cases have been managed using the program. Strabismus cases have included: Duane syndrome 188, superior oblique palsy 139, Brown syndrome 73, esotropia 311, exotropia 201, primarily vertical 82, DVD 69, sixth nerve palsy 54, third nerve palsy 78, and double elevator palsy 19. Strabismus cases are especially suited for store and forward telemedicine because the findings can be captured successfully with external images (Figure 1). Some participants find the lack of movement to be a limiting factor, but others (the author included) believe this is not a significant drawback, and definitely not worth the trouble to insert.

**Pediatric cataract**: A total of 29 cases of pediatric cataract have been seen. The lack of a suitable slit lamp camera is definitely a drawback, but even seeing a picture of the child's face, and a close up of the eye can be useful to an ORBIS mentor. This is also useful for the ORBIS VF preparing for a hospital based program when seeing a patient through pre-screening (Figure 2).

**Retinoblastoma**: When the retina can be imaged effectively, the management of retinoblastoma can be carried out effectively utilizing telemedicine. ORBIS established a retinoblastoma program in Guatemala City after providing them with a digital fundus camera and suitable equipment for treatment with laser and cryotherapy (Figure 3). This has made possible the referral of retinoblastoma cases to ORBIS Cyber-Sight partners, St. Jude Research Hospital and the Hamilton Eye Institute, both of Memphis Tennessee, USA. In addition, a pediatric oncology facility in Amman Jordan became a Cyber-Sight partner. This group and our partner in Guatemala have requested consultation a combined 402 times. As a testimony to the effectiveness of Cyber-Sight in the improving management skills for retinoblastoma by connecting partners and expert mentors, the doctors in Jordan improved their ability to design the best treatment program from 57% of cases before starting the program to 86% after two years experience.6

**Oculo-plastics**: Oculo-plastics can be dealt using effectively with telemedicine because not only the patient's physical findings can be captured with the photograph, but imaging, X-ray and MRI can also be shared. Oculo-plastics patients have accounted for 145 of the cases seen since 2003 (Figure 4).

**Other diagnoses**: In the other diagnostic categories of Cyber-Sight, cases have been seen as follows: cataract 42, corneal and external disease 146, glaucoma 50, retina and vitreous 304, uveitis 46, ophthalmic genetics 17, and neuro-ophthalmology 108.
Summary

Several factors suggest that the Cyber-Sight telemedicine process has been effective. To support this, a study of 239 cases in three strabismus categories: superior oblique palsy, Duane syndrome, and Brown syndrome, demonstrated that mentors provided a different diagnosis in 25% of cases and a different treatment program in more than 50% cases. There can be little doubt that Cyber-Sight helped put the partners on the right track in the management of the cases submitted to E-Consultation on Cyber-Sight.

In the past four years partners have tended to be faithful to the program suggesting that there is value to be found both for the physician and the patient. Likewise, mentors have remained faithful to the program. Since the inception of the program, there have been no complications brought to our attention. Partners and mentors have expressed both satisfaction and confidence in the program as evidenced by responses to questionnaires. Partners made the following comments:

- “Once you start using it you will not be able to stop.”
- “This helped me a lot in the management of difficult cases by giving me opinions regarding management, surgery and follow up of these cases. I also use Frequently Asked Questions, Featured Cases, Strabismus Minute, and surgical skill videos (cataract). All of these improve my practice and I feel that there is a big support for me especially in pediatric ophthalmic clinic.”
- “Cyber-Sight web site is like practicing ophthalmology with experts right by your side. This provides a bilateral benefit in the doctor-patient relationship in terms of giving quality care ophthalmology to all of my patients.”

<table>
<thead>
<tr>
<th>Case #IND-Gu0019</th>
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</thead>
<tbody>
<tr>
<td><strong>Doctor</strong></td>
</tr>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td><strong>Patient Name</strong></td>
</tr>
<tr>
<td><strong>Vision</strong> OD: 6/24 OS: 6/12</td>
</tr>
<tr>
<td><strong>Age / Gender</strong></td>
</tr>
<tr>
<td><strong>Refraction</strong></td>
</tr>
<tr>
<td>OD sph: +5.00 cyl: -1.50 axis: 140</td>
</tr>
<tr>
<td>OS sph: +4.00 cyl: -3.00 axis: 140</td>
</tr>
<tr>
<td><strong>Patient History</strong></td>
</tr>
<tr>
<td>Patient presented with complaint of dV ou Patient was found to have floriform cataract. Patient was operated for cataract +iol ou and regained vision 6/12 ou. Patient presented with DV after 2 years of surgery. On examination thick after cataract was found. Le memb +vit was done. RE after cataract is present.</td>
</tr>
</tbody>
</table>

**Figure 2**
Conclusion

ORBIS Telemedicine, Cyber-Sight, now four years old, has the promise of expanding the effectiveness of patient care and teaching programs of ORBIS by offering partner doctors and others in the eye health team around the world a close and ongoing relationship with colleagues acting as mentors and friends. While an ORBIS program can offer intense and personal contact, this must be for a limited time, usually one week for a given volunteer faculty. The goal of Cyber-Sight is to capitalize on this initial contact and build on it by offering *extended presence* made possible through information technology.

If you have any questions, concerns or comments please contact
us through the web site at www.cybersight.org or by sending an e-mail to Lynda Smallwood, Cyber-Sight Senior Manager, ORBIS Telemedicine at cyber-sight.consult@orbis.org.

References

5. Ben Zion I., Helveston EM. Use of telemedicine to assist ophthalmologists in developing countries for the diagnosis and management of four categories of ophthalmic pathology, Clinical Ophthalmology (In press Oct. 2007).
Delhi Ophthalmological Society
Monthly Clinical Meeting, December 2007

Venue: Mohan Eye Institute, 11B, Ganga Ram Hospital Marg, New Delhi - 110 060
Date and Time: Sunday 30th December 2007, 11.00 A.M.

Case Presentations:
1. Case of Bilateral Hypertrophic Blepharochalasis
   Discussant: Vikas Sinha, 10 min.
2. Unusual Case of Central Eale's in a young girl
   Discussant: Sanjiv Mohan & Lalit Choudhary, 5 min.

Clinical Talk:
Management of Pediatric Cataract
Discussion: Archana Sood, 15 min.

Symposium: Recent Trends in Corneal Surgeries
Chairman: Gobinda Mukherjee, Co-Chairman: J.S. Titiyal

- Corneal Collegen Crosslinking with riboflavin in Kerotoconus
  Rishi Mohan Bhatnagar
- Amniotic & mucus membrane graft
  A.K. Grover
- Deep Anterior lamellan Keratoplasty Big Bubble Technique
  Namrata Sharma

Followed by Lunch

Delhi Ophthalmological Society
Monthly Clinical Meeting, January 2008

Venue: Waiting Area Speciality Clinics, Venu Eye Institute & Research Centre, New Delhi
Date and Time: 20th January, 2008 (Sunday), 11.30 a.m.

Clinical Cases:
1. An unusual presentation of Retinitis Pigmentosa
   Discussant: Ankur Agarwal, 10 min.
2. Optic Nerve Glioma - missed diagnosis
   Discussant: Kanak Tyagi, 10 min.

Clinical Talk:
Orbital Implants: An overview
Discussion: Archana Sood, 15 min.

Mini Symposium
Chairman: S.C. Gupta, Co-Chairman: Anil Tara

- Tele Ophthalmology
  Abhishek Dagar, 15 min.
- Glaucoma Screening
  Subodh Sinha, 15 min.
- Diabetic Retinopathy Screening
  Vinay Garg, 15 min.

Panel Discussion: 15 Mins. To be followed by Lunch

Monthly Clinical Meetings Calendar 2007-2008

Centre for Sight
29th July, 2007 (Sunday)
Sir Ganga Ram Hospital
25th November, 2007 (Sunday)

Dr. R.P. Centre for Ophthalmic Sciences
26th August, 2007 (Sunday)
Mohan Eye Institute
30th December, 2007 (Sunday)

Dr. Shroff Charity Eye Hospital
30th September, 2007 (Sunday)
Venu Eye Institute
20th January, 2008 (Sunday)

Guru Nanak Eye Centre
28th October, 2007 (Sunday)
Army Hospital (R&R)
24th February, 2008 (Sunday)

Midterm Conference of DOS
17th,18th November, 2007 (Saturday - Sunday)
Safdarjung Hospital
9th March, 2008 (Sunday)
Terminology and characteristics

Characteristics of Congenital Esotropia (Figure 1 & 2)

- Esotropia (20.00 to 90D)
- Alternation on fixation preference (amblyopia)
- Neurologically normal
- Hyperopia connection does not eliminate esotropia
- L.N or M.L.N
- + Oblique muscle dysfunction
- Vertical incomitance A and V
- + Dissociated vertical deviation
- + Asymmetric OKN
- + Torticollis
- Usually conformed by 6 months
- Best treatment results in subnormal binocular vision
- Ciancia syndrome
- Langs congenital esotropia syndrome
- Nystagmus blockage syndrome

Many doubts remain about timing of onset, etiology, terminology and treatment outcomes. Come in mind dealing with IE these issues are now being discussed in new light. Data generated from experience has provided information about the outcome of early surgery or Botulinum Toxin injections. If etiology is important terminology is important birth better understanding of newborn visual sensory system and motor system?

The precise nature of cortical motor fusion defect causing congenital E.T remains obscure. Does motor fusion center fail to develop postnataally.

The so-called "baggage" of congenital E.T i.e D.V.D, latent nystagmus, OKN asymmetry, oblique muscle is most logically assigned to brainstem.

Motion Symmetry VER indicates the so called "open window" for developing B.S.V in infants with esotropia deviation end approximately 8mts. So patching alternately will benefit a better B.S.V potential (Figure 3)

Since the motor fusion center (Corpus collosum) in the cortex is defective, Congenital Esotropia is like a boat in waters with a weak anchor and therefore eyes can drift away.

Just as in orthopaedic conditions like congenital hip dislocation, prediction of esotropia during the neonatal period is difficult P.E.T. may be a useful tool.

Neuroanatomic Abnormalities of Primary Visual Cortex in Macaque Monkeys with Infantile Esotropia (Figure 4a&4b).

Significant problems in the diagnosis and management of Infantile Esotropia is by periodic assessment of refractive errors typically developing around 24 months of age.
Prediction as to which E.T. patient develops hyperopic refractive errors later, is difficult.

Typical Congenital Esotropia in not present at birth. However esodeviations persisting beyond 2 to 4 months can be considered abnormal.

Advances in the management of congenital E.T will depend on a better understanding of etiology leading to design and use or innovative 'Non-Surgical' techniques to discourage 'CONVERGENCE' and stimulate bifoveal fusion or Botulinum Toxin treatment: Treating this disorders while they are developing gives better opportunity to allow the brain compensating developmental anomaly.

**Treatment Options**

What should be done in management?

Is it appropriate to assess our present knowledge?

**Early surgery**

Timing of strabismus surgery is not determined either by the size papebral fissure or extra ocular muscle size. Globe size on the other hand is significant with the continued growth of the globe taking place specially the posterior part and hence importance of measuring from limbus since the "torque" can be obtained with a smaller "gear" (Table 1)

Selection of the preferred surgical correction of treatment of large angle infantile esotropia remains controversial.

Ultimate goal of surgery should be to obtain alignment within monofixation range as early as possible with least number of surgeries.

How early is early surgery in the management to achieve better binocularity.

Surgery done very early has usual risk of over corrections in majority due to overall change in E.O.M length and tension relationships (Table 1).
Age for surgical alignment for essential Esotropia has been continuously reduced considering the functional benefits. Experience of the surgeon comes into play in judging anatomical maturity of infant eye.

Two approaches

1. Uniform approach i.e., two muscle surgery as initial procedure so called “enblock” recession of medial rectii followed by later further surgery.

2. Selective surgery (Three muscle Surgery) Bilateral medial rectus recession with one lateral rectus resection.

Parameters

Majority of surgeons agree the maximum recession of M.R from limbus to be 10 mm by one year age and beyond one year 11.5 mm, the minimum practical recession remaining at 8.5 mm. Lateral rectus resection of 6 mm with addition for every 5 p.d eso 1.5 mm is added, not exceeding 9.5 mm in the young to avoid significant restriction.

In retrospective studies by various authors show that no patent with congenital E.T even when treated early has normal binocularity.

A wide array of seemingly unrelated motor anamalies develop after treatment frequently after a latent period in spite of early and near possible alignment.

Anomalies

Abnormal head posture, oblique muscle dysfunctions, manifest latent nystagmus, O.K.N. asymmetry and consecutive A.V patterns, should be considered while taking decrease in for surgery.

The best attainable result from surgical treatment for congenital esotropia is subnormal binocular vision.

Table 1 (a): Showing the change in insertion site of MR along with growth of eye ball.
(b): Shows the distance from insertion for a particular around of esodeviation.

