Insights into Clinical Care from the Ophthalmological Press

■ **Paul Alan Harris, OD**

Abstract

Philosophical differences in clinical practice and political differences secondary to scope of practice issues between pediatric ophthalmology and behavioral optometry have led a dearth of communication between the two professions. Over time a lack of collegial dialogue has led to a widening of the gap between the professions. One way of learning how others think is to read their literature. Reading Binocular Vision & Strabismus Quarterly is one way to find out about current clinical and theoretical thinking in the group of pediatric ophthalmologists. This paper presents an abstract of the thinking from several of the most recent issues of BVSQ.

Key Words

amblyopia, bifocals, consecutive strabismus, cycloplegia, dissociated vertical deviations, emmetropization, esotropia, exotropia, extraocular muscle pulleys, full plus, hyperopia, iatrogenic illness, LASIK, myopia, partial plus, patching, surgery, strabismus

I recently began reading the *Binocular Vision & Strabismus Quarterly (BVSQ)* to become familiar with the current international ophthalmological clinical and theoretical thinking. The *BVSQ* seemed like a good place to start. What I read was not always what I had expected; many of the thoughts appear to be far more moderate.

I have extracted heavily from several of the most recent editions of *BVSQ*. By being better informed we can more effectively inform our patients of the alternatives that are available to them, as well engaging into more meaningful dialogues with members of the medical community. I highly recommend that you subscribe to journals such as *BVSQ* and read the articles rather than depending solely on third party abstracting and interpretation. In general, my comments appear in the sections, which begin at the left margin and are in regular font. Direct quotes and abstracts are indented and italicized.

The following articles and discussions are contained in: BVSQ 2000;15(2).

Guest Editorial: Amblyopia: Its Treatment Today and Its Portent for the Future by John T. Flynn

Amblyopia occurs during the process of visual development which is an active, monocular and binocular process lasting until early teen years when Vernier and other types of very precise and high level acuity thresholds (the so called hyper-acuities) finally reach adult levels.

Treatment of amblyopia has basically not changed since occlusion therapy of the sound eye was introduced in Europe during the mid-eighteenth century. While this might seem to suggest that the therapy is completely satisfactory and therefore requires no critical analysis, familiarity with its use in the clinic suggests otherwise. In addition, recent prevalence studies report that amblyopia remains a very common cause of monocular vision loss, ranking among the top three causes in adults up to the age of 65 years, mute testimony to the persistence of the defect throughout life.

He asked the question, "What is the outcome of occlusion of the dominant eye on the vision of the non-dominant eye?"

When one pools the raw data of many published series since 1960, the answer emerges that approximately 75% of amblyopic patients are successful on the first episode of occlusion therapy, success is here defined, as it is in most studies, as a visual acuity of 20/40 or better. Naturally, the outcomes are not the same for all three types of amblyopia. Strabismic is best (78%), then Anisometropic (67%) and Strabismic Anisometropic is poorest at (59%).

The next question asked was, "After successful occlusion, at what rate does that vision achieved by arduous effort by the child and the parents decline?"

Using the type of analysis developed for plotting cancer survival, it turns out that 73% of successfully treated amblyopes maintain vision for one

year, 61% for two years, and 54% for three years.

Amblyopia remains a significant cause of preventable monocular visual loss in children which persists into adulthood. Indeed, this prevalence in the adult population has led some observers to question the value of childhood visual screening for amblyogenic defects if the results seem to indicate the persistence of the disorder in the older age group.

Editorial on Surgery for Accommodative Esotropia by P.E. Romano, M.D.

This article begins as a commentary on two different approaches for the treatment of accommodative esotropia. As it proceeds, it becomes a vehicle for Romano, the editor, to comment on the secondary iatrogenic effects of what he calls, the North American ophthalmologic philosophy. This approach is based primarily on prescribing based on the cycloplegic refraction, i.e., maximum plus for distance and near, and extra-ocular muscle surgery as a last resort.

M.H. Gobin is the chief proponent for an alternate method: he usually surgically repositions four extraocular muscles without prescribing maximum plus. This "European" method was originally presented at the Trans VII International Orthoptic Congress meeting in 1991 in the section on Advances in Amblyopia and Strabismus, under the title, "The surgical correction of accommodative esotropia".

Dr. Romano was commenting on an article by Semmlow, J, Putteman A, Vercher J-L, Gauthier G, and Berard P-V, entitled, "Surgical modification of the AC/A ratio and the binocular alignment ("phoria") at distance; Its influence on accommodative esotropia: A study of 21 cases." appears in the same issue of BVSQ and supports Gobin's approach.

