



Session: Free papers Session I - Esotropia 1

The Effect of Duration on Diagnostic Occlusion in Strabismus

Daniel SALCHOW¹, Annsophie JUNGKAMP¹, Mirjam ROSSEL-ZEMKOUO¹

¹Charité - University Medicine Berlin, Berlin, Germany

Introduction: Diagnostic monocular occlusion may be used to minimize the effect of fusion on the strabismus angle. The optimal duration of occlusion has not been established.

Methods: In this monocenter, prospective, non-randomized, masked trial, adult patients with intermittent or decompensated strabismus and intact binocularity were enrolled. Exclusion criteria were previous eye muscle surgery, ocular or orbital trauma, craniofacial malformations, nystagmus, neurological or myopathic disorders and paretic strabismus. The strabismus angle in prism diopters (PD) was measured before (baseline) and after 1 hour, 4-6 hours and 48 hours of diagnostic occlusion. We present the results of an interim analysis.

Results: Of 15 patients, 5 had an exo- and 10 an esodeviation. Average baseline strabismus angle with distance fixation was 23.5 +/- 7.9 PD (standard deviation), and with near fixation 24.4 +/- 13.3 PD. After 48 hours of occlusion, it increased to 27.1 +/- 7.9 PD (distance) and 27.4 +/- 16.1 PD (near), the difference was not statistically significant. In 4/5 patients with exodeviation and a mean baseline distance / near difference of 18.5 +/- 5.1 PD, this difference decreased to 11.7 +/- 2.9 PD ($p = .0.15$). In the remaining patients with a baseline distance / near difference up to 10 PD, it increased from 2.4 +/- 2.8 PD to 6 +/- 4.6 PD ($p = .24$).

Conclusion: The effect of duration on diagnostic occlusion to evaluate strabismus is variable. On average, the angle increased, which was more pronounced in patients with exodeviation. In patients with baseline distance / near difference up to 10 PD, it increased, whereas it decreased in patients with baseline distance / near difference greater 10 PD.



Session: Free papers Session VIII - Graves & Neurologic disease

Ocular Torsional Instability-A Neurodiagnostic Sign of Prenuclear Disease

Michael BRODSKY¹

¹Mayo Clinic, Rochester, United States

Background: Accurate diagnosis of efferent visual system disease in neuro-ophthalmology involves the classification of clinical signs as prenuclear, nuclear, or infranuclear in origin.

Purpose: To describe ocular torsional instability as an easily recognizable clinical sign of prenuclear disease.

Methods: Retrospective chart review of patients in whom ocular torsional instability was diagnosed using indirect ophthalmoscopy.

Results: Twenty patients were diagnosed as having ocular torsional instability (OTI). Eight of these had neuro-ophthalmologic disease caused by structural injury to prenuclear ocular motor areas. Six patients had infantile strabismus (esotropia in 7, exotropia in 1, associated with various combinations of monocular nasotemporal optokinetic asymmetry (MNTA), latent nystagmus (LN), and dissociated vertical divergence (DVD), indicating prenuclear involvement of subcortical visuo-vestibular pathways within the brain. Three patients presented with intermittent exotropia with DVD signifying early onset, while two had acquired esotropia that was noninfantile in origin. One had partially accommodative esotropia with bilateral inferior oblique overaction, and one presented with acquired esotropia followed by spontaneous secondary exotropia.

Conclusions: Ocular torsional instability provides a useful clinical sign of prenuclear ocular motor dysfunction. When detected in patients without any signs of infantile or early-onset strabismus, OTI signifies the need for neuroimaging to rule out neurovestibular or cerebellar causes of prenuclear disease.



Session: Free papers Session VIII - Graves & Neurologic disease

Binocular vision problems in Parkinson's disease Patients: How can we help?

Daisy GODTS¹

¹Antwerp University Hospital, Edegem, Belgium

Objective: To describe the binocular complains, the examinations and the possible therapy to improve binocular vision in patients with Parkinson's disease.

Material and Methods: Forty elderly patients, age 64 to 82, with Parkinson's disease who underwent a complete motility and orthoptic examination were included in this prospective study. Ocular alignment, fusion amplitudes, stereopsis, convergence, horizontal and vertical eye movements were evaluated.