<table>
<thead>
<tr>
<th>Age</th>
<th>Corneal diameter (mm)</th>
<th>Axial Length (mm)</th>
<th>Medial rectus insertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 mo</td>
<td>OD 12.0</td>
<td>3.75</td>
<td>3.75</td>
</tr>
<tr>
<td></td>
<td>OS 13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year, 7 mo</td>
<td>OD 11.00</td>
<td>20.9</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>OS 11.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 year, 9 mo</td>
<td>OS 11.0</td>
<td>21.5</td>
<td>4.5</td>
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<td></td>
<td>OS 11.0</td>
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<tr>
<td>6 years</td>
<td>OD 12.3</td>
<td>23.2</td>
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<td></td>
<td>OS 12.3</td>
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<td>7 years</td>
<td>24.2</td>
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<td>4.5</td>
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<tr>
<td>9 years</td>
<td></td>
<td>24.0</td>
<td>4.0</td>
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</tbody>
</table>

Figure 5: Polypeptide chain of Botulium Toxin

Figure 6: Mechanism of Action of Botox
Subnormal binocular vision*

- Orthotropia or heterophoria
- Normal visual acuity in both eyes
- Fusional amplitudes
- Normal retinal correspondence
- Foveal suppression in one eye in binocular vision
- Reduced or absent stereopsis
- Stability of alignment
- Optimal treatment result for congenital esotropia

Microtropia

- Inconspicuous shift or no shift on cover test
- Mild amblyopia frequent
- Fixation central or parafoveolar in one eye
- Fusional amplitudes
- Anomalous retinal correspondence (if small shift on cover test)
- Reduced or absent stereopsis
- Fairly stable alignment
- No further treatment except amblyopia prevention
- Desirable treatment result

Monofixation (Parks)

- Esotropia (XT)<10 prism diopters
- Harmonious ARC*
- Alternation or amblyopia
- Fusional amplitudes
- Stable angle
- Good result
- Cosmetically acceptable?
- 80% have anomalous retinal correspondence**
- Less stability of angle

Further surgery based on appearance; amblyopia treatment as needed; may benefit from correction of hyperopia

- May be acceptable result

*Large-angle esotropia/exotropia (>20 prism diopters) Unexpectable result further surgery required

Generally demonstrable findings that sensory and motor results are superior in infants aligned before 6 mts compared to those aligns by 18 to 24 mts of age.

Non Surgical Management

Botulinum Toxin Injection

Introduction

"Botolium Toxia A being interventional and not invasive is an excellent alternative method for surgery, when it becomes

Figure 7: Botox vial and EMG needle

Figure 8: Reconstitution of botulium toxin
apparent, supportive therapy would yield no further benefit effect good 'Sensorial Anchorage'. The out comes considered are vision, residual angle of strabismus and neutralising abnormal force dynamic and orbital stiffness”

Clinical Pharmacology

Polypeptide with heavy and light chain bonded by a disulphide bond, the heavy chain is responsible for binding and the light chain is toxic moiety. The mech of action is experienced in Figure 3.

Mechanism of Action

Binding
- BOTOX binds first to a cholinergic nerve ending

Internalization
- BOTOX enters the nerve terminal via receptor-mediated endocytosis

Blocking
- Once inside cell, the light chain is internalized into the cytoplasm and blocks release of acetylcholine. BOTOX selectively cleaves SNAP-25, leading to functional denervation of the injected muscle (Figure 6)

Procurement

Its supplied in sterile lyophilised form of purified toxin in a vial / preservative free saline for injection. An EMG needle and dilution table is supplied along with it (Figure 7).

<table>
<thead>
<tr>
<th>Diluent</th>
<th>Added (0.9% Sodium Chloride Injection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 ml</td>
<td>10.0 U</td>
</tr>
<tr>
<td>2.0 ml</td>
<td>5.0 U</td>
</tr>
<tr>
<td>4.0 ml</td>
<td>2.5 U</td>
</tr>
<tr>
<td>8.0 ml</td>
<td>1.25 U</td>
</tr>
</tbody>
</table>

Preparations Available

Three preparation of botulinum toxin are commercially available as Botox, Dysport (type A) and Myobloc (type B)

How supplied
- Type A: are supplied in lyophilized and has to be reconstituted
- Type B: is supplied in a liquid formulation does not need reconstitution and stable for three months if refrigerated

One unit corresponds to calculated (LD50) HOWEVER intermanufacturing differences in LD50 and potency varies. So amount of units for thereputic dosage varies.

Reconstitution

Steps of botulinum toxin reconstitution (figure 8) (applicable to Botox® and Dysport®). Withdraw proper amount of diluent in a syringe, and slowly insert the needle tip into the Botox® vial. The...
Early treatment with botulinum toxin allows a self-adjusting sensorimotor mechanism, once the motor system is modified. Attempts to change original angle apart without changing the arc of contact a weakening of sensory motor system mechanism, which are counteracting binocular alignment of visual axes (Figure 10a&b). Major drawbacks of this procedure include unstable results, need for repeated injections and need for surgery later in life. When the muscle is chemically denervated it atrophies and may develop extrajunctional acetylcholine receptors. There is evidence that nerve can sprout and re-innervate the muscle, thus reversible

**References**


The effect of botulinum toxin injections in infantile Esotropia seems to be strongly related to the age / i.e., during the “open window” period. The medial rectus is more sensitive to toxin allowing the ipsilateral lateral rectus to regain function.

Repeat bilateral M.R infections 2.5 units one month hence if deviation is noticed >15 p.d.

Patching or Fresnel prism therapy recommended for small angle deviation after one month of initial injection
Sixth cranial nerve palsy is an important cause of acquired horizontal diplopia. It is the most frequently involved cranial nerve in oculomotor palsy.

Anatomical Considerations

The sixth cranial nerve nuclei are located in the lower pons beneath the fourth ventricle. Because of its long, tortuous intracranial course, and the location of the peripheral part of the nerve near the clivus as it enters the area of the cavernous sinus, elevated intracranial pressure from any cause may tether the nerve, causing lateral rectus paresis. As such, it is regarded as non-localizing nerve palsy.

Although shorter in length than the fourth cranial nerve, the course of the sixth nerve leaves it vulnerable to a variety of insults. The site of lesion can be localized based on the associated signs and symptoms; the reader is referred to standard textbooks of ophthalmology for details of anatomy and anatomical localization of lesions.

Clinical Considerations

Epidemiology and Risk Factors

In a recent population-based study that reviewed 137 patients spanning a 15-year period, the sex incidence was equal, the annual incidence was 11.3/100,000, and the peak incidence was in the seventh decade. In 35% of the cases, the patients had hypertension and/or, less frequently, diabetes; 26% were undetermined, 5% had a neoplasm, and 2% had an aneurysm.

Isolated sixth nerve palsy (no additional neurological or ocular signs) is a common presentation. Although the spectrum of causes overlap, the risk factors may differ in children and adults.

Adults

Typically, adults present over 40 – 50 years of age and the paresis maybe due to a variety of insults. Traditionally, a patient presenting with isolated sixth nerve palsy and with vasculopathic risk factors (diabetes, hypertension) may be observed without imaging for 3 months, as a micro vascular etiology is common. However, there are conflicting reports on the subject.

Some authors recommended MRI in all patients presenting with acute sixth nerve palsy, even with a vasculopathic history. However, other authors have found an almost 86% rate of spontaneous resolution in cases of sixth nerve palsies with known vasculopathic risk factors. Table 1 enumerates the common causes of sixth nerve palsy in adults and children.

In younger adults, the etiology maybe more obscure and aggressive search for a cause is imperative.

There is a consensus that patients with bilateral or nonisolated sixth nerve palsy should have an MRI, medical work-up, and lumbar puncture. Accompanying neurological deficits may point toward areas of the brain to focus on as discussed in table 2. Infectious etiologies, such as botulism or cytomegalovirus (CMV), neoplasm (nasopharyngeal cancer), or inflammatory causes, such as Guillain-Barre syndrome, should be kept in mind.

Pain with a sixth nerve palsy is nonspecific. Some causes of painful sixth nerve palsy include:

<table>
<thead>
<tr>
<th>Table 1: Causes of sixth nerve palsy in adults*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infections</strong></td>
</tr>
<tr>
<td>• Arachnoiditis, Lyme’s disease, psittacosis, Staphylococcus aureus infection, syphilis, varicella zoster</td>
</tr>
<tr>
<td><strong>Trauma</strong></td>
</tr>
<tr>
<td>• Head injury, skull fractures, cervical spine fractures</td>
</tr>
<tr>
<td><strong>Neoplasm</strong></td>
</tr>
<tr>
<td>• Chondroma, chondrosarcoma, chordoma, cylindroma, metastasis</td>
</tr>
<tr>
<td><strong>Systemic disorders</strong></td>
</tr>
<tr>
<td>• Vascular – atherosclerosis, diabetes, hypertension, preeclampsia</td>
</tr>
<tr>
<td>• Hematological – leukemia, lymphomatous meningitis</td>
</tr>
<tr>
<td><strong>Other vascular causes</strong></td>
</tr>
<tr>
<td>• Aneurysm, arteriovenous malformations, cerebrovascular insults</td>
</tr>
<tr>
<td><strong>Associated neurologic disorder</strong></td>
</tr>
<tr>
<td>• Cluster headache, demyelinating disease, elevated intracranial pressure, intracranial hypertension</td>
</tr>
<tr>
<td><strong>Iatrogenic</strong></td>
</tr>
<tr>
<td>• Myelography, nerve blocks in the head and neck, post lumbar puncture, post spinal or epidural anaesthesia</td>
</tr>
<tr>
<td><strong>Others</strong></td>
</tr>
<tr>
<td>• Idiopathic, inflammatory, interferon toxicity, lithium toxicity, OKT3 toxicity</td>
</tr>
</tbody>
</table>

• inflammatory etiology e.g. Tolosa-Hunt syndrome,
• aneurysm,
• bone metastasis,
• ophthalmoplegic migraine.

Children

Causes of sixth nerve palsy are similar as in adults, but vascular diseases are less common whereas trauma and neoplasia occur more often. The causes are enumerated in table 3

A child may develop a sixth nerve palsy following a viral illness, around 1-3 weeks following a non-specific febrile episode or immunisation. The viral agent is believed to have a neurotrophic effect that results in sixth nerve palsy. This condition is benign but often recurrent. Spontaneous resolution that results in 6 months is the rule. Amblyopia prophylaxis is essential in children who acquire this condition.

The role of MRI in children with isolated sixth nerve palsy is controversial. Children < 14 yrs with no neurological signs and symptoms – no work up is required. Examine every 2 weeks initially, then monthly till the palsy resolves.

Caution: Persistent palsy after 3 months requires further evaluation.

Neuroimaging is recommended in a child with persistent, bilateral, or sixth nerve palsy accompanied by other neurologic signs or symptoms.

Transient sixth nerve palsies may occur in neonates caused by

• increased intracranial pressure associated with forceps or vacuum extraction in assisted deliveries
• overstretching of the sixth nerve
• hypoxia
• temporary edema caused by the birth process.

Patients usually recover within six months. Patients with increasing esotropia and neurological signs and symptoms require investigations.

Clinical features

Clinical history includes the following:

• Esotropia
• Anomalous head posture

Table 3: Causes of sixth nerve palsy in children*

<table>
<thead>
<tr>
<th>Infections</th>
<th>Trauma</th>
<th>Neoplasm</th>
<th>Systemic disorders</th>
<th>Other vascular causes</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viral – CMV, Epstein Barr virus, influenza, varicella zoster virus</td>
<td>Head trauma, skull fractures</td>
<td>Primary – astrocytoma, chondrosarcoma, craniopharyngoma</td>
<td>Vascular diseases, leukemia, dermatomyositis</td>
<td>Aneurysm, AV malformation</td>
<td>Congenital, idiopathic, immunization, inflammatory, lead poisoning</td>
</tr>
<tr>
<td>Others – Abcess, Gradenigo syndrome, Lyme’s disease</td>
<td></td>
<td>Secondary: neuroblastoma, lymphosarcoma</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Table 2: Indications for systemic evaluation in sixth nerve palsy

<table>
<thead>
<tr>
<th>Age</th>
<th>Isolated sixth nerve palsy</th>
<th>Bilateral/ Non Isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric</td>
<td>Follow up vs MRI</td>
<td>MRI</td>
</tr>
<tr>
<td>Adult &lt; 50</td>
<td>MRI/ medical eval/ lumbar puncture</td>
<td>Same</td>
</tr>
<tr>
<td>Adult &gt; 50</td>
<td>Medical eval/ ESR/ CRP/ MRI</td>
<td>MRI/ medical eval/ lumbar puncture</td>
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</tr>
<tr>
<td>Adult &gt; 50</td>
<td>Medical eval/ ESR/ CRP/ MRI</td>
<td>MRI/ medical eval/ lumbar puncture</td>
</tr>
</tbody>
</table>
Physical findings include the following:

- An esodeviation that increases on ipsilateral gaze and is often greater at a distance – diagnostic strabismus measurements should be done in all gazes. Measurements made with the uninvolved eye fixing (primary deviation) will be less than that with the involved eye fixing (secondary deviation). A small vertical deficit may accompany a sixth nerve palsy, but a deviation over 4 prism diopters should raise the question of additional pathology, such as a fourth cranial nerve palsy or skew deviation.
- An isolated abduction deficit; Prolonged sixth nerve palsies may lead to secondary contractures of the medial rectus muscle
- End gaze nystagmus
- Slowed ipsilateral saccades
- Papilledema (if increased intracranial pressure)
- Nystagmus (usually in children, ie; secondary to pontine glioma)
- Otitis media
- Orbital wall fracture
- Tender, enlarged, nonpulsatile temporal arteries in giant cell arteritis

Additional investigations that can be done include Hess charting, Saccadic velocity, binocular diplopia free fields. In addition to diagnosis, Hess charting helps in monitoring progress and recovery in an acute case.