In the abstract to the full report on page 121 the authors state:

Methods: *Patients-subjects: 21 patients who had difficulty adjusting to spectacle correction underwent bilateral medial rectus loop suspension-recession surgery to alleviate their accommodative esotropia. Measurements of AC/A, uncorrected distance phoria, and related parameters were taken before and after surgical intervention was performed and were analyzed using analysis of variance (ANOVA).*

Results: *Both AC/A ratios and the distance phorias were statistically significant (p=0.05), and independently, reduced by this surgical procedure. The manifestation of accommodative esotropia and response to surgery can be fairly accurately predicted from the values of AC/A ratio and distance phoria.*

Romano comments:

A decade ago in Australia on the Gold Coast at the quadrennial International Strabismological Association meeting there were multi papers and panels and discussions, which did not however resolve the dispute between the Gobin inspired North American groups who condemned the procedure – no surgery on accommodative deviation was their cry.

The North American way of handling these patient only optically and without surgery insofar as possible is hardly perfect either: it has its own bad effects too: the blocking of the normal emmetropization process (AAPOS 1998, Palm Springs) (See report BVSQ 1998; 13:133)

This report by A. Mulvihill, A. McCann, and M. O'Keefe, all of Dublin, Ireland, studies the records of 151 children with refractive accommodative esotropia (RAET). They reported on patients whom they treated by the North American method of prescribing the full cycloplegic plus found.

Surgery for residual esotropia was required in 15% and an additional 3% required surgery for late decompensation. Mean cycloplegic refraction per eye increased from +3.90 to +6.30 diopters between 1 and 2 years of age and thereafter remained stable between +6.00 and +6.40 up the early teenage years with no reduction.

They hypothesize that full cycloplegic spectacle correction of the hyperopia may interfere with the emmetropization of the eye.

Here are Dr. Romano's comments on these findings:

There seems no doubt now that this is the case. There are now a number of reports attesting to this very undesirable state of affairs. We need to do something here. It is one thing to not aggressively treat school myopia. It is a much graver sin to interfere with a normal life process, namely emmetropization, creating in these children permanent hyperopia, a permanent need for optical correction which might not otherwise have been necessary, and a permanent esotropia requiring optical correction which means the patient is permanently esotropic whenever they take their glasses off; and later in life a possibility for premature presbyopia. Remember Job #1: DO NO HARM. Well, we are doing harm here. We need to find a way to keep their eyes straight while allowing emmetropization to occur. The following is a small step in the right direction, but only a very small step towards that goal.

Lastly, he reports on a study done by Drs. Edward Cheeseman Jr. and Elba M. Pacheco:

...proposed in their poster using the Reichert distance vectographic suppression test to determine the amount one can safely reduce a hyperopic spectacle correction among accommodative esotropes. They were able to reduce the power of the spectacles by an average of 0.75 D by this method, reducing the power 0.50 D to 1.00 D each visit, stopping just short of where the patient's suppression on the vectograph was becoming worse. Their minimum follow up of 6 months with no loss of control or increase in vectographic suppression was impressive, but they were able to reduce the power of the glasses only 0.50 to 1.25D.

This next article is part of a summary by Evelyn Paysee of the 15th Annual Cullen course, Pediatric Ophthalmology and Strabismus, given at the Baylor College of Medicine, Houston, Texas during March 2000. Dr. Paysee comments on Dr. Coats'

Dyslexia: Do's and Don'ts

Dr. David Coats presented a discussion of dyslexia. The typical presentation includes academic underachievement, skipping of words, changing word or letter order, word reversals, poor reading comprehension and frustration. The work-up for dyslexia includes a complete 8-point eye examination with the addition of intelligence and neuropsychological testing. Dr. Coats uses a standard

reading paragraph and vocabulary list to get a sense of cadence and reading level. Dyslexia is often associated with other abnormalities including attention deficit disorder and other learning disabilities. It affects 2-8% of the population. He emphasized that dyslexia is not an ophthalmological abnormality, but a brain processing problem and that enlisting the help of a developmental pediatrician is the best way to handle these complex children.

The following comments made by the editor Romano will interest readers of the *Journal of Behavioral Optometry.*

However, the signs and symptoms of dyslexia may be mimicked by ophthalmologic abnormalities such as deficiencies of fusion convergence or accommodation, etc.