Results: Near exodeviation varied from 2 prism dioptres (PD) exophoria (X') to 30 PD exotropia (XT') with a median angle of 13 PD X'. At distance fixation, the deviation ranged from 4 PD esophoria (E) to 18 PD exotropia (XT) with a median angle of 5 PD exophoria (X). Convergence fusional amplitude at near ranged from 0 to 20 PD (mean 9.2 PD) and from 0 to 16 PD (mean 5.6 PD) at distance. Divergence fusional amplitude at near ranged from 4 PD to 18 PD (mean 11 PD) and from 2 to 16 PD (mean 8.5 PD) at distance. Stereopsis was reduced or absent in 72% of the patients. Convergence was limited from 10 cm to 50 cm (mean 22.5 cm). Saccadic smooth pursuit movements were seen in about 40% of the patients especially in horizontal gaze, followed by slow saccades and reduced elevation. All patients were treated with blinking exercises and convergence/fusion exercises, horizontal prisms were given in the reading glasses (2 to 16 PD Base In, mean 4.7 PD Base In), in distance glasses (4PD Base Out to 16 PD Base In, mean 2.2 PD Base In) and 5 patients needed vertical prisms in both reading and distance glasses (2 to 8 PD, mean 5 PD).

Conclusion: Patients with Parkinson's disease complain especially about near problems often associated with double vision due to convergence insufficiency and reduced fusion amplitudes. Patients with Parkinson's disease can be helped with blinking exercises, convergence and fusion exercises and two pairs of prism glasses instead of multifocal glasses.



Session: Free papers Session VIII - Graves & Neurologic disease

Evaluation Of Near Reflex in Multiple Sclerosis Patients

Kadriye DEMIR BONCUKÇU¹, Burçin ÇAKIR¹, Nilgün ÖZKAN AKSOY¹

¹sakarya universitesi, sakarya, Turkey

Purpose: To evaluate the amplitude of accommodation (AA) and convergence in patients with multiple sclerosis (MS).

Material-Method: MS patients under 35 years of age without visual evoked potential (VEP) abnormalities (MS Group) and healthy individuals of similar age (Control Group) were included in the study. Only findings from the right eye of the participants were included in the analysis. Fusional vergence amplitudes with prism, measurement of amplitude of accommodation (AA) with minus lens technique, stereopsis measurement with Titmus Stereo test (TST), near-object fixation and near point of convergence (NPC) measurement with a ruler, Convergence Insufficiency Symptoms Survey (CISS) results and presence of nystagmus were recorded retrospectively from the files of the cases. Statistical comparison was made between the groups.

Results: The mean age was 28.04 ± 3.7 years in the MS group (20 females, 4 males) and 27.16 ± 3.1 years in the control group (20 females, 5 males) ($p=0.763$). There was no statistically significant difference between groups in stereopsis ($p=0.395$), mean convergence amplitude ($p=0.666$) divergence amplitude ($p=0.773$) at distance; mean convergence amplitude ($p=0.836$) divergence amplitude ($p=0.877$) at near and near point of convergence measurements ($p=0.908$). AA was -5.31 ± 0.7 D in the MS group and -6.1 ± 0.8 D in the control group, and the mean AA values between the two groups were statistically significant ($p<0.001$). CISS results were lower in the control group and there was a statistically significant difference between the groups. ($p<0.001$). In addition, endpoint nystagmus was statistically significantly higher in the MS group. ($p<0.001$).

Conclusion: Compared to the healthy control group, MS patients under 35 who did not have optic nerve attacks had lower accommodation amplitude and more signs in favor of convergence insufficiency symptoms. In addition, endpoint nystagmus was observed at a higher rate in the MS group.



Session: Free papers Session VIII - Graves & Neurologic disease

Ocular gaze palsies due to stroke: profiles and outcomes

Fiona ROWE¹, Lauren HEPWORTH¹, Hanna KERRY¹, Howard CLAIRE^{1,2}

¹University of Liverpool, Liverpool, United Kingdom

²Northern Care Alliance NHS Foundation Trust, Salford, United Kingdom

Introduction: Ocular gaze palsies arise from a range of neurological/brain injury insults, with many related to microvascular events. The objective of this study is to explore the types and outcomes of gaze palsy that occur following stroke in a UK-based prospective epidemiology study.

Methods: All adult stroke admissions admitted to three acute stroke units over a 15-month period were recruited with orthoptic assessment for stroke survivors able to undergo visual assessment. Full documentation of stroke demographics and orthoptic assessments was captured, including visual acuity, visual fields, visual perception, ocular alignment and motility, and binocular function. Descriptive quantitative analysis was undertaken.