It is important to distinguish paresis from a true palsy as the management differs in these cases. Paresis is the condition in which the function of the nerve maybe compromised but residual lateral rectus function remains. In true palsy function of the nerve has been completely eradicated so that no meaningful LR contraction occurs. The differences are as enumerated in table 4.

A clinical trial with Botulinum toxin during the acute phase may help distinguish paresis from a true palsy. After injection into the antagonist medial rectus muscle if abduction improves, the lateral rectus function is present.

### Differential Diagnosis

**Differential Diagnosis of an Abduction Deficit:**

- Cranial sixth nerve palsy
- Myasthenia gravis
- Restrictive
  - Trauma
  - Thyroid eye disease
  - Inflammation
- Congenital
  - Duances syndrome
  - Mobius syndrome
  - Congenital esotropia
  - Congenital absence of the lateral rectus
- Spasm of near reflex
- Divergence paralysis
- Post surgical
  - Disinsertion or dehiscence of the lateral rectus
  - Excessive lateral rectus recession
  - Excessive medial rectus resection
  - Lost lateral rectus
  - Scarring and restriction of the medial aspect of the globe

### Nonsurgical Treatment

Nonsurgical approaches include patching to avoid diplopia, prisms, botulinum toxin (Botox® [Allergan, Inc., Irvine, CA]) injection of the ipsilateral medial rectus, and steroids if the etiology is inflammatory. The patient should be followed regularly to observe for improvement or worsening of the deviation. A worsening deviation may indicate ipsilateral medial rectus contraction, and would be an indication for a work-up to rule out a progressive lesion.

### Table 4: Partial versus complete sixth nerve palsy

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Partial sixth nerve palsy</th>
<th>Total sixth nerve palsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abduction</td>
<td>Usually beyond midline; decreased abduction if MR contracted</td>
<td>No abduction beyond midline</td>
</tr>
<tr>
<td>Forced generation</td>
<td>Reduced</td>
<td>Absent</td>
</tr>
<tr>
<td>Forced duction</td>
<td>No restriction unless MR contracted</td>
<td>No restriction unless MR contracted</td>
</tr>
<tr>
<td>Saccadic velocity</td>
<td>More than 175 degrees</td>
<td>Less than 100 degrees</td>
</tr>
<tr>
<td>Agonist antagonist</td>
<td>≤ 40% difference</td>
<td>≥ 40% difference</td>
</tr>
</tbody>
</table>
In children up to 4 years of age, treatment of the acute palsy is aimed at preventing amblyopia and preserving binocular fusion because children may rapidly learn to suppress the second image. Standard amblyopia therapy is instituted as early as possible. Adopting a small face turn is beneficial and parents should permit their children to assume the anomalous head posture.

Patching is an effective way to temporarily relieve symptoms of diplopia, and can be accomplished with a standard eye patch or with the use of opaque tape on the patient’s spectacles. Alternate occlusion is ideal to prevent secondary contracture of the medial rectus; however, occlusion of the good eye may lead to disorientation and vertigo.

For small deviations, Fresnel add on prisms are a good option (case 1). Vision may be blurred by the prisms in proportion to the amount of prism applied.

Case 1: A 37-year-old male presented with a history of diplopia for 5 months with face turn to the left side. On examination, he had a left esotropia of 45 prism diopters (Figure 1a) in the primary position along with a limitation in abduction left eye. Hess charting showed a left lateral rectus paresis (Figure 1b). Systemic evaluation was within normal limit. Fresnel add on prisms (Figure 1c) were prescribed and the patient was comfortable.

In adults with acute sixth nerve palsy, intervention is directed at preventing secondary contracture of the antagonist MR muscle and creating a meaningful area of single binocular vision during the recovery period.

There is a definite role of Botox® in the acute management of acute sixth nerve palsy. It functions to prevent or reduce the contracture of the antagonist medial rectus, to alleviate diplopia and also to treat small postoperative deviations. (Case 2). The optimal timing however remains controversial. The decision to use depends on the degree of incapacitation caused by sixth nerve palsy. If involvement is only partial and the patient has an area of binocular vision, intervention maybe delayed. If involvement is total, botulinum toxin maybe used as early as 2 weeks. Some surgeons recommend botulinum if no signs of improvement is apparent within a month of onset. Botulinum toxin is also beneficial in cases in which surgery is contraindicated.

Complications of Botox® include ptosis, induced hypertropia, subconjunctival hemorrhage, possible globe perforation, and failure to maintain an effect.

Case 2: A 62-year-old lady presented with diplopia and inward deviation of the left eye along with a significant head turn to the left since one month. On examination, her visual acuity both eyes was 6/6(N6). On orthoptic evaluation, she had an esotropia of 14 prism diopters and 16 for near in the primary position (figure 2a) and there was a restriction in abduction left eye. The rest of the clinical evaluation was unremarkable. Hess charting supported the diagnosis of left lateral rectus palsy (figure 2b). She was a known case of diabetes, hypertension, migraine on systemic therapy. Botulinum toxin was injected into the left medial rectus muscle. Post injection, there was an improvement in alignment and in the diplopia free field, the head turn disappeared (figure 2c).

Surgical Treatment

It is mandatory to wait for six months for spontaneous improvement before any surgical intervention is planned. If the palsy continues to improve, it may be observed.

Surgical approaches are based on the function of the paretic muscle, the field(s) of diplopic symptoms, and the likely secondary effects of a procedure. Surgical choices depend on the degree of residual lateral rectus function as well as the direction of deviation (Table 5). At this juncture, it is important to differentiate between a paresis and a palsy as already discussed.

Mild lateral rectus paresis may be addressed by a recession of the ipsilateral medial rectus, or by a recession of the yoke contralateral medial rectus (creating a matching weakness in the contralateral eye. which would be less likely to induce an exotropia in contralateral gaze. A contralateral medial rectus posterior fixation suture (Faden operation) may also effectively serve this purpose. In a moderate paresis, it is usually necessary to resect the paretic lateral rectus...
Table 5. Approach to Surgery for Cranial Sixth Nerve Lesions

<table>
<thead>
<tr>
<th>Lateral rectus function</th>
<th>Surgical approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild lateral rectus paresis</td>
<td>Recess same side antagonist MR or Recess contralateral yoke MR</td>
</tr>
<tr>
<td>Moderate lateral rectus paresis</td>
<td>Resect paretic LR and Recess ipsilateral or contralateral MR</td>
</tr>
<tr>
<td>Lateral rectus palsy</td>
<td>Transposition plus recess either ipsilateral or contralateral MR</td>
</tr>
</tbody>
</table>

and recess either the antagonist or yoke medial rectus. Surpramaximal medial rectus resections (10-15 mm) and large lateral rectus resections (10-15 mm) can be done on the same eye. An adjustable suture on the recessed medial rectus enhances the surgeon's ability to provide good centration of the binocular diplopia-free field. A contralateral medial rectus posterior fixation suture or recession combined with a unilateral recession procedure maybe needed if the primary deviation is more than 40 prism diopters.

Case 3: A female patient presented with (L) lateral rectus palsy after lateral orbitotomy (figure 3a). Since the range of movement of (L) lateral rectus was good and limitation was minimal a recession/resection procedure was considered. (L) MR recession of 9mm was done while LR was resected by 12mm. The post picture shows excellent alignment in primary position (figure 3b).

In complete sixth nerve palsy, the goal of surgery is:
- to create an abducting force
- increase the binocular diplopia-free field
- provide centration of the binocular diplopia-free field

In such cases with no lateral rectus function, resection of the lateral rectus may have transient mechanical effect but will result in poor long-term alignment. Supramaximal recession resection procedures may have a mechanical effect but have a reoperation.
rate of 50%. More importantly, resection of a palsied lateral rectus destroys anterior ciliary circulation increasing the chance of anterior segment ischemia after subsequent vertical rectus transposition procedures.

Thus a transposition procedure should be performed as the initial operation if preoperative evaluation does not disclose significant muscle force generation. Vertical rectus muscle transposition of the superior and inferior rectus to the lateral rectus insertion improves abduction; plus a weakening of the ipsilateral or contralateral medial rectus is indicated (case 4). Alternatively, the antagonist medial rectus can be weakened by injecting Botulinum toxin. Various muscle transposition procedures have been described.

Case 4: A seven-year-old female child presented to us with a history of inward deviation of the right eye since 2 years of age. There was a history of head injury at that time; the MRI had shown a hemorrhagic contusion of the temporal lobe, which had resolved on the recent MRI. The right eye was densely amblyopic the vision being only hand movements close to face and the left eye was 6/6; the rest of the anterior and posterior segment was normal. On orthoptic evaluation, she had a right esotropia of 55-60 prism diptors on prism bar reflex test for both distance and near; extraocular movements (Figure 4a) showed a limitation in abduction of the right eye with the eye not moving beyond midline. Forced duction test on the table showed restriction of abduction of the right eye pointing to a medial rectus contracture. A vertical transposition procedure (transposition of the right superior and inferior rectus to the lateral rectus insertion with posterior fixation on lateral rectus (Fosters method) with medial rectus recession was done. Post operatively, the corneal reflexes were well centered and she regained some abduction as illustrated in (Figure 4b).

Problems in management
Failure to distinguish between paresis and palsy may lead to incorrect choice of surgery. Also, failure to identify medial rectus contracture may lead one to forego performing a MR weakening procedure.

Complications
Induced vertical deviation
A major concern of transposition procedures is inducing a vertical deviation in patients with only a horizontal deviation. This can occur in 13-30% cases. A precaution to be taken to decrease this complication is to place both superior and inferior rectus on adjustable sutures.

Anterior segment ischemia
The extent of surgical manipulation in transposition procedures as well as the need to augment the effect of the procedure by medial rectus recession increases the risk of anterior segment ischemia especially in predisposed patients. Steps to avoid this can be a chemodenervation of the medial rectus in place of recession or recessing the contra lateral medial rectus. Ciliary vessel sparing procedures may be tried.

Under corrections and over corrections can occur.
The success rate for patients with either traumatic or non-traumatic sixth nerve palsy is favorable, particularly for those with residual lateral rectus function. If surgery is indicated, the patient should be aware that more than one procedure may be needed, and prisms may be required postoperatively.
Childhood blindness is a result of a number of diseases and conditions that occur in childhood and early adolescence, which may lead to permanent loss of vision. A few of these conditions may be present congenitally but most of them are either developmental or acquired. Hence these can be prevented, avoided or cured with optimum visual rehabilitation, if recognized in time and if proper modes of rehabilitation are instituted. It is sad that in many developing countries, inadequate suspicion of different conditions that can lead to blindness, inadequate treatment at the grass-root level in spite of attempts at treatment, inadequate counseling and inadequate coverage of the total population result in a lifetime of blindness and dependency for this helpless population.

Though children represent only 1.5 million of the world's 45 million blind, childhood blindness emerges as one of the important causes of blindness, when measured in terms of the years of blindness. In contrast to blindness in the elderly, blindness in children can mean an entire lifetime of sightlessness. A matter of equal significance is that 50% of childhood blindness is avoidable and on many occasions remains unnoticed, thus becoming irreversible at a later date. Also important is the fact that vast majority of childhood blindness happens before the age of 5 years, a period when 75% of learning and maturation is through sight. Visual impairment thus affects all areas of development of the child. The most important areas are communication, bonding, level of wakefulness, motor development, spatial concepts, balance, object appreciation, picture perception, incident learning, language development and social interaction.

**How common is childhood blindness?**

According to the World Health Organization, an estimated 1.5 million children are blind. Three quarters of these children live in the poorest regions of Africa and Asia. Each year almost half a million children go blind which approximates one child every minute.

Although the actual number of children who are blind is much smaller than the number of adults who are blind from different conditions, the number of years lived with blindness by blind children is almost the same as the total number of “blind years” due to age related cataract. The high number of blind years resulting from blindness during childhood is one of the reasons why the control of childhood blindness is a priority of the WHO / IAPB vision 2020: The right to sight programme.

**Causes of Childhood blindness**

Some of the causes of childhood blindness in developing countries are:

- Congenital Cataracts due to Rubella
- Developmental cataract
- Congenital Glaucoma
- Retinal dystrophies of genetic origin.
- Retinopathy of Prematurity
- Amplyopia (multifactorial)
- Uncorrected refractive errors
- Corneal blindness

**Vision 2020 Priorities**

Vision 2020: The right to sight is a global initiative of the World Health Organization (WHO) and the International academy for prevention of blindness (IAPB), with an international coalition of NGO's, professional associations, eye care institutions and corporations.