The following abstracts are contained in: BVSQ 2001; 16 (1).

This first abstract deals with treatment of amblyopia after the "critical period" of 7-years of age and shows that these children can be treated. I found it noteworthy that there was no mention of treatment being more difficult, or taking longer than when the children are younger, or of not being able to achieve as good of an endpoint.

Successful Amblyopia Therapy Initiated after Age 7 Years. Mintz-Hittner HA, Fernandez KM. (Arch Ophthalmol 2000;118,1535-41)

Objectives: *To report successful therapy for anisometropic and strabismic amblyopia initiated after age 7 years.*

Methods: *A consecutive series of 36 compliant children older than 7 years (range, 7.0 to 10.3; mean, 8.2 years) at initiation of amblyopia therapy for anisometropic (19 patients; mean age, 8.3 years), strabismic (9 patients; mean age, 8.0 years), or anisometropic and strabismic (8 patients; mean age, 8.0 years) amblyopia was studied. Initial (worst) visual acuities were between 20/50 and 20/400 (log geometric mean, -0.83 [antilog, 20/134] for all patients; -0.88 [antilog, 20/100] for strabismic patients; and –0.88 [antilog, 20/151] for anisometropic and strabismic patients. Initial (worst) binocularity was absent or reduced in all cases. Therapy consisted of either (1) full time standard occlusion (21 patients; mean age, 8.0 years), (2) total penalization (7 patients; mean age, 7.8 years), or (3) full time occlusive contact lenses (8 patients; mean age, 8.8 years).*

Results: *Final (best) visual acuities were between 20/20 and 20/30 for all 36 patients.*

Conclusion: *Given compliance, therapy for anisometropic and strabismic amblyopia can be successful even if initiated after age 7 years.*

In this next abstract, it becomes evident that there is ophthalmological concern regarding the effect of lenses on the future refractive status of their patients. The idea of not prescribing the full amount of the manifest hyperopic refraction is considered in terms affecting the process of emmetropization.

Abnormal Emmetropization In Infants With Partial Spectacle Correction for Hyperopia. Atkinson J, Anker S, Bobler W et al. (Invest Ophthalmol Vis Sci 2000; 41:3726-31)

Purpose: *The development of emmetropic refraction is known to be under visual control. Does partial spectacle correction of infants' refractive errors, which has been shown to have beneficial effects in reducing strabismus and amblyopia, impede emmetropization? The purpose of the present study was to perform the first longitudinal controlled trial to investigate this question in human subjects.*

Methods: *Children identified as having significant hyperopia [at least one meridian +3.50D] in a population screening program at age 8 to 9 months were assigned to treated (partial spectacle correction [= 1 D. less than the least hyperopic meridian]) or untreated groups. A control group of infants with no significant refractive errors at screening was also recruited. Measurements of retinoscopic refraction under cycloplegia were taken at 4 to 6 month intervals up to the age of 36 months, and changes in refraction of 148 subjects were analyzed longitudinally.*

Results: *Refractive error decreased toward low hyperopic values between 9 and 36 months in both hyperopic groups. By 36 months, this reduction of hyperopia showed no overall difference between children who were treated with partial spectacle correction and those who were not. Despite the improvement, both hyperopic groups' mean refractive error at 36 months remained higher than that of the control group. When infants in all three groups were considered together, the rate of reduction of refractive error was, on average, a linear function of the initial level of hyperopia.*

Conclusions: *The benefits of partial spectacle correction for infants with hyperopia can be achieved without impairing the normal developmental regulation of refraction.*

This next abstract raised a number of questions for me.

Detecting Children Who Will Benefit from Treatment in an Orthoptic Clinic for Specific Learning Difficulties. McNamara R. (Brit Orthoptic J 1999; 56:22-30)

This article reported a prospective study to determine which orthoptic tests would correctly identify children who would benefit from treatment for a specific learning disability. The cover test, base in fusion range, eye tracking test and the Wilkin's rate of reading were statistically significant between the treated and untreated groups.

It is not clear whether they were treating the "orthoptic problem" or the specific learning difficulty. Are they implying causation and if so, in which direction? They specified the base in fusion range without specification to whether that was at distance, near, or both. It is not clear if their base out ranges or phorias had no relation or predictive value? The abstract didn't specify the tracking test that was utilized. It would be interesting to know what test and what criteria were recommended, and the Wilkin's test was not defined. Arnold Wilkins is from the UK and is involved with the Intuitive Colorimeter. This is a testing device that evaluates color as it affects reading speeds. No mention was made of correlations between color and orthoptic findings. Those interested should obtain the full article.