Results: Of 1500 stroke admissions over 15 months; 1204 survived and were assessed by orthoptists. Of 290 with confirmed ocular motility disorders, 97 had gaze palsies. Mean age for those with gaze palsies was 74.94 years (SD 15.04) with 46.5% female and 53.5% male. Stroke was due to infarct in 93% and haemorrhage in the remainder. Stroke severity was assessed using the Barthel Index with mean score of 6.0 (SD 6.86). 73 had horizontal gaze palsy of which 9 were INO and 4 were one and a half syndrome. 24 had vertical gaze palsy of which 11 were upgaze palsy and 9 were downgaze palsy. Gaze palsies often occurred with other visual impairments. All had follow-up assessments with full recovery for 29.1% at mean 51.0 days (SD 48.83), partial recovery for 40.7% and no recovery for the remainder.

Conclusions: In this epidemiology study, incidence and prevalence of CNP in acute stroke survivors was 6.89% and 7.14% respectively. From the sub cohort of ocular motility deficits, incidence and prevalence was 29.62% and 29.65% respectively. Horizontal gaze palsies were more common than vertical gaze palsies. Full recovery was usually over a period of 2 months with partial recovery over a longer period of time. Ocular gaze palsies were seen with more severe strokes.



Session: Free papers Session VIII - Graves & Neurologic disease

Update on third nerve palsy with cyclic spasm

Alain SPIELMANN¹

¹Institut Ophtalmologique du Panthéon, Paris, France

Introduction

Cyclic spasm is peculiar and rare in third nerve palsies. It can combine different clinical features depending on the muscles that are involved. The main characteristics have been already described in the literature. We found new clinical features that seem not to have been described previously.

Material and Method

We studied a serial of 5 cases : 3 were congenital or early onset cases in children, 1 was acquired in a 40-year-old woman after stroke, 1 was acquired bilateral third nerve palsy after head trauma in a girl with cyclic spasm on the right eye and synkinesis on the left eye. We also studied a few more cases where transient cyclic spasm was suspected, as even though no spasm could be seen during office examination but as parents could show pictures with disappearance of the ptosis.

Results

Most of the clinical features were consistent with those described in the main review of literature by Clarke and Scott in 1975. In particular we had a case involving the lid, heralded by lid twitching. We also had a case involving the pupil. In another case, twitching of the lid was not followed by opening of the lid, and was considered as an aborted spasm. The two acquired cases were unusual as the spasms occurred in an aperiodic basis and were triggered either by pressing the inferior lid or by forced blinking, as if increasing pressure in the orbit could stimulate the levator. In one case, contrary to the rule, the spasm did not disappear under general anesthesia but disappeared during sleep.

Conclusion

Our study confirms that there are two main types of third nerve palsy with cyclic spasm, as described previously. However, spasms can occur in several other ways and can be aborted before the lid can fully elevate. It can be triggered by increasing pressure in the orbit. It can persist under general anesthesia. Cases of transient spasms without periodicity are probably underestimated and can be suspected on photographs or testimonies of the parents.



Session: Free papers Session VIII - Graves & Neurologic disease

Contralateral recession of the inferior oblique muscle in Grave's disease patients with Inferior rectus fibrosis with and without prior Inferior rectus recessions

Sera SARIM¹, Hinke Marijke JELLEMA², Inga NEUMANN¹, Maggie FISCHER¹, Anja ECKSTEIN¹

¹Department of ophthalmology, University Duisburg Essen, Essen, Germany

²Orbital center, Department of Ophthalmology, Amsterdam University Medical Centers, Amsterdam, Netherlands

Contralateral recession of the inferior oblique muscle in Grave's disease patients with Inferior rectus fibrosis with and without prior Inferior rectus recessions

Introduction: The aim of the study was to evaluate the dose effect on vertical deviation and cyclotorsion and to assess the resulting binocular single vision after inferior oblique recession in patients with Grave's orbitopathy.

Methods and patients: Patients without (group 1; n=52) and with prior inferior rectus recession (group 2, n=10) were evaluated. Inclusion criteria was a small vertical squint angle with excyclotorsion. The median preoperativ vertical squint angle was 4° [8 pdpt] in primary position and 7,3° in adduction [14 pdpt]. Preoperative Excyclotorsion was 5° [10 pdpt] in PP. The recession distance was preoperatively determined: 0,5° squint angle reduction in PP per mm recession distance [1]

Results: Inferior oblique recession generated a good field of binocular single vision (BSV) for both groups of patients (group 1 achieved 79 % BSV in PP and group 2 80 % BSV in PP). 60 % of the patients were completely diplopia free in downgaze. Squint angle reduction was in group 1 0,4 °/per mm recession distance and 0,54°/mm in group 2 in primary position. The vert. deviation side difference influenced the dose effect. Excyclotorsion was reduced to ?2° in 40 % of the patients in group 1 and 50% in group 2.