Considering the magnitude of the problem, following conditions are priorities for control:

- Corneal scarring, due to measles, vitamin A deficiency, harmful traditional eye medicines and ophthalmia neonatorum: Priorities in poor and very poor regions.
- Pediatric Cataract and glaucoma: Important treatable causes in all regions.
- Retinopathy of prematurity, a condition which is preventable and treatable; important in middle income countries, and in urban centres in developing countries.
- Refractive errors: Treatable causes in all regions.
- Low vision: Services need to be expanded or developed in all regions.

**Targets for disease control**

The following targets have been agreed for disease control:

- Reduce the global prevalence of childhood blindness from 0.75/1,000 children to 0.4/1,000 children.
- Elimination of corneal scarring caused by vitamin A deficiency, measles, or ophthalmia neonatorum.
- Elimination of new cases of congenital rubella syndrome.
- All children with congenital cataract to receive appropriate surgery, with immediate and effective optical correction, in suitably equipped specialist centre
- All babies at risk of retinopathy of prematurity to have fundus examination, by a trained observer, 6-7 weeks after birth. Cryotherapy or laser treatment to be provided for all those with treatable disease.
• All school children to receive a simple vision screening examination, with glasses provided for all those with significant refractive error. This should be integrated into the school health programme.

**Human resource development**

The implications and recommendations for human resources development are as follows:

• Ensure that prevention of childhood blindness is an explicit aim of all primary health care programmes.

• Ensure that all secondary level eye clinics have facilities to provide appropriate spectacles for children with refractive errors.

• Train one refractionist per 1,00,000 population by 2010.

• Train at least one low vision worker for every 20 million children, by 2010, and for every 5 million by 2020.

• Train one paediatric-orientated ophthalmologist for every 50 million population by 2010, and one per 10 million population by 2020.

**Appropriate Technology & Infrastructure**

There is the following need for appropriate technology and infrastructure development.

• Development of low cost, high quality low vision devices, which should be widely available, even in low income countries.

• Establish a network of specialist ‘childhood blindness’ tertiary centers.

The responsibility of suspecting and detecting childhood blindness due to any reason, congenital or acquired often rests on the pediatricians initially. It is of importance to train and remind pediatricians at every level of contact to keep on looking out for the achievement of the normal visual milestones of the child along with the other milestones that they observe and refer the patient to an ophthalmologist immediately on the slightest suspicion of a problem.

**References**


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**DOS Elections**

Applications are invited from Delhi Members of Delhi Ophthalmological Society for the post of: Vice President (1 Post)

The eligibility criteria for different post prescribed in DOS Constitution (1998) will be followed. Application should be submitted on a plain paper duly proposed and seconded by a member of DOS (not in arrears). Application should reach Secretary’s Office latest by 25th January, 2008 (2 p.m.).

Last date of withdrawal is 25th February, 2008 (5 p.m.)

Election will be held during the Annual DOS Conference on 29th March, 2008.

Secretary, DOS
Binocular vision is seeing with two eyes simultaneously. Binocular vision is one of the greatest assets that evolution has given mankind as it gives us the third dimension to our world around us. Binocularity has many advantages, it gives us a wider field of view than a monocular field, binocular summation in which the ability to detect faint objects is enhanced and most important stereopsis in which horizontal disparity between the two eyes because of their different positions on the head give precise perception of depth.

The process of seeing an object binocularly requires simultaneous perception of that object by two different retinæ, fusion of the image formed by the two retinæ and perception of the depth of that object.

Retinal correspondence

Visual direction

The visual direction of an object is represented by a line joining the centre of the fovea to the object. Such a visual direction is the locus of all points fixed relative to the eye whose images stimulated a given point on the retina. The visual direction is of two types, oculocentric and egocentric. Oculocentric direction is a monocular phenomenon where the image of a stimulus is formed on the retina with respect to the fovea. The fovea being the center of the highest visual acuity, has primary visual direction while the all other retinal points carry secondary visual direction. When we look at an object, the object is imaged on the fovea. Other objects imaged above the fovea are seen as “below” and those images below the fovea are seen as “above”. Visual sense of direction is organised about the fovea (figure 1a). According to egocentric direction, two corresponding retinal points on separate stimulation appear to have the same visual direction (figure 1b). Egocentric direction is determined by retinal position, proprioceptive information about the eye, head and body position and the vestibular apparatus. All this information allows us to determine if a change in retinal position is due to object movement or due to eye or head movement.

Objective and subjective space

The terms location of an object and localization of an object are two different entities. Location is the position of the object in the physical (objective) space while localization is in the subjective space that is where the observer perceives it to be. Objects which are separated in physical space may have an identical subjective space.

Retinal correspondence

Two retinal points are said to correspondent when they are equidistant from their respective foveolas of two eyes and have identical visual directions (figure 2). When we look at an object it stimulates the corresponding points or areas on two different retinas which give rise to perception of a singular vision. This single vision is assumed to be representation of image formed by the cyclopean eye (figure 2b). An object stimulating to non correspondent points (disparate points) will cause physiological diplopia.

Horopter and Panum’s area of fusion

Aguiloniusin (1613) described horopter as the horizon of vision. A horopter is the locus of all points in the physical space which stimulate corresponding points on the two retinæ. When the two foveæ focus on a given object, there are other object points in
space that are also focused on corresponding points on the two retinae. Joining all of these the locus will be a circle passing through the fixation point and the pupil of the two eyes. This locus of points have zero binocular disparity. This imaginary circle is called the Vieth Muller circle (figure 3). Horopters found experimentally do not coincide with the theoretical horopters, as such they are called as empirical horopters. It has been seen that for an empirical horopter there is a certain distance ahead and behind the horopter where diplopia is absent. This area is called the Panum's fusional area. It is thicker peripherally and thinner centrally. Panum's area at the fovea is of the order of 5 deg of arc only. As retinal disparity in the horizontal meridian is more easily overcome than the vertical disparity hence logically the Panum's area must be an oval with a longer horizontal diameter. Any object stimulating the disparate retinal points can still be perceived as single by the virtue of fusion of image formed is located in Pannum's area. Pannum's area not only allows for fusion but also provides gross stereopsis for the images falling in this area.

**Fusion**

Fusion is the ability of the two eyes to create a composite image out of two similar looking images. To visualize an object as singular perception the two eyes require sensory fusion and motor fusion.

**Sensory fusion**

Sensory fusion is by the virtue of retinal correspondence. As discussed earlier that when an object stimulates corresponding points on two different retinae it is seen as one. So what happens when two different objects stimulate the corresponding retinal areas? If the objects are similar in size, shape, contour brightness, colour and sharpness they will be fused and seen as one. And difference in size, colour or contour may lead to retinal rivalry.

**Motor fusion**

The sensory fusion occurs only when the images of two similar objects fall on the corresponding retinal areas or in the Panum's fusional area. So when the image is formed lies in the periphery the two eyes align themselves in such a way that the image now falls in Panum's area and sensory fusion is maintained. Thus motor fusion is the ability of eyes to align themselves is such a manner that the sensory fusion is maintained. The ability to maintain motor fusion is deficit in cases of extraocular muscle palsies therefore diplopia is present in such cases. Motor fusion is required only when the images fall on non foveal point and no stimulus is required when the images fall on the fovea of each eye.
Retinal Rivalry

When two objects with dissimilar size, shape or contour are presented to corresponding retinal points the sensory fusion becomes impossible and confusion occurs. To avoid this rivalry and confusion alternating suppression of the two eyes occurs resulting in alternating perception of the two images (figure 4).

Stereopsis

Stereopsis is the ability to appreciate the third dimension to objects. It requires two slightly dissimilar images of the same object reaching the visual cortex (figure 5). Stereopsis is the result of stimulation of two slightly horizontal disparate retinal points. The images formed by two disparate objects fuse together to give a stereoscopic view of that object provided that the fused image lies in Panum’s area of fusion. This is achieved due to the physiological interpupillary distance which causes the two eyes to look at the same object from slightly different angles. The retinal disparity is required for stereopsis or else the image falling within the horopter is perceived as flat. The greater the disparity greater is the depth effect. Stereopsis that can be resolved by minimal horizontal separation is known as stereoacuity. Stereopsis can be global or local.

Global stereopsis

Global stereopsis is slow neural process which requires the matching of many disparate points across the foveal visual field. The point to point combinations give rise to finer and precise perception of depth.

Local stereopsis

Local stereopsis is a quicker process that requires matching of only few foveal locations & produces a cruder perception of depth.

Theories of Binocular Vision

The recent concepts of binocular single vision are based on correspondence and disparity of retinal points. Hubel and Wiesel have given the neurophysiologic basis of binocular vision and stereopsis.

Theory of Correspondence and Disparity

According to this theory the binocular vision depends upon the stimulation of corresponding or disparate retinal points. When two corresponding retinal points are stimulated simultaneously they give single binocular vision. When these points are stimulated by two similar objects the fusion occurs and stimulation by two different objects leads to retinal rivalry. When an object stimulates two disparate retinal points that lie within Panum’s area of fusion it results in depth perception of that object, as the retinal disparity increases and image lies beyond the Panum’s area diplopia occurs. The above physiology of binocular vision can be explained on the basis of retinal correspondence and disparity.

Neurophysiology of binocular vision

Huber and Wiesel classified neurons into four classes viz. binocularly corresponding, monocular right, monocular left excitatory and binocularly disparate. According to their theory, when a stimulus is moved away from conjugate points on the retina to disparate points, after a particular distance, fusion breaks and diplopia manifests. At corresponding points, the classes of neurons excited are binocularly excitatory, monocular left and monocular right excitatory. When a slight disparity is introduced, the binocularly corresponding neurons cease to fire, the binocularly disparate start firing. But as both monocular groups of neurons are also firing, there is still a perception of a single fused image. This binocular vision in presence of a slight disparity in the images of the two retinae is based on the presence of the Panum’s area of fusion. When the disparity is beyond the Panum’s area of fusion, the visual direction of the two retinae is grossly different and they different directions manifest as diplopia.
**Stereopsis-Clinical Evaluation**

**Rohit Saxena MD, Swati Phuljhele MD, Vimla Menon MD**

Stereopsis is the appreciation of depth due horizontal disparity between stimulated retinal points located in the Panum’s area of fusion. If we consider an object point which is in front of the fixation point within the Panum’s area of fusion, it will elicit temporal disparity. This disparity will give a sensation of that object being located in a proximal plane to the fixation object. Similarly an object located behind the fixation point but still in the Panum’s area of fusion will elicit nasal disparity and give a perception of the object being located behind the fixation object. In both the conditions it follows that if the Panum’s area of fusion is crossed then diplopia will be elicited. Fusion is not a prerequisite for stereopsis. But most points on a stereogram should be fused so that it forms a plane of reference for eliciting stereopsis. Stereopsis may be fine upto spatial disparities of 0.5 degrees or coarse upto 7-10 degrees of disparity. Stereopsis that can be resolved by minimal horizontal separation is known as stereoacuity. The mean stereoacuity with normal binocularity is 20 seconds of arc with standard deviation of ± 10 sec arc. Most of the clinical test that have been used to measure stereopsis have 40 sec arc as cut off between normal and abnormal stereopsis.

**Principle of stereotests**

Stereopsis is based on disparity which is created artificially for the test used for measuring stereopsis. The basic mechanism is dissociation of two eyes so each eye gets a slightly different view of the same object and then fuses to form a single image with third dimension.

**Haploscopic principle**

In this principle the dissociation is achieved by placing angled mirror in front of each eye so that right eye sees the right temporal field while left eye sees the left temporal field. This principle is used in synaptophore and stereoscopes (figure 1).

**Anaglyph**

A stereogram in which dissociation of image is produced by using colour is known as anaglyph. The anaglyph consists of stereo paired object formed by using conjugate colours like red and green (figure 2). These objects when viewed with special glasses, one lens being coloured red and the other coloured green a three-dimensional scene is perceived. The test based on this principle is TNO test.

**Vectographic principle**

The vectograph permitted two stereo paired pictures developed in such a way that light passing through one is polarized in one direction while light passing through the other is polarized in the other direction. This permits a viewer to use special glasses consisting of Polaroid filters to see the three-dimensional scene. Vectography has the advantage over anaglyphic photography that avoids the annoyance of seeing the red-blue tint in the scene. This principle is used in tests like Titmus fly test and Randot stereopsis test.

**Panographic principle**

This stereogram is real depth stereogram, which incorporates of cylinder or prism, in its pattern, that will cause the deviation of the image to give real time depth perception. Lang’s test is based on this principle.

**Stereoscopic stimuli**

**Line or contour stereogram**

These targets have monocular edges that are separated on a background to produce disparity. They measure local stereopsis, e.g Titmus fly test.