In the next abstract the relationship between binocularity and reading problems is discussed. Although the magno-cellular timing issue is brought up in the second

sentence it is not addressed in the rest of the abstract.

Monocular Occlusion Can Improve Binocular Control and Reading In Dyslexics. Stain JF, Richardson AJ, Fowler MS. (Brain 2000; 123:164-170)

Developmental dyslexia is a neuro-developmental condition that causes 5-10% of children to have unexpected difficulty learning to read. Many dyslexics have impaired development of the magno-cellular component of the visual system, which is important for timing visual events and controlling eye movements. Poor control of eye movement may lead to unstable binocular fixation, and hence unsteady vision; this could possibly explain why many dyslexics report that letters appear to move around, causing visual confusion. Previous studies have suggested that such binocular confusion can be permanently alleviated by temporarily occluding one eye. In the current report, 143 dyslexics with initial unstable binocular control between the ages of 7-11 years were studied to assess their binocular control and reading progress after monocular patching. They were randomly assigned to wear yellow spectacles with or without the left lens occluded, and were followed for 9 months. Significantly more of the children who were given occlusion gained stable binocular fixation in the first 3 months (59%) compared with children given the unoccluded glasses (36%). This advantage was independent of IQ or initial reading ability. Furthermore, at all the 3-month follow-ups, children were more likely to have gained stable binocular control if they had been wearing the occluded glasses. Gaining stable binocular control significantly improved reading; the children who did so with the help of occlusion improved their reading by 9.4 months in the first 3 months, compared with 3.9 months in those who were not patched and did not gain stable fixation. Over the whole 9 months, children who received occlusion and gained stable fixation nearly doubled their rate of progress in reading compared with those who remained unstable. At all the follow-ups the reading of those given occlusion was significantly better than that of those not occluded. Thus monocular occlusion helped children with unstable binocular control to gain good binocular fixation. If they gained stability, they made significantly faster reading progress. The progress made by the children who gained stable fixation was much greater than that achieved with other remedial techniques.

The authors did not specify how binocularity was evaluated. The assertion that patching of one eye would help to achieve a better and more stable binocular condition, is quite interesting. The abstract did not include even speculation regarding the mechanism responsible for this change, let alone any a statement of the theory by which these changes could occur. It is also interesting to note the use of the yellow filters. No rationale was given as to why yellow was chosen. They chose to occlude the left eye of all those in the treatment group. It is interesting to think that there might be an underlying unstated tenet of ophthalmology, which might go something like; **the suspension of binocularity for a period of time by use of a patch facilitates the reestablishment of binocularity after the patch is removed**. I have no basis for understanding this rationale but clearly this must be operational here. If this underlying tenet exists, might it then be what drives some other aspects of ophthalmological care?

I have conjectured that there may indeed be, in a well functioning binocular individual, a lateralization of specializations. For some people this might be their leading or preferred eye for figure (Parvo-cellular stream – ***what is it*** stream). The other eye may be the leading or preferred eye for ground information (Magno-cellular stream – ***where-is-it*** stream). Information about leading or preferred eye was not given. My point is that there may be different effects on reading performance if the eye that is patched were based on which stream was to be interrupted. Lastly, there was no information as to the amount of time or time of day the glasses were worn. I plan to read the original article particularly to view the reference list. Perhaps this will indicate the authors' underlying rationale.

The following are contained in: BVSQ 2000; Volume 15 (4)

In a letter to the editor, Burton Kushner, M.D., of Madison, Wisconsin, discusses his treatment of exotropia by over-minusing the patient's distance prescription. His concern was that this might cause progressive myopia. He cites a paper he published in Archives of Ophthalmology in 1999 entitled, "Does Overcorrecting Minus Lens Therapy for Intermittent Exotropia Cause Myopia?" He states:

Many studies (summarized in my paper) have found that the myopic shift (loss of hyperopia or increase in myopia) per year is related to the refractive error at the time in question. Specifically, hyperopic children lose approximately +0.15 D of hyperopia per year between 6 and 15 years of age, whereas myopic children show an increase in myopia of approximately - 0.50 D per year. Children who start out hyperopic and then become myopic show an interesting phenomenon. While they are hyperopic they lose plus at the slower rate of 0.15 D per year. Once they become myopic, they accelerate and gain minus at the higher rate of –0.50 D per year.