Conclusion: Inf. obl. muscle recession can be very successfully performed at the contralateral eye in patients with inferior rectus muscle fibrosis either as a primary prodecure or as a second step after maximal inferior rectus recession. The major advantage of this procedure is that overdosage will cause diplopia in upgaze more than in downgaze, which is much less troublesome in daily routine.

1. Eckstein, A., et al., [Contralateral Recession of the Inferior Oblique Muscle in Grave's Disease Patients with Mild M. rectus inferior fibrosis]. Klin Monbl Augenheilkd, 2015. 232(10): p. 1178-83.



Session: Free papers Session VII - Exotropia et misc.

Prevalence of ocular torticollis in patients with non-syndromal unicoronal craniosynostosis and its ophthalmic features

Sjoukje LOUDON¹, Parinaz ROSTAMZAD^{1,2}, Yasmine ESSER^{1,2}, Mieke PLEUMEEKERS², Emily TAN¹

¹Erasmus MC Rotterdam, dept. Ophthalmology, Rotterdam, Netherlands

²Erasmus MC Rotterdam, dept. Plastic and Reconstructive Surgery, Rotterdam, Netherlands

Introduction

Unicoronal craniosynostosis (UCS) patients often show a torticollis. Several reasons both ocular and non-ocular have been postulated. This study aims to establish the prevalence of an ocular torticollis (OT) in non-syndromic UCS patients and possible associated ocular features. In addition, MRI was employed to investigate changes in the extraocular muscles.

Methods

Medical records of all non-syndromic UCS patients treated at the Erasmus MC University Medical Center Rotterdam between 1994-2022 were retrospectively reviewed. Data was collected from electronic medical records. Patients with other craniofacial disorders or incomplete orthoptic data were excluded. Patients were categorized as having an OT based on their orthoptic diagnosis. MRI brain data were acquired with a 1.5T Unit.

Results

Overall, data of 146 patients was included (mean age at initial examination was 3.5 ± 4.4 yrs) of whom 57 exhibited a torticollis, with an ocular cause identified in 54 cases. Torticollis was first identified at age 2.9 ± 2.7 yrs. The prevalence of OT was 37% (n=146; 95% CI [0.292-0.454]). The primary cause of the torticollis was incomitant strabismus (n=47; 87%) followed by concomitant strabismus (n=6; 11%) and congenital nystagmus (n=1; 2%). Pseudo-superior oblique palsy was the most common subtype (n=34; 59.6%). Significant associations were observed between OT and ocular motility abnormalities ($p < 0.001$), alphabetical patterns ($p < 0.001$), strabismus ($p < 0.001$) and amblyopia ($p = 0.002$). A subset of 24 patients had MRI scans pre-craniofacial surgery, revealing the presence of all extraocular and oblique muscles. A smaller and asymmetric superior oblique muscle was seen on the ipsilateral side of the closed suture.

Conclusion

A third of the patients with UCS had torticollis. Torticollis in patients with UCS is predominantly ocular related and revealed at different ages. MRI analysis revealed a reduced volume of the superior oblique muscle on the side of the closed suture.



Session: Free papers Session VII - Exotropia et misc.

Convergence Insufficiency: Are We Making a Difference in Patients' Lives or Is It a Waste of Time!

Joel Lee Zher JONG^{1,2}, Zainab SALEEM¹, Joshua SIMMONS¹, Martin RHODES¹, **Jessy CHOI**^{1,2}

¹Sheffield Teaching Hospital NHS Foundation Trust, Sheffield , United Kingdom

²University of Sheffield, Sheffield , United Kingdom

Introduction

Convergence insufficiency (CI) is a common condition that can impair visual performance and comfort during close visual work. This prospective study evaluated the effectiveness of interventions on clinical outcomes and health-related quality-of-life using the adult strabismus quality-of-life questionnaire (AS20) in patients with CI.

Methods

Data was extracted from a database collected at first consultation from 2015 to 2022. Demographics, interventions and outcomes of 80 patients with CI (mean age 46.5±24.6 years) were analysed.