**Random dot stereograms**

Julesz proposed the concept of random dots forming a vectograph. The stereogram consists of randomly arranged dots in such a way that there is a lateral shift of central core of dots (figure 3), lines, patterns, which give rise to stereoscopic view while the stereoscopic form or background itself has no edge differentiation. Any shape can be generated with random dots. These stereograms measure global stereopsis. The random dot stereograms are used in Lang’s stereopsis test, TNO test, Randot tests.
Real Stereopsis test

Frisby Davis test

The Frisby test is different from previous stereotests in its principle. While in those tests the stereoscopic effect is artificially produced by superimposing two dissimilar pictures and dissociation of eyes by polarized or red and green glasses was required to test stereopsis, the Frisby test presents targets which are actually ‘in depth’. The targets are printed on the two sides of transparent plexiglass plates of different thicknesses (figure 4). There are three plates, 1mm, 3mm and 6mm thick respectively. Each plate has printed on it four random-texture patterns and ‘hidden’ in one of these is a circular shape. The patient has to decide in which pattern the hidden shape lays a task that can be done successfully only if stereopsis is present. In this case it is the difference between the two levels, related to the distance from the observer, and the PD, which gives the measure of the stereo acuity. As there are four patterns on each plate, they can be presented in any one of four positions and with either side facing the patient, so that the small area may appear in front of or behind the level of the surrounding pattern. This reduces the possibility false positive response from the patient. The test can be held at any of six distances, from 30cm to 80cm, the distance being controlled by the use of a tape attached to the test and held by the patient against the check. The six positions, combined with the three thicknesses of plates, provide 18 values of stereo acuity, ranging from 880 seconds of arc to 20

Langs Stereopsis test

The Lang Stereotest was created to simplify stereopsis screening in children. It is based on two principles: random dots and panoramic principle. It is composed of fine cylinder grating on which random dots are imprinted. There are three stereoscopic shapes, cat, star and car which measure stereopsis of 1200, 600, 550 seconds of arc respectively. In the new Lang II test, the random dots are smaller and less dense. This disparity is finer, namely 200 seconds of arc for the moon and the star, 400 for the car, and 600 for the elephant. The test is administered at 40 cm exactly at right angle to remove monocular clues. The major advantage of the test is that it does not require any special glasses but difficulty in recognition of form and monocular parallax clues are major disadvantages.

Vectographic test

Titmus stereo test

The test consist of vectographic stereograms which has contour pattern that use crossed polarized filters locates at axis 45° and 135° infront of either eye. The test consists of three parts (figure 5). The fly test consists of a picture of a large housefly. It is used for small children. The child is asked to pick a wing of the fly. In presence of gross stereopsis, he will attempt to hold at a level above the plane of the book. It is a test for gross stereopsis about 3000 sec of arc.

The animal test is performed if gross stereopsis is present. It has three rows each having a picture of five animals. In each row one animal is imaged disparately and as a misleading clue one animal is also printed heavily. The disparate images account for thresholds of 10, 200 and 400 sec of arc respectively. A patient with stereopsis

Figure 3: Arrangement of Random Dot Stereogram with the lateral displacement of central core

Figure 4: Plexiglass plate of Frisby David Near Stereotest

Figure 5: Titmus Fly Stereotest
feels the particular disparate image to be standing out while the one with no stereopsis feels the heavily marked animal to be standing out.

The circle test consists of nine squares each having four circles. In each square one circle is disparately imaged. The patient is asked to point out the circle which stands out. The square in which he finds no circle standing out is the limit of his stereoacuity. It tests a range of stereoacuity from 800 to 40 sec of arc. It's the most widely used test as it is easy to administer but sometimes false presence of stereopsis can be elicited as some patients may point out to the specific disparate images as they look different from the rest and not due to stereopsis.

Randot stereotests

Randot stereotest is similar to Titmus fly test except that the stimulus for pattern used is a random dot stereogram rather than the contour stimulus as. This theoretically removes the lateral displacement cue found in the Titmus fly test. The test has three parts (figure 6). The right hand side has eight stereograms, all of 660 seconds of arc. The left side has circles and animal patterns interposed in random dot pattern. The various modifications of Randot test includes: Randot preschool test, Randot stereosmile test. The test is performed at 40 cm as with all other near stereopsis test.

Random Dot E test

Random E test has three cards (figure 7) that are viewed with polaroid glasses. The first card is a three dimensional model which the patient is shown for recognition. The second card has the stereo image which has to be viewed and recognized with polaroid glasses. The third card has the flat (non disparate) letter which is blank. The cards are held at 50 cm and the patient is asked to recognize the presence of stereoscopic E between the second and third card figure. Increasing the test distance gives increasing stereoacuity testing.

Anaglyph Tests

TNO test uses red-green anaglyph for viewing random dot stereograms (figure 8). It consists of a booklet with seven plates. The plates contain red and green dots on gray background thus red lens filters green light and sees red dots and vice versa. Each plate has stereoscopic as well as monocular targets that serve as control. The first three plates determine gross stereopsis (1980 sec arc) while the last four determine the stereoacuity, 480-15 sec arc. The monocular largest serve as control.

Stereotests for Distance

Distance stereotesting is proved to be highly sensitive to small refractive error changes, heterophorias and strabismus. Distance stereopsis evaluation aids in assessment of control of deviation and deterioration of fusion in cases of intermittent exotropia. Normal distance stereoacuity indicates good control with little or no suppression while deterioration in same may be an indication of surgery in such cases.

AO Vectographic Project-O-Chart Slidetest (figure 9) was first one to be devised for assessing stereoacuity for distance. The AO Vectographic Project-O-Chart Slide test uses polarising lenses on a phoropter, generating disparities from 480–30 seconds of arc. It has disadvantage of being based on principle of lateral displacement which provided monocular clues.

Mentor BVATsystem

It uses graphic capacity of a high-frequency microprocessor and liquid crystal binocular glasses. Images are alternately presented at a frequency of 60 cycles per second to each eye, using synchronized liquid crystal shutter glasses. The rapid alteration of these images allows simultaneous perception. The amount of disparity in the stereo patterns can be altered to allow a measurement as refined as 15 seconds of arc. Mentor BVAT system has provision of measuring both global and contour stereoacuity. Global stereopsis involves binocular fusion of a set of dots or lines. The distance global random dot stereogram (BVRDE test) presents a 20/320 letter E in different orientations varying from 15 to 240 sec arc. This stereogram is devoid of figure-ground clues and the patient cannot guess what the stereo figure is. Contour stereopsis involves binocular fusion of a single dot or line segment.
The distance contour circles stereogram presents four circles, one of which ranges from 15 to 240 sec arc. The latter is comparable with the Randot circles and Titmus circles. Some of the figures of the contour stereopsis test may be selected monocularly because they look different and not because they are seen stereoscopically.

**Distance Randot test**

This test is designed to evaluate 3 levels of disparity (800, 200 and 60 arc sec) using vectographic random dot stimuli and are mounted on books to be viewed through polarizing glasses. The test consists of 6 books (2 books for each level of disparity; each book containing 2 vectographs). For each disparity level, there are 3 vectographs that contain a stereotarget and 1 vectograph is blank. The stereotargets are simple geometric shapes. The subjects have to view the books at a distance of 3 m. Testing is started with the coarse disparity (800 sec of arc) and proceeded to progressively smaller disparity. To enhance testing in small children, matching cards can be provided. If the subject identifies or matches 2 out of 3 of the stereotargets, the level is passed.

**Frisby Davis 2 Test**

The FD2 test is based upon the near Frisby Stereo Test but with various modifications for distance presentations. The FD2 test comprises a box containing four back illuminated and differently shaped plastic objects mounted on rods (figure 10). These are either four animal or four geometric shapes set in a transparent frame pointing towards the observer. The shapes are translucent but sufficiently dark to obscure the rods, giving the appearance that the shapes are free floating. One shape is set by the examiner to be nearer to the observer at each presentation and the test requirement is to identify this target. The amount of disparity presented can be altered by the depth differences provided in the test which ranges from 1 cm to 13.4 cm, and by the distance of the observer from the targets. These two features provide the disparities ranging from 200–4 seconds of arc. The test has targets in form of animals which make it friendly for young children.
As modern day ophthalmologists of the third millennium we owe it to our patients to find reliable, predictable means to correct their refractive errors. But the challenge remains in the fact that most patients presenting for refractive surgery are in the prime of their productive lives and their problem could be taken care of by simple glasses or contact lenses. Any ill effects of refractive surgery could have long term disastrous complications on the entire life of an individual and hence it is important to tailor make the choice of refractive surgery to the needs of the individual patient.

For a long time refractive surgery was predominantly a single speciality procedure with initially RK, later PRK and then Lasik being the predominant procedure. Now both patients and surgeons have the ‘freedom of choice’ in the sense they can pick and choose from an array of options like RK, ALK LRI, Surface ablation procedures, Lasik, Phakic IOLs, Intracorneal inlays, Refractive Lens exchange, Bioptics etc. In this Phakic IOLs are fast gaining popularity as an alternative to laser refractive correction in higher grades of refractive error.

High Refractive Errors

Patients with high myopia (above -10 diopters) constitute only about 2% of the myopic population but 13-15% of patients presenting for refractive surgery belong to this group. It is estimated that moderate myopes (-5.00 to -10.00 diopters) are 10 times more likely to present for refractive surgery than low myopes and high myopes are 16 times more likely to present for refractive surgery than low myopes. This stands to reason because higher the refractive error more is the handicap the patient faces visually and cosmetically and hence greater is the motivation to search for methods to get rid of the refractive error.

Limitation of Lasik in High Refractive Errors

Lasik is justifiably still the most widely practiced modality of refractive surgery because of the high level of comfort, quick recovery, stable predictable results and ability to perform bilateral treatment in one sitting. But when it comes to higher grades of refractive error it has the following limitations:

- Significant residual error.
- Loss of Best Spectacle corrected Visual Acuity.
- Risk of iatrogenic Keratectasia when excessive ablation has been done or residual bed is too thin.
- Induction of tear film abnormalities.
- Induction of higher order aberrations especially spherical aberration, which leads to poor contrast sensitivity, limitation of night vision and diminished quality of vision.

Advantages of Phakic IOLS in High Refractive Errors

- Excellent refractive accuracy even with significant astigmatism.
- Preservation of corneal sphericity and hence quality of vision.
- Preservation of accommodation which is lost with refractive lens exchange.
- Predictable healing.
- Rapid visual recovery.
- Stable post-operative refraction.
- Being an additive procedure and not subtractive like laser vision correction, phakic IOLs are reversible and adjustable.
- No initial investment on costly equipment like a lasik unit is necessary. Having said that, no patient walks into a clinic asking for phakic IOLs. They usually come for laser vision correction (LVC) and it is the surgeon who motivates for phakic IOLs since LVC may not be suitable. Hence LVC and phakic IOLs are complimentary to each other and access to both is necessary.
- The technique of implanting a phakic IOL is similar in many ways to phacoemulsification and a good anterior segment surgeon can easily incorporate it in his practice.

Disadvantages of Phakic IOL

- Though the first Phakic IOL procedure was performed in 1953 and the iris clip phakic IOLs have been in use since 1988 long term data is somewhat sparse.
- Because of the limited space available to carry out the surgical maneuvers the learning curve is steep and requires significant surgical dexterity.
- Cost of the imported phakic IOLs is very high. Indian versions of these lenses at lesser price are becoming available.

Challenge in Phakic IOL Surgery

In conventional cataract surgery the crystalline lens which measures about 5 mm in the anterior posterior diameter is removed and we have about 8 mm space, when the eye ball is filled up, between the corneal endothelium and the posterior capsule to carry out all our surgical maneuvers. In phakic IOLs since the normal crystalline lens is retained there is only 3 mm space between the corneal endothelium and the anterior capsule of the crystalline lens within which all steps have to be carried out without damaging the corneal endothelium, angle of the anterior chamber, iris, pupil and lens. (Figure 1)

Indication for Phakic IOLS

Any refractive error which is in unsuitable for LVC could be considered for phakic IOLs. There are surgeons who consider...
LVC to be inappropriate beyond -8 diopters. Our indications are:

- Myopia beyond -12D
- Hyperopia beyond +4D
- When the initial corneal thickness is less than 480 microns.
- When the residual bed after lasik is likely to be less than 280 microns.

**Phakic IOL - Options**

There are primarily three sites of fixation.

a. **AC Angle - BAIKOFF, NUVITA lenses**: Have been largely given up because of complications like progressive pupillary distortion, UGH Syndrome and corneal decompensation. At present Alcon is conducting trials with an angle fixated IOL which may become available for clinical usage shortly. (Figure 2)

b. **Iris fixated IOLs**: Originally designed by Jan worst and named Lobster claw lenses and subsequently renamed as ARTISAN lenses and now marketed as VERISYSE. At present phakic IOLs of this design are also manufactured by some Indian Companies.

c. **Posterior chamber**: These are placed in the posterior chamber just in front of the normal crystalline lenses. The common models are STAAR ICL (Implantable Contact Lens) and PRL of which the ICL is more widely used. (Figure 3)

**Optical Advantages of Phakic IOLS**

The phakic IOLs are placed much closer to the nodal point of the eye. Hence the effective optic zone of the phakic IOL is 1.25 times on the corneal surface. That is, a phakic IOL of 5mm optic size will have an effective optic zone of 6.25 mm on the corneal surface. (Figure 4)
We are all familiar with the slight improvement in visual acuity some patients experience after surgical correction of higher grades of myopia. This is primarily because of the minification effect of the concave spectacle lenses being dispensed with. The improvement in visual acuity that patients experience after phakic IOL implantation is even more, again because of the optics of the phakic IOL being close to the nodal point of the eye.