He continues further on:

I have seen some early myopes who never progressed despite full time spectacle wear and the occasional high hyperope who has lost as much as 6 D of hyperopia despite full time spectacle wear. Also, I have seen numerous high hyperopes who had been overcorrected with surgery for esotropia, taken out of their hyperopic correction to treat the consecutive exotropia, and yet who showed an increase in their hyperopia during the years that they were not wearing hyperopic correction. Until better studies are done, one can only say that there may be theoretical reasons (by extrapolation) to believe that cutting the plus will increase the loss of hyperopia.

The letter concludes with:

We live in a LASIK-happy society, and spectacles may now be less acceptable than they were in the past. This does not mean that we should replace spectacles with a treatment modality that may be temporarily more pleasing to parents, but has such a high risk of causing infinitely more serious problems a few years down the road.

BVSQ's editor, Dr. Romano provided the following comments on four posters that were exhibited at the Association for Research in Vision and Ophthalmology in Florida, April 30 – May 5, 2000.

Poster 679-B54, Truong, Cottriall, McBrien: Expression of

Muscarinic Receptors in Tree Shrew Ocular Tissues: *Conclusion: This study… is the first to report the presence of muscarinic receptor mRNA in the mammalian sclera. Together, the finding of the m1 subtype in the sclera, as well as the ciliary body, retina and choroid demonstrate that muscarinic antagonists [atropine] could act directly on any of these tissues in preventing myopic eye growth.*

My thoughts here are that there might be the potential for some analogue of atropine to be developed, which could select for the sclera receptors and therefore interrupt the development of axial myopia while either not affecting or minimally affecting accommodation and pupil size.

Poster 698-B73, Winawer, Zhu, Park, Wallman reported that in chicks, that by blurring vision with plus lenses for as little as 2 minutes every 2 hours, with normal viewing the rest of the time, changes in refractive error or vitreous chamber depth occurred *suggesting a particular potency of myopic blur to change the growth of chick eye.*

The plus lenses make the chick artificially myopic when the lenses are on. The thought is that the blur, detected by some unknown mechanism, at the level of the retina may be triggering release of factors, which facilitate scleral changes allowing for growth of the eye. A collateral change may be the raising of IOP or the raising of IOP may be found to be triggered by a similar but parallel process.

Poster 3742-B840 Lozma, Kjorpes, Movshon: Contour Integration in Amblyopic Monkeys: These researchers report that in these animals contour integration *is impaired compared to normal. In most cases the fellow eye is also poorer than normal.*

Romano added his comment that this was yet another theoretical reason why monocular amblyopia must be treated because it affects both eyes. I have felt strongly that in some individuals with non-strabismic amblyopia we may be dealing with an over-specialization. That is, the person learns to use one visual channel for central, *what-is-it* tasks, and the other channel primarily for peripheral, *where-is-it* tasks. As stated above, I believe that in normal high-functioning binocular individuals, this specialization exists but is subtle. In some forms of amblyopia I believe that this specialization becomes overbalanced in such a way that the primary *what-is-it* channel when asked to take over *where-is-it* chores does so poorly and visa versa. This explains to some degree when you patch the amblyopic eye on a refractive amblyope, why they have more trouble moving through an obstacle course than when you patch the non-amblyopic eye. Both channels are affected and one should no longer speak of a "good" eye or a "bad" eye as both channels are affected.

Here is another example where I provide you with the entire abstract!

Poster 3749-B847: Ridder III and Rouse, Can Sweep VEP's Predict Post-Amblyopia Therapy Snellen Acuity? *Answer: YES, it is a good predictor.*

I found several sections from a report by David Coats, M.D., on the joint meeting of the **European Stabismological Association** and the **Sociedad Española De Estrabología**, which was held in Barcelona Spain in September 2000. Often we are cited for not having research to back our clinical approaches and often the one pointing the finger at us is an ophthalmologist. I found the following to be of interest:

> M. Clarke, Ch. Wrigth, J. Henderson, S. Richardson, J. Anderson and the Amblyopia Treatment Trial Group from the United Kingdom presented preliminary information and design of a large multi-center study to determine the benefits of early screening and treatment of amblyopia. They cited a paucity of controlled trials as the driving force behind their study. *The purpose of the study is to determine if amblyopia treatment is effective.*

D. Friedrich from Germany reported on a method for rating the intensity of a patching program, by fractioning the amount of time patched.