Results

Orthoptic exercises were prescribed to 58% of patients, 31% received prisms, 11% received no treatment, with 3 discharged on the same day. At latest follow-up review, 22.5% were recommended to continue exercises, 20% had prisms, 1 underwent bimedial resection and 2 had botox. The median follow-up was 5.0(0-55) months, 97.5% were discharged with 27.5% following failure to attend and 10% deceased. At the latest follow-up, the attendance failure rate was higher for exercises (36%) than for prisms (15%). Both near prism cover test and near-point of convergence (NPC) improved from a median of 12(95%CI 10-14)D to 8(95%CI 5-10)D, and 17.5(95%CI 15-20)cm to 10.0(95%CI 8.3-12.0)cm respectively ($p<0.05$). Near prism fusion range also improved from 10(95%CI 8-14)D to 19(95%CI 16-20)D. The median AS20 score at presentation were 100(30-100) and 47.5(0-100), and post-intervention were 100(80-100) and 77.5(12.5-97.5) for psychosocial and functional components, respectively. Improvement was noted in NPC (33%) and mean AS20 scores was 9% higher psychosocially and 32.8% functionally, highlighting the benefits of intervention on patients' quality-of-life.

Conclusion

This cohort provides valuable insights into the clinical management of CI, as evidenced by improvements in NPC and AS20 scores. However, the study also found that long-term compliance with treatment is intrinsically challenging, emphasising the importance of disease education.



Session: Free papers Session VII - Exotropia et misc.

Bilateral lateral rectus recessions with pre-placed direct scleral sutures in the management of basic intermittent exotropia – 8 year outcomes

Alasdair KENNEDY¹, Eliza GREEN², Neil CLOUGH², Ailsa RITCHIE², Luis AMAYA²

¹Moorfields Eye Hospital NHS Foundation Trust, London, United Kingdom

²Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom

Introduction

Basic intermittent exotropia (IXT) is usually managed with either unilateral recession-resection (RR) or bilateral lateral rectus recessions (BLR). A randomised control trial by the Pediatric Eye Disease Investigator Group (PEDIG) comparing these techniques found similar results at 3 years but favoured the RR group at 8 years with lower suboptimal surgical outcomes. We present 8 year outcomes of an alternative BLR technique with more generous recessions and pre-place direct scleral sutures.

Methods

Retrospective recruitment of patients with basic IXT who had BLR between 8 to 10 years ago in our unit by a single surgeon.

Methods (from PEDIG study to allow direct comparison):

1)Inclusion criteria at time of surgery: age 3-10 years, basic IXT, 15-40 prism dioptre (PD) by alternate prism cover test (PCT), stereoacuity <400 arcsec, no prior surgery

2)Suboptimal surgical outcome measures at >8 years post-op:

a.exotropia of >10 PD or esotropia of >6PD by simultaneous PCT (SPCT) at near or distance

b.loss of stereoacuity by 0.6 log arcsec

c.reoperation or non-surgical treatment of IXT

Surgical technique: 1mm more recession per muscle compared to PEDIG BLR group with pre-placed direct scleral sutures (presentation includes video)

Results

25 patients met the inclusion criteria and 14 patients recruited so far. At the time of surgery, the average age was 5 years (3-8), the average near deviation was 21 prism diopters (PD) (10-35) and distance was 29 PD (20-40).

The average time since surgery at post-operative review was 9.5 years (8.9-10.3). 2 patients (14%) had an exotropia >10PD on SPCT. No patients had stereoacuity loss and 1 patient (7%) had a reoperation. The cumulative suboptimal surgical outcome was 21% compared to 68% for BLR and 53% for RR in the PEDIG study.

Conclusions

Although the study numbers are small, the results suggest that BLR with more generous recessions and pre-placed



direct scleral sutures may yield better long term outcomes for basic IXT in children.



Session: Free papers Session VI - Vertical Strabismus

Clinical Evolution of Congenital Brown's Syndrome

Sibel OTO¹, Ege KARSLIOGLU¹, Sezin AKCA BAYAR¹

¹Baskent University Hospital, Ankara, Turkey

Introduction: Brown's syndrome is characterized by a limitation of elevation in adduction with positive force duction testing. Surgery is usually reserved for severe cases. The aim of this study is to evaluate the clinical progression and outcome of patients followed with conservative approach.

Methods: The medical records of consecutive patients diagnosed as congenital Brown's syndrome between 2007-2023 and followed conservatively were reviewed. Deviation in primary position (PP), grade of limitation of elevation in adduction, head posture, presence