Since cornea is untouched quality of vision is better after phakic IOL implants than LVC.

**Presequisites for Phakic IOL**

Laser Vision Correction (LVC) is simpler and more easily accepted by patients than phakic IOLs. So phakic IOLs are essentially indicated in patients where LVC is not possible or controversial i.e.

- Beyond - 12 D or +4D.
- When initial corneal thickness is less than 480 microns.
- When lasik in that particular eye will leave behind less than 270 microns in the residual bed.
- Forme Fruste cases of keratoconus where performing LVC may dangerously weaken the cornea. Even phakic IOLs are better avoided where keratoconus is established.

Patients beyond the age of 18 years and refractive error stable for at least one year.

Endothelial cell count > 2000/sq mm.

AC depth (Corneal endothelium to anterior capsule) more than 3mm.

**Power Calculation for Phakic IOLS**

There are 3 parameters that are essential for phakic IOL power calculation.

- Spectacle power at vertex distance of 12mm.
- AC depth.

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**Figure 4:** Effective Optical Zone: At the corneal plane is $1.25 \times$ the optic zone of the lens.

**Figure 5:** Verisyse and ICL power calculation charts
• Horizontal and vertical radii of curvature of cornea.

In case of IOLs horizontal white-to-white diameter measured with a calipers under a microscope and verified with an orbscan is important to get the appropriate sizing of these lenses. Sizing of the posterior chamber phakic IOLs is extremely important for getting the appropriate vault and separation between the back of phakic IOL and the anterior capsule. In iris clip lenses, one size fits all, and sizing is not important. These measures are at present sent to the manufacturer and they calculate the exact power of the phakic IOL and dispense it. (Figure 5) For iris clip lenses the Vander Heijde formula is used. Software and nomograms are also available for the surgeon to calculate the power and tweak the powers according to their preferences.

Phakic IOL - Options

The two currently available options in India are the VERISYSE (iris clip lenses) and the ICL (posterior chamber lenses) and their characteristics will be briefly discussed here.

Verisyse - Iris Clip Lenses (Figure 6)

These lenses are made of PMMA and have an overall diameter of 8.5mm. In the power range from -3D to -15.5D they are available in 6mm optic size while between -15.5D to -23.5D and +1D to +12D they are available with 5mm optic size. Toric versions have become available now. The foldable version (Figure 7) with silicon optics and PMMA haptics which can be introduced through a 3mm incision can also be obtained.

The surgery is done under peribulbar (Risky with the large myopic eyes but more comfortable for the surgeon and patient since the iris needs to be handled) or topical. The one-step that needs is to be mastered while implanting these lenses is the process of enclavation of the iris which should be adequate and significant to avoid displacement of the IOL in the postoperative period. The enclavation can be done with a needle (Figure 8) which comes with each phakic IOL or with a forceps.
High molecular weight viscoelastics is recommended since they not only provide good space but can also be evacuated completely at the end of surgery.

**ICL or Implantable Contact Lens**

They are made of highly biocompatible collagen copolymer with a refractive index of 1.45. They are available in powers from -2D to -20D and +1D to +10D. The toric version which is available with the myopic powers can correct up to 6D of astigmatism. The IOLs are extremely thin with the optic centre measuring in thickness (Figure 9) about 50 microns and the haptics 500-600 microns. The overall diameter varies between 11.5 to 13mm (4 sizes) and the sizing depends on the white-to-white measurement. (Figure 10)

The loading of these lenses has to be extremely precise and there are markers (different for the spherical and toric versions - Figure 11) to indicate and assist in proper placement of these lenses. Surgery is done under topical or peribulbar with the pupil fully dilated and preferably through a 3.2 mm temporal clear corneal or near limbal incision. (Figure 12)

Low molecular weight viscoelastics like HPMC is only recommended both for loading the lenses and during the surgical
• Dysphotopsia.
• Pigment dispersion and lens deposits.

**Biometrics**

In extremes of refractive error a phakic IOL can be implanted and residual refractive error can be corrected by LVC. If it is done as a planned procedure, a microkeratome flap could be created, phakic IOL implanted and later the flap lifted for laser ablation. This is done to avoid subjecting an eye with a phakic IOL insitu to high pressure and suction during the creation of the flap.

**Conclusion**

Phakic IOLs are an important addition to the armamentarium of a modern day refractive surgeon. Though a good anterior segment surgeon can incorporate this in his or her practice there is a steep learning curve mainly because of the limited confines within which all the surgical maneuvers have to be carried out. With the toric and foldable lenses becoming available, more literature emerging on the long-term follow up of these lenses and improvement in the design of these lenses, the phakic IOLs will be a valuable adjunct in the treatment of higher grades of refractive error.

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**Complications of Phakic IOLS (Figures 16, 17, 18)**

- Endothelial cell loss and corneal decompensation.
- Cataracts.
- Anterior Uveitis.
- Secondary Glaucoma.
- Displacement of the phakic IOL.
- Decentration of IOL due to improper placement.
- Ovalisation and distortion of the Pupil.

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**Answer Quiz No. 6**

1. ISHIHARA
2. MACULÆ
3. LANTERN
4. ISHIHARA
5. PROTAÑOPIA
6. ERYTHROPÆIA

**Extra Word:** COLOUR

**Author**

D. Ramamurthy MD, DNB

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**Figure 16:** Deposits on the lens due to post op iridocyclitis

**Figure 17:** Iris atrophy at site of enclavation

**Figure 18:** Corneal edema due to secondary glaucoma
NF1 is inherited as autosomal dominant with complete penetrance, affected patients have a 50% chance of passing it to their children. The severity of disease varies even within families with children inheriting NF from mothers having more severe disease. NF 1 has been mapped to chromosome 17q11 and NF 2 has been mapped to 22q12.

**Clinical Features**

Clinically it is divided into two forms NF1 and NF2. NF1 is the more common variant with a frequency of 1 in 3500 individuals while NF2 affects 1 in 30000 individuals. There is no predilection for race or sex. Clinical signs may not appear until late childhood or early adulthood. Limited forms of disease may not be even identified.

NF is inherited as autosomal dominant with complete penetrance, affected patients have a 50% chance of passing it to their children. The severity of disease varies even within families with children inheriting NF from mothers having more severe disease. NF 1 has been mapped to chromosome 17q11 and NF 2 has been mapped to 22q12.

**Cutaneous features**

Triad of skin findings in NF1 include, café-au-lait spots, fibroma molluscum, plexiform neurofibromas. Café-au-lait spots are hyperpigmented macules on any part of the body. The number and size of these spots tend to increase as the patient ages. Histologically they are hyperpigmentation of the basal cell layer of the epidermis and show increased number of melanocytes. Freckling is also observed (90-95% of patients) frequently in NF patients. It may present with buphthalmos and ectropion. Mechanisms postulated are maldevelopment and mechanical ptosis, with the characteristic ‘S shaped deformity’ appearance. They may enlarge significantly and lead to hypertrophy of surrounding subcutaneous tissue and osseous overgrowth with resultant severe disfigurement. Worsening of cutaneous features is seen on onset of puberty and in pregnancy.

NF2 demonstrates minimal cutaneous involvement with occasional café-au-lait spots and papules.

**Central nervous system features**

NF1 presents commonly with defect in the bony orbital wall. It is due to congenital absence of greater wing of sphenoid, which may result in herniation of brain into orbit called spheno-orbital encephalocele. Optic nerve gliomas (pilocytic astrocytomas consisting of glial cells i.e astrocytes and oligodendrites) may be found in 20% of the patients. Nerve root and spinal cord neurofibromas are also seen and depending on their location may lead to neurological deficits. MRI studies have shown hamartomas which present as bright lesions in the brains of children. Affected children by school age may show learning disorders and low intelligence.

NF2 presents with bilateral acoustic neuromas. They are actually schwannomas arising from the vestibular nerve in the auditory meatus. They become symptomatic during the second or third decade with tinnitus, hearing loss and balancing problems. NF2 is also associated with spinal cord gliomas, meningiomas and neurofibromas of the nerve roots. (Endnotes)

**Skeletal and visceral features**

NF1 shows kyphoscoliosis and pseudoarthroses. (fractures that do not heal) commonly of tibia. Enlargement of sella turcica may be seen. Hamartomas of the gastrointestinal tract may lead to intestinal obstruction. Pheochromocytomas occur ten times more frequently in NF patients.

**Ocular features**

Following are the ocular features found in NF1:

Lisch nodules or iris melanocytic hamartomas are a dominant feature. They are raised, smooth surfaced, dome-shaped lesions of the iris. Usually bilateral, clear or tan brown and may be located anywhere on the iris surface or deep within the iris stroma. They vary in size from minimally visible to 2 mm in diameter. Iris hamartomas are rare.

Plexiform neurofibromas of the upper eyelid present as thickening and mechanical ptosis, with the characteristic ‘S shaped deformity’. In severe cases, it may extend to the temporalis fossa and cheek. Ipsilateral congenital glaucoma is commonly seen with upper eyelid neurofibromatosis. It may present with buphthalmos and ectropion of the upper eyelid. Mechanisms postulated are maldevelopment and infiltration of the angle or ciliary body and choroids by hamartomatous tissue.

Involvement of neural crest derived cells which include, prominent corneal nerves, nevus of Ota, choroidal melanoma, and choroidal...
hamartomas. A choroidal naevus in patients of NF1 is at high risk of developing choroidal melanoma.

Proptosis results from optic nerve glioma, orbital neurofibromas or defect in the bony orbital wall is due to congenital absence of greater wing of sphenoid resulting in herniation of brain into orbit and pulsatile proptosis.

Visual morbidity is usually due to glaucoma or optic nerve gliomas manifesting as unilateral decreased visual acuity, strabismus, mild proptosis or optic atrophy. CT films show fusiform enlargement of the orbital, canalicular or chiasmal portions (causing see-saw nystagmus) of the optic nerve. Presence of kinks in neuroimaging is the hallmark of gliomas.

Following are the ocular features found in NF2:
Presenile cataracts are found in up to 85% of patients. Plaque like posterior subcapsular or cortical cataracts in patients less than 30 years hint at a diagnosis of NF2.

Figure 1: Plexiform neurofibromatosis involving the left upper eyelid, cheek, temporalis fossa and forehead, prior to and post debulking with levator muscle resection surgery at 2 months of follow-up.

Figure 2: Plexiform neurofibromatosis involving the left upper eyelid, prior to and post debulking surgery at 1 week.

Figure 3: Plexiform neurofibromatosis of the left upper eyelid with café-au-lait spots.
Fundus involvement include, macular or paramacular epiretinal membranes, combined retinal and retinal pigment hamartomas.

Meningiomas of the optic nerve sheath have been observed in children with NF2. It tends to be a more aggressive variant of the adult form. CT shows tubular thickening with 'railroad tracking' and calcification.

Ocular motility may be restricted in a few cases.

Rarely, optic nerve gliomas, unilateral lisch nodules, neurilemomas may be associated.

Management

Early diagnosis and genetic counseling are important in the management of NF. Routine examinations looking for lisch nodules, glaucoma, cataracts, optic nerve and retinal lesions and should be advocated in patients with a positive family history.

MRI with gadolinium enhancement is the preferred technique for imaging brain, spinal cord, and other neural tumors in NF1 & 2. Hamartomas enhances on T2 weighted images.

Treatment of cutaneous and eyelid lesions includes debulking and...
reconstructive surgery but long term results can be frustrating due to recurrence. Associated ptosis may get corrected to some extent by levator muscle resection.

Presenile cataracts (NF2) should be removed at the earliest as these patients may already have hearing loss due to acoustic neuroma.

Glaucomas should be detected early and monitored by antiglaucoma drugs and visual fields

Retinal lesions are not usually progressive but if significant growth or exudation develops laser and cryotherapy or surgery maybe done.

Removal of acoustic neuromas is challenging as it risks damage to the facial and cochlear nerves.

Gliomas and meningiomas require observation with vision, visual fields and neuroimaging. Treatment is variable depending on the extent and requires consultation with an oncologist and radiotherapist.

**Prognosis**

Orbito-temporal neurofibromatosis may require repeated surgical interventions. Visual prognosis is related to the presence ocular features. Patients with mild form of disease have a good quality of life. Prognosis becomes guarded when the disease is associated with central nervous system or malignant tumors.

### Diagnostic Criteria for Neurofibromatosis Type 1

The Patient should have two or more of the following:

- Six or more café-au-lait spots
  - Each 0.5cm or larger in prepubertal individuals
  - Each 1.5cm or larger in postpubertal individuals
- Two or more neurofibromas of any type or one or more plexiform neurofibroma.
- Freckling in the axilla or groin
- Optic nerve glioma
- Two or more Lisch nodules of the iris
- A distinctive bony lesion
  - Dysplasia of the sphenoid bone
  - Dysplasia or thinning of long bone cortex
- A first degree relative of NF type 1

### Diagnostic Criteria for Neurofibromatosis Type 2

**Following Clinical Features Indicate Definite NF-2**

- Bilateral vestibular schwannomas (acoustic neuromas) or
- First degree relative of NF2 plus
- Unilateral vestibular schwannoma appearing before age 30yrs.
  - Or any two of the following: Meningioma, Glioma, Schwannoma, Juvenile Posterior Subcapsular Lens Opacities/ Juvenile Cortical Cataract and Combined Hamartoma of Retina.

**Following Clinical Features Indicate Probable NF2**

Unilateral vestibular schwannoma appearing prior to the age of 30 yrs. plus at least one of the following: meningioma, glioma, schwannoma, juvenile posterior subcapsular lens opacities/ juvenile cortical cataract and combined hamartoma of retina. Or

Multiple meningiomas (two or more) plus unilateral vestibular schwannoma appearing prior to the age of 30 yrs or one of the following: glioma, schwannoma, juvenile posterior subcapsular lens opacities/ juvenile cortical cataract and combined hamartoma of retina.

### References

6 years young computer professional male presented with sudden decrease in vision for the last two days. Visual acuity recorded was finger counting close to face in the right eye and 6/6 in the left eye. Anterior segment was normal in both the eyes and so was fundus examination in the left eye. Right eye fundus showed a large subhyaloid hemorrhage covering the whole of the macula (Figure 1).

Conservative treatment option was discussed, but patient’s occupation necessitated early visual rehabilitation. Hyaloidotomy option was then discussed with the patient and he opted for it. Hyaloidotomy was done in the most dependent part of the hemorrhage using double frequency YAG (532nm). One minute after hyaloidotomy he felt better and his vision improved to 5/60 (Figure 2) and after 10 minutes his vision was 6/36 (Figure 3). After 2 hours he regained vision of 6/9 in his right eye (Figure 4).

Although subhyaloid hemorrhage carries a good prognosis with conservative treatment but at times hyaloidotomy can be considered for faster visual rehabilitation. The only problem which hyaloidotomy can sometimes lead to is conversion of subhyaloid hemorrhage to intragel hemorrhage which may cause troublesome floaters.
A 45 year old female presented with horizontal and vertical diplopia of acute onset for past one month and asymmetrical drooping of both upper lids, right for 10 days and left for 5 days. The diplopia progressed for a couple of days and then stabilized. No diurnal variations or remissions were noted. She had a complete droop of the right upper lid and a partial droop of the left. There was no redness pain or protrusion of the eyes, no visual symptoms and no history of trauma. No history suggestive of hypertension or diabetes or any other systemic illness was elicited including any drug intake. There were no such previous episodes.

Unaided visual acuity was 6/6 both eyes Head posture was erect and facial symmetry was maintained, pseudoptosis was present in left eye. On manually elevating right ptotic upper lid , left eye lid began to droop (see-saw ptosis). Worsening of ptosis was present on prolonged up- gaze. On application of ice to right eye upper lid for two minutes there was improvement of 3mm in ptosis (ICE TEST). Orbicularis function was weak in right eye but typical Peek sign was not present (figure 1).

She had 46 prism diopter [PD] exotropia and 24 PD left hypertropia [LHT] in primary position [PP]. The ocular motility was akin to right superior division 3rd nerve palsy and left inter nuclear opthalmoplegia. There was no primary position or end gaze nystagmus Force duction test was negative in both the eyes. FGT revealed a paretic left medial rectus. Pupils were normal in size and reactions .There was trace intorsion in both eyes by indirect ophthalmoscopy.

Her random and postprandial blood sugar was 224 and 286mg/dl respectively ACh RAb titre were found to be. Rapid nerve stimulation test [RNS] and neostigmine test clinched the diagnosis of ocular myasthenia. Rest of the investigative work up was unremarkable including her thyroid profile. A diagnosis of Ocular Myasthenia with Non insulin dependent diabetes mellitus was made She was started on oral Pyridostigmine 30 mg 5 times a day, tab prednisolone 40 mg per day and oral metformin Ptosis recovered almost completely in a week's time and ocular motility took 3 weeks for similar recovery (Figure 2).

Three decades ago, acetylcholine receptor antibodies [AChRAB] were discovered in myasthenia gravis resulting in grouping of the disease as sero-positive [SPMG] or seronegative [SNMG]. Many other antibodies have been discovered in SNMG like anti MuSK, antitin, antiactinin, anti Ryan dine. Many differences in clinical presentation, response to therapy and prognosis have been documented between SPMG and SNMG subtypes. SPMG with AChRAB seems to be associated with higher risk of other auto immune disorders like thyroid disease, Diabetes Mellitus and many others. Upto 18 percent of SNMG patients have been shown to harbour either type 1 or type 2 Diabetes Mellitus in one study. SPMG patients are more likely to have ocular myasthenia. The dramatic response to systemic steroids in this case points towards the presence of antibodies like AChRAB. Ocular myasthenia is other wise known to respond poorly to medical treatment with anticholine esterases.

While evaluating oculomotor nerve palsies in a diabetic, which are usually due to ischemia or midbrain stroke, the rare possibility of ocular myasthenia should be kept in mind, especially if the presentation is atypical and simulates superior division 3rd nerve palsy or inter nuclear opthalmoplegia along with some amount of ptosis and papillary sparing. The response to medical treatment in the form of systemic steroids and Pyridostigmine may be dramatic, justifying a therapeutic trial in such cases. The deleterious effect of systemic steroids on glycemic control however should be kept in mind and monitored.

Contributed by
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www.dosonline.org
**Reconstruction for a Recurrent Meibomian Cell Carcinoma**

*Shaloo Bageja DNB, A.K.Grover MD, MNAMS, FRCS*

Meibomian gland carcinoma is a rare eyelid tumor comprising less than 1% of all eyelid malignancies in the western world but is more often seen in Asian populations. It can arise from the meibomian glands of tarsus or gland of Zeiss and occasionally from caruncle or eyebrows.

Reconstruction of large eyelid defects following tumor excision is challenging and requires thorough knowledge of eyelid anatomy. Variety of techniques are available to repair large to total eyelid defect like Cutler-Beard flap, tarsoconjunctival flap, eyelid graft and medial or temporal forehead flap. Excellent results can be obtained by adapting one of these procedures, as appropriate to a given eyelid defect.

We report this case to demonstrate the difficulties involved in reconstruction after excision of a recurring tumor.

**Case report**

A 68 year old lady presented to the outpatient department of our hospital with a mass in right upper lid for 8 months. The mass had gradually increased during this period but was asymptomatic till the last two months when she developed watering and foreign body sensation in the right eye. There was no previous history of recurrent swellings of eyelids, trauma, previous surgery or any other malignancy.

She wedge biopsy elsewhere a month ago. Histopathology showed a Meibomian gland carcinoma.

**Examination**

General examination was within normal limits. There was no lymphadenopathy. Ocular examination revealed best corrected visual acuity of 6/12 in both eyes. Extraocular motility was full. Pupils were reactive and fundus was normal.

Eyelid showed thickened tarsal plate (Figure 1) with conjunctival ulceration and a mass of 22 mm x 11mm in size. The swelling involved lateral canthus. On palpation, it was firm in consistency. The lid margins were ulcerated along with loss of cilia (Figure 2).

**Investigations**

A screening for metastasis was performed. Results of complete blood picture, ESR, renal and liver function tests were normal. Chest X-ray was normal. MRI imaging was done to rule out intraorbital extension.

**Primary Repair**

A wide surgical excision with frozen section control with reconstruction of lid under general anesthesia was planned.

**Steps of surgery**

A temporal forehead flap and tarsoconjunctival flap from lower eyelid were used to reconstruct the anterior and posterior lamina respectively of the upper eye lid. (Figure 3(a)-3(m)).

A second stage surgery was undertaken after 6 weeks for division of the tarsoconjunctival flap and formation of lid margin (Figure 4).

The patient was followed up every month for three months and then every 3 monthly. After a year, she presented with a nodular, firm swelling about 7mmx6mm in size in the lateral one third of lower lid (Figure 6). It was clinically diagnosed as a recurrence of meibomian cell carcinoma.

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*Figure 1: Thickening of tarsal plate involving almost whole of the right upper lid along with lateral canthus*

*Figure 2: Ulceration of eyelid margin with conjunctival ulceration*
Figure 3(a): excision of tumor with 4 mm clear margin

Figure 3(b): Stage II primary procedure - division of flap

Figure 3(c): Frozen section confirmed meibomian cell carcinoma and margin was free of tumor cells

Figure 3(d): marking of tarsal conjunctival flap, 4 mm away from lower eyelid margin

Figure 3(e): showing tarsal conjunctival flap

Figure 3(f): suturing of tarsal conjunctival flap with remaining conjunctiva in the upper lid

Figure 3(g): separation of levator muscles from surrounding tissue for its anchorage to the forehead flap

Figure 3(h): anchorage of lower lid to the lateral orbital rim by double armed 5/0 prolene suture to form the lateral canthus

Figure 3(i): marking of superficial temporal artery based flap

Figure 3(j): undermining of flap from the subcutaneous tissue

Figure 3(k): anchorage of levator fibres to the flap
After a complete metastatic work up she was again taken up for wide surgical excision with frozen section control with an eyelid reconstruction.

**Repair following excision of Recurrent tumor**

Tumour excision was done with 4mm clear margin [figure 6(a)-6(b)].

Mass was sent for frozen section and margins were reported free of tumour cells. As forehead flap and tarsconjunctival flap from lower lid were already utilized for reconstruction of whole upper eyelid defect in the primary repair. A Mustarde's Cheek Rotation Flap (Figure 7a & b) with Tarsalconjunctival graft from left upper lid was planned.

The patient is being followed closely and is free of any tumor recurrence till date.

With Mustarde's cheek rotation flap and tarsalconjunctival graft from the other eye it was possible to reconstruct the lower lid with...
sufficient functioning for protection of globe. The cosmetic appearance were also satisfactory (Figure 8).

**Discussion**

Full thickness reconstruction of more than half of eyelid is a surgical challenge. Goal of reconstruction is to replace both the anterior and posterior lamella of the eyelid. Such a reconstruction requires a functional as well as aesthetic improvement in the long term. It can be achieved by using a combination of flap and grafts.

Various options available are sliding tarsoconjunctival flap, Posterior lamellar graft with local myocutaneous flap, Cutler Beard (Bridge flap), Median Forehead Flap and Temporal Forehead flap.

We preferred temporal superficial artery based flap in our case in the primary repair as there was total loss of upper lid following tumor excision. They provide an excellent vascular supply. The procedure is cosmetically acceptable, in terms of colour of skin and movement of lids with adequate palpebral aperture. Though it seems to have bulky upper lid with less mobility.

Pillai Pemi et al\(^3\) suggested surgical reconstruction mobilizing local compound pedicle flaps, incorporating well defined 100% take with acceptable cosmetic appearances and no re-currence of the malignancies\(^3\).

Patrinely et al\(^4\) showed use of mucosalized tarsal graft with bipedicled myocutaneous flap for total or near total upper lid defects. It has the advantage of being physiologically similar tissue, single stage and acceptable contour and closure.

Recurrence with meibomian cell carcinoma may vary from about 6-29%\(^5\) with a reported median time of 9 months\(^6\). In our case...
patient showed recurrence after a year. Surrounding tissues were already utilized in primary repair, we adapted Mustarde cheek rotation flap with tarsocconjunctival graft from other eye for repair of a recurrent tumor.

**Conclusion**

The surgeon should have a thorough knowledge of eyelid anatomy and be well versed with the available techniques. Technique of reconstruction should be chosen on the basis of the extent of the tumor and the specific needs of the patient. The purpose of presenting this case was to highlight the difficulties encountered in cases of resurgery where surrounding tissue has already been utilized in primary repair.

**References**


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**Nominations for Dr. P.K. Jain Oration & Dr. S.N. Mitter Oration**

Nominations are invited for a distinguished Ophthalmologist of long standing and who is a voting member of the Delhi Ophthalmological Society, for the above mentioned Orations of DOS.

**Selection Procedure**

Nomination can be sent by:

1. Any of the Past Awardees
2. Any of the Past Presidents
3. At least 5 members of the Executive Committee
4. At least 15 members of the Delhi Members of DOS.

The nomination must include an introductory paragraph justifying the Nomination, a Biodata of the Nominee, a statement to the effect that the Nominee would accept the Award if awarded and would deliver an Oration of his choice at the Annual Conference of the DOS and would intimate the Society the Topic at least 4 weeks before the Conference and a typed script 15 days before. The Awardee would need to give the copyright of the text of his talk to the Society.

**Selection Process**

The selection will be made by a Selection Committee consisting of the President, Secretary and 3 senior, distinguished members from 3 different sub-specialties of Ophthalmology. The Executive Committee would take the final decision on the basis of the recommendations of the Selection Committee. The nominations must be received in DOS Secretariat not later than 5.00 p.m. on **February 7th, 2008**.

*Advance copy of the nominations may be sent by email. The hard copy must however be received in the DOS Secretariat by the last date for receiving the nominations.*
Are orthoptic exercises an effective treatment for convergence and fusion deficiencies?

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PURPOSE

To investigate whether orthoptic exercises are an effective way to influence the near point of convergence, fusion range and asthenopic symptoms.

METHODS

Seventy-eight patients met the inclusion criteria of visual acuity 6/9 or better, no history of orthoptic treatment, squint surgery or Meares Irlen syndrome/dyslexia. Information was collected from case records related to diagnosis, near point of convergence, fusion range, prism and cover test measurements and symptoms. Type, duration and frequency of exercises were also recorded. Non-parametric statistics were applied.

RESULTS

Patients ranged in age from 5 to 73 years (mean 11.9). Females outnumbered males (46:32). The diagnoses were: decompensating heterophoria (n = 50) or convergence insufficiency (n = 28; primary 27; secondary 1). Exophoria was more common (n = 65), than esophoria (n = 11) or orthophoria (n = 1). Treatments were aimed at improving near point of convergence and/or reduced fusional reserves. The mean treatment period was 8.2 months. Reduced near point of convergence normalized following treatment in 47/55 cases, and mean near point of convergence improved from 16.6 to 8.4 cm (p = 0.0001). Fusional reserves normalized in 29/50. Fusional convergence improved significantly for those with exodeviation (p > 0.0006). Asthenopic symptoms improved in 65 patients. A reduction in deviation of 5 pd or more occurred in 20 patients.

CONCLUSIONS

Orthoptic exercises are an effective means of reducing symptoms in patients with convergence insufficiency and decompensating exophoria, and appear to target the proximal and fusional components of convergence. Their role in esophoria is unclear and needs further study.

Inferior oblique muscle fixation to the orbital wall: a profound weakening procedure

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JAAPOS. 2007 Feb;11(1):17-22

INTRODUCTION

Recurrent or persistent inferior oblique overaction may occur after inferior oblique (IO) recession or anterior transposition. IO nasal and temporal myectomy and anterior-nasal transposition may result in undesirable IO palsy, exotropia, incyclotorsion, or limitation of elevation. Previous studies have shown that a rectus extraocular muscle may be profoundly weakened if the muscle insertion is reattached to adjacent orbital periosteum. We describe a reversible profound weakening surgical procedure of the IO muscle.

METHODS

A total of 10 consecutive subjects with V-pattern strabismus and/or IO overaction underwent IO orbital fixation procedure by attaching its insertion to the periosteum of the lateral orbital wall. One subject was not included because short follow-up. Five subjects with persistent IO overaction after IO anterior transposition underwent bilateral IO orbital wall fixation. Four subjects with no previous IO surgery underwent unilateral IO orbital wall fixation; 3 of these 4 subjects had superior oblique palsy with a large vertical deviation in primary position and 1 had a V pattern with asymmetric IO overaction.

RESULTS

V pattern significantly improved from 22(Delta) preoperatively to 7(Delta) postoperatively (p = 0.002). IO overaction improved from 2.5 (range, +1.5 to +4) to 0.1 (range, -2 to +3) postoperatively (p < 0.001). Six of 9 subjects had no residual overelevation in adduction postoperatively. Unilateral IO orbital fixation corrected 7(Delta) of vertical deviation in the primary position and 23(Delta) in adduction. Mean postoperative follow-up was 5 months.

CONCLUSIONS

IO orbital fixation has a profound weakening effect on the IO muscle. Advantages of this procedure include reversibility and that it can be converted into another form of weakening procedure, if required.
Refractive effect of the horizontal rectus muscle recession

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Int Ophthalmol. 2007 Jul 19

PURPOSE

To determine refractive and corneal topographic changes after horizontal rectus muscles recession.

METHODS

In a noncomparative interventional case series, 49 eyes of 27 patients were evaluated in two groups: (1) exotropic patients (24 eyes) who underwent lateral rectus muscle(s) recession, and (2) esotropic patients (25 eyes) who underwent medial rectus muscle(s) recession. Full ophthalmic examination including cycloplegic automated refraction was carried out before, 1 and 3 months after surgery. Corneal topography was performed preoperatively and repeated at 3 months postoperatively.

RESULTS

In eyes underwent medial rectus recession, there were statistically significant myopic shifts in spherical equivalent at month 1 (from +2.09 +/- 1.82 to +1.88 +/- 1.83 diopters, P = 0.03) and in astigmatic power at both month 1 (from -0.85 +/- 0.67 to -1.15 +/- 0.65 diopter, P = 0.04) and month 3 (from -0.85 +/- 0.67 to -1.16 +/- 0.65 diopter, P = 0.01). Myopic shifts were also noted following lateral rectus recession; however, there were not statistically meaningful. Significant astigmatic axis shift, which was toward against the rule astigmatism, was detected only after lateral rectus recession at both month 1 (P = 0.02) and month 3 (P = 0.02). Corneal power measured by topography was also demonstrated a statistically significant reduction (less than 0.3 diopter) after recession of either medial (P < 0.001) or lateral (P < 0.001) rectus muscle.

CONCLUSIONS

In spite of being statistically significant in some parts, the amounts of refractive and corneal topographic changes were not clinically remarkable. Therefore, it does not seem necessary to perform cycloplegic refraction early after horizontal rectus muscle recession; however, a precise refraction in all cases of strabismus should not be deferred later than 3 months.
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All members are requested to send their present address (clinic & residence), Phone numbers, Fax, E-mail address, any additions in degrees and sub-specialities for incorporating in the next edition of the DOS Members’ Directory. Please send the details latest by 25th January, 2008 to the DOS Secretariat at the address, Mail or E-mail given below:

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Secretary, Delhi Ophthalmological Society, Room No.474, 4th Floor,
Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences,
Ansari Nagar, New Delhi - 110 029
Phones: 011-65705229, E-mail: dosonlin@vsnl.net, Website: dosonline.org
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7th International Symposium on Ocular Pharmacology and Therapeutics
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Contact: Robert Nesbitt
Phone: 44-229-080-488
Fax: 44-227-322-850
E-Mail: isopt@kenes.com

April, 2008
12-16 CHICAGO
ASCRS/ASOA Symposium and Congress
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May, 2008
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18th International Visual Field & Imaging Symposium (IPS2008)
Nara, Japan
Contact: Chota Matsumoto
Phone: 81-72-366-0221 ext 3335
Fax: 81-72-368-2559
E-Mail: ips2008@med.kindai.ac.jp

June, 2008
19-22 WURZBURG, GERMANY
21st Annual Congress of the German Retina Society/
8th Symposium of Int'l Society of Ocular Trauma,
Main Topic: Ocular Trauma
Wurzburg, Germany http://www.retinologie.de

July, 2008
7-10 MONTREAL, CANADA
9th International Conference on Low Vision
Rehabilitation - Vision 2008
Montreal, Province: QC (Canada)
Contact: Beatrice Laham
Phone: 514-906-1979, Fax: 514-395-1801
E-Mail: blaham@opus3.com

September, 2008
5-7 NEW DELHI, INDIA
Biennial Meeting SAARC Academy of Ophthalmology
India Habitat Centre, New Delhi
Contact: Dr. Namrata Sharma
Phone: 011-26589810
E-Mail: namrata.sharma@gmail.com

DOS Members
If you want to VOTE in the forthcoming DOS Election, Please ensure that your correct address (office and residential) is available in the DOS secretariat by 25th January, 2008. Outstation member are not permitted to vote in DOS Election.

Secretary, DOS

DOS Members
DOS members are requested to send us their suggestions or resolutions to be discussed in the general body meeting to be held on 30th March, 2008. These will be discussed first in the executive meeting and then forwarded to General Body Meeting.

– Secretary DOS

Letter to Editor

Dear Dr. Namrata,
I wish to congratulate you for conducting one of the best Mid-term Conference in recent times. The live surgery was the best part and I hope that it is repeated in the Annual Conference too.
Keep up the good work.
Thanking you.
Dr. Ankur Sinha
Consultant, Ophthalmology,
Santokha Durlabhji Memorial Hospital cum Medical Research Institute,
Bhawani Singh Marg, Jaipur - 312015
## Anagram Time

Each of the following words is a jumbled ophthalmic or related term. There is, however, an extra letter in every set of letters. These extra letters will also form a six letter ophthalmic word when unjumbled.

So get cracking.

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Answers on page number 58

*Saurabh Sawhney DO, DNB Ashima Aggarwal MS, DNB*  
Insight Eye Clinic, New Delhi
The basic principles in strabismus surgery are re-balancing the static and dynamic forces using recession and resection procedures. Recession as a “Weakening” procedure is a misnomer as a good recession would not lead to underaction or change in excursion of globe, force generation and saccadic velocity.

The minimum and maximum recessions and resections are different for various recti, as less than minimum would be ineffective and more than maximum – beyond arc of contact, muscle acts like a retractor (gross underaction). Care to be taken while recession of LR Recession – Beware of inferior oblique inclusion syndrome, SR Recession – Take care of underlying Superior Oblique, IR Recession – Relation with Lockwood’s ligament and the inferior oblique muscle. Excessive recessions (Planned or Unplanned) may lead to palpebral aperture changes (MR & LR — Widened palpbral aperture, IR – Lower lid Ptosis, SR – Upper lid retraction.), Underaction of muscle, decreased excursion of globe or saccadic velocity.

Recession as a “Strengthening” procedure shortens the muscle, however there is no increase in muscle power.

Few points to remember

1. Recession stronger than resection.
2. Response of Medial rectus stronger than Lateral rectus (ratio of 3:2 approx.).
3. Surgical plan should not induce incomitance.
4. Do enough but do not over.
5. Be consistent.
6. Adjustments based on past surgical results.

Factors affecting outcome of strabismus surgery

1. Patient factors.
   a. Age (more effect in young).
   b. Patient’s response and tendency for adherence and scarring.
   c. Anatomic variations.
   d. Previous surgery.
   e. Larger deviation – more response.
   f. Sensory state of patient (binocularity / ARC etc).
2. Surgical plan.
   a. Desired results (over / undercorrection).
   b. Unilateral Vs Bilateral surgery.
   a. Placement of sutures.
   b. Exposure of muscle.
   c. Dissection (check ligaments, intermuscular septum) (more so with vertical recti).

Unilateral recession and resection Vs Bilateral Recession

1. Bilateral recessions
   a. Theoretical advantage (being fully reversible).
   b. No additive effect.
   c. More suitable for children under general anesthesia.
   d. Good for mild to moderate strabismus.
2. Recession-Resection.
   a. Additive effect of (approximately 25%).
   b. Good for moderate to large angle.
   c. Choice of procedure in amblyopic or poor vision eyes.
   d. suited for adult strabismus in local anesthesia.

Vertical displacement of horizontal muscles: needed in “A” or “V” patterns or vertical tropias.

Obliques to be tackled wherever necessary.

For Re-surgeries and special form of strabismus (DRS, DVD etc) there is individualized approach and no rules apply..

Ankur Sinha, MD
Santokba Durlabhji Memorial Hospital cum Medical Research

Table 1. Minimum and maximum recession of various recti muscle from their respective site of insertions

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Muscle</th>
<th>Minimum limit of recession (mm)</th>
<th>Maximum limit of recession (mm)</th>
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<td>1</td>
<td>Medial Rectus</td>
<td>2.5</td>
<td>5.5-6.0</td>
</tr>
<tr>
<td>2</td>
<td>Lateral Rectus</td>
<td>4</td>
<td>8.0-9.0</td>
</tr>
<tr>
<td>3</td>
<td>Superior Rectus</td>
<td>2.5-3.0</td>
<td>5.0</td>
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<tr>
<td>4</td>
<td>Inferior Rectus</td>
<td>2.5-3.0</td>
<td>5.5</td>
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Table 2. Minimum and maximum resection of various recti muscle from their respective site of insertions

<table>
<thead>
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<td>2.5-3.0</td>
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</table>

Table 3. Gross nomogram for primary horizontal muscle surgery in comitant strabismus (Bilateral resections are rarely done).

<table>
<thead>
<tr>
<th>Deviation in Prism Dipters</th>
<th>Exotropia</th>
<th>Exotropia</th>
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<td>Deviation in Prism Dipters</td>
<td>MR Recess &amp; LR Recess</td>
<td>Bilateral MR Recess</td>
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<tr>
<td>15</td>
<td>3.0 &amp; 4.0</td>
<td>2.5, 3.0</td>
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<td>20</td>
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<td>25</td>
<td>4.0 &amp; 5.0</td>
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<td>50</td>
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<td>50+</td>
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Each faculty can send up to three topics on any subject. Please fill up a separate form for each subject and send it latest by 15th January, 2008. Online submission will be appreciated.

Looking forward to seeing you in the conference.

Dr. Lalit Verma
President, DOS

Dr. Namrata Sharma
Secretary, DOS