> *For example, if the patient has been asked to patch 2 hours per day and is awake an average of 10 hours per day, the treatment recommendation would be documented as 0.20 daily. If asked to patch one day per week, the treatment would be recorded as 0.13 weekly. Dr. Friedrich has found that during the first 6 months of amblyopia treatment, an occlusion frequency of up to 0.5 is needed to improve acuity, with an occlusion frequency of 0.1 to 0.2 needed thereafter for maintenance.*

Here the researchers, J-T de Faber and MT Fo Sang from the Netherlands reported that:

> *..the axis of corneal astigmatism changes significantly in some patients when tested under binocular versus monocular conditions. They obtained sitting and supine corneal measurements on 15 normal subjects. Their advice to the refractive surgeon: "Beware of potential changes in the corneal astigmatic axis and be certain that the conditions under which the test was performed are known.*

Daniel Malard, FCOVD from France presented a similar paper at the European Kraskin Invitational Skeffington Symposium on Vision in 1997 on changes in keratometry readings when the person had their head on the headrest and their feet on the footrest versus when they did not have either planted stably. He also found significant differences. Neither group of researchers have postulated on the mechanism.

K. Unnebrink, C. Bauer, G. Kolling and H.J. Simonsz from Germany reported preliminary findings from the early versus late infantile strabismus esotropia study. This involves data from 89 clinics in 11 European countries with 532 patients enrolled: 231 had surgery prior to age 2 and 301 had later surgery. So far 197 of the subjects have turned 6 years of age at which time final data is to be taken on all children.

> *Sixty-five percent were found to be within ±10 diopters of orthotropia. Approximately 25% of the children developed a consecutive exotropia. Dissociated vertical deviation was more common in patients with a consecutive exotropia than in patients with a residual esotropia or with straight eyes. Latent nystagmus, on the other hand, was more common in children with esotropia than those with exotropia.*

In a report on the Year 2000 meeting of the Texas Society for Pediatric Ophthalmology, reported by James Mims III, M.D., held on September 23, 2000 in Austin, TX, David Dries, M.D., reported on **Long Term Amblyopia Treatment Outcomes.** He located the charts of 85 patients with at least 6 years of followup,

including 60 strabismic amblyopes, 20 refractive amblyopes, and 5 deprivation amblyopes. Patients in the strabismic and refractive groups both had poor retention of best-obtained visual acuity if they had 20/50 or worse initial visual acuity at the treatment onset. Strabismic amblyopes were much more likely to regress than refractive amblyopes. Amblyopes gained vision, but many lost it during the adolescent years, teenage years, and 20's when treated by the general ophthalmologists and residents in this study. Again, the major conclusion was that initial visual acuity of 20/50 or worse predicted poor long-term outcome. However, it should be kept in mind that with only slightly better one line better starting acuity the patient isn't considered to be amblyopic by most definitions.

The following were contained in: BVSQ 2001;16 (2)

An article of particular interest was the report by James Mims III, M.D., entitled, "Strabology Report of the 27th Annual Meeting of the American Association for Pediatric Ophthalmology and Strabismus." The meeting took place March 21-25, 2001 in Orlando Florida. The following are excerpts from this fine report:

The most impressive new concepts were presented in the workshop run by Joseph Demer, "Beyond Origins and Insertions: New Concepts of Extraocular Muscles for the Strabismus Surgeon". One of the key new points is that there is elastic connective tissue attached to the posterior surface of the bony orbital rim which acts as a spring under tension pulling the extraocular muscle (EOM) pulleys forward, while the orbital fibers of the EOM are pulling backwards on these same connective tissue springs. When a rectus muscle relaxes, the pulley moves anteriorly, so the angle of approach of the muscle going to the globe stays the same as it is when the rectus muscle contracts. This is the long-sought anatomical correlate to Listing's plane. (The eye moves as though it were fixed in a rubber membrane fixed at its equator.) The orbital fibers of the rectus muscles, comprising 40% of the fibers and occupying a crescent shape in cross section on the outward side of the global fibers, appear to insert on the pulleys and not on the globe directly! These orbital EOM fibers pull in tonic fashion against the connective tissue springs that connect the pulleys with the inner surface of the orbital rim. The pulleys of the rectus muscles translate 8 mm forward and backward as the eye changes from right to left gaze. This keeps the EOM pulleys as far posterior to the axis of rotation as the muscle insertions are anterior to the axis of rotation.

I had not heard of these pulley systems before. The opening editorial of this issue referred to these pulleys, and I had made a note to find out more about them. This section helped to define the "what" and "how" of these pulleys. More on pulleys later! In the same report Dr. Mims states:

*At times we get requests from patients to give them some idea of how successful surgery is. Argentina's Alberto O. Ciancia, M.D., presented on 4 or more years of followup on 390 children with infantile esotropia. Esotropia recurred and increased postop from 8% immediately after surgery to 27% four years later. Consecutive exotropia was 8% four years postop. For a subgroup of 137 patients with followup of 10 to 28 years, 57% had **orthotropia** (10 ET to 10 XT) and 22% has experienced recurrent esotropia and 21% had developed consecutive exotropia.*

So to recap, the day after surgery 92% are straight, four years later 35% are turned and, at a minimum of 10 years after surgery, 43% are turned more than 10 prism diopters from orthophoria. I hope you caught the term "orthotropia"! It is nice to see in print the criteria that ophthalmologists use to classify their work as successful. The surgery was a success if the ending angle of deviation is plus or minus 10 prism diopters from straight. How many of those ended up as micro-esotropes? How many other types of tropia are in the 57% that they consider successes? More interesting would be to see what percentage of their total caseload would optometrists deem successful, based on our stringent standards for the outcomes of vision therapy?

Evelyn Paysee, M.D., David Coats, M.D., and two students investigated the attitudes of children toward strabismus.

She and her co-workers observed 34 naïve children through a one-way mirror as they played with orthophoric and strabismic dolls. She found that a negative attitude towards strabismus seems to emerge at approximately six years of age. Whether the child subjects had strabismus themselves or the gender of the child had no influence on their responses to the dolls.

Two reports related to refractive surgery were noteworthy:

Sherry Fawcett Ph.D., et. al. confirmed in 32 adults that after LASIK or PRK performed to produce monovision, stereo acuity and bifoveal fusion tested with Randot and Worth 4-Dot was permanently impaired.

Romano, the editor of the BVSQ inserted his comment at the end. He asked whether *all* of the research team reported the findings *all* the time on *all* of the stereo tests. I would ask, "How do you know the changes are permanent?" and "What degree of change is termed significant?"

Arlene Drack, M.D., and Scott Lambert, M.D., held a workshop on refractive surgery in children. During this workshop about 20 attendees held up their hands when asked if they had seen patients with new strabismus after (emphasis in the original) LASIK! Also, Drack distributed an article from The Wall Street Journal that reminded everyone that experimenting on children brings special ethical dilemmas.

This is an angle that I had not considered or seen in any of the patients with whom I have worked. It does give us something to consider however as a possible complication of LASIK.

One paragraph was included on the costs of treating strabismic patients ophthalmologically:

John W. Simon, M.D., and Patrick a. Costello, M.D., reported the average cost/year to treat 48 children with acquired esotropia (mean 3.8 years of age, 44 months followup) was $547/patient/year. This included treatment of the esotropia and the amblyopia in 26 of the 48 cases.

No information was included regarding the duration of and number of visits. Nor were costs for eyewear or home treatment supplies specified. Treatment could range from surgery and orthoptics to sending home patches. A great deal more information would be needed for us to know exactly what that $547/patient/year is buying.

The following are from the abstract section of this issue of the BVSQ.

In an article entitled, **Is It Mandatory to Treat Amblyopia Prior to Surgery in Esotropia? Dadeyan S, Kamlesh MS** *(ACTA Ophthalmologica 2001; 79:28-30) 100 patients were examined to determine whether the presence of amblyopia has any influence on the outcome of motor and sensory surgical success in esotropia. It was interesting to note the success criteria of the surgery stated as, "Motor success (+/- 10 PD of orthophoria)", a further confirmation of what constitutes ophthalmological surgical success.*

Results: *There were no significant differences in motor success (84% vs. 75%) and sensory success (55% vs. 50%) whether amblyopia was fully treated or partially treated.*

Conclusion: *It is not mandatory to treat amblyopia prior to surgery, unless it is a case of infantile esotropia with moderate amblyopia and amblyopia therapy is continued postoperatively.*

What is the prevalence of different subtypes of esotropia? **Mahoney, BG** reports in **Common Forms of Childhood Esotropia,** in (Ophthalmol 2001; 108:805-809) on 221 consecutive cases of esotropia coming into a single clinic between August 1, 1995 and July 31, 1998.

117 (52.9%) of the 221 children had some form of accommodative esotropia, 38 (17.2%) were associated with congenital or acquired abnormalities of the central nervous system, 23 (10.4%) displayed acquired non-accommodative esotropia, 15 (6.8%) resulted from ocular sensory defects, 12 (5.4%) had confirmed congenital esotropia, 7 (3.2%) had paralytic esotropia, and 9 (4.1%) could not be categorized.

So where in the neurology does suppression occur? The following paper begins to answer the question.

What Is Suppressed in Binocular Rivalry: An Eye or a Feature? Freeman AW, Nguyen VA, Wong EMY (Clin Exp Ophthalmol 2000; 28:233-244, Abstracts of papers presented at the Australian Ophthalmic Visual Science Meeting 1999)

Aim: *Binocular rivalry results when the two eyes are presented with incompatible stimuli: the subject's percept alternates from one stimulus to the other every few seconds. There has been recent interest in whether binocular rivalry suppression is directed at an eye or a stimulus characteristic. We have performed two experiments with the aim of answering this question.*

Experiment 1. *We induced rivalry with orthogonal gratings, and measured sensitivity by flashing a test stimulus to one eye during the dominance or suppression phases of rivalry. The test stimulus was a grating with the same spatial frequency as the inducing gratings, and the same orientation as the inducting grating to the untested eye. Detection sensitivity for the test stimulus was reduced when the tested eye's inducing stimulus was suppressed, even though the test was aligned with the dominant inducing stimulus. This result implies suppression of an eye.*

Experiment 2. *We presented a mixture of red and green spots to one eye and a spatially identical array of spots to the fellow eye, but with red swapped for green and green for red. When the cone contrasts of the two colors were appropriately adjusted, subjects saw all the green spots and none of the red, indicating that suppression was selectively and simultaneously applied to both eyes. These results imply suppression of a stimulus characteristic.*

Conclusions: *The results of the two experiments can be reconciled by assuming that test stimulus detection is mediated by primary visual cortex and that perception of the rivalrous stimulus is mediated by a higher cortical level. Such a model is supported by recent physiological evidence.*

An abstract was published which reported on 6 cases of endophthalmitis after pediatric strabismus surgery. All 6 cases were treated at two tertiary care institutions between 1983 and 1998. Fortunately these cases are very rare. The following are the conclusions of the abstract:

Endophthalmitis After Pediatric Strabismus Surgery. Recchia FM, Baumal CR, Sivalingam A, Kleiner R, Duker JS, Vrabec TR (Arch Ophthalmol 2000; 118:939-944)

Children may not recognize or verbalize symptoms. Causative organisms are virulent. Visual and anatomical outcomes are poor. Lethargy, asymmetric eye redness, eyelid swelling, or fever in the postoperative period, even if initial postoperative examination results are normal, should prompt urgent ocular examination. The diagnosis of endophthalmitis may be made when biomicroscopic or indirect ophthalmoscopic examination confirms the presence of vitreous opacification with or without hypopyon.

The last abstract in this edition that I found of interest was entitled, **Relationship of Dissociated Vertical Deviation and the Timing of Initial Surgery for Congenital Esotropia by Neely DE, Helveston EM, Thuente DD, Plager DA.** (Ophthalmol 2001; 108:487-90). The article was written to clarify the incidence of dissociated vertical deviation (DVD), or double hyperphoria, among patients with congenital esotropia and to identify any relationship between the time when patients undergo their initial strabismus surgery and the time when they may subsequently have DVD develop.

Participants: *105 consecutive patients undergoing surgery for esotropia over a 10-year period.*

Methods: *All patients underwent bimedial rectus recession before 24 months of age.*

Results: *by 6 years of age, 92% of available patients had DVD. The mean age of onset was 2.81 +/- 1.37 years. There was no significant different between patients surgically aligned before 6 months of age compared with those aligned between 6 and 12 or 12 and 24 months of age.*

I look forward to reading more in the ophthalmological press. These four issues were quite enlightening to me as I hope my discussions were for you. Although many of us have excellent working relationships with individual ophthalmologists, formal communication between those of us who offer vision therapy/visual training with pediatric ophthalmologists is not as open as it could or should be. The losers are frequently the patients. We have an obligation to these patients to become as knowledgeable as possible about the care, theories, treatment modalities as

well as the general recommendations being made by pediatric ophthalmologists and in particular for strabismics and amblyopes. To subscribe to BV&SQ, contact Binoculus Publishing, PO Box 3727, 740 Piney Acres Circle, Dillon, CO 80435-3727.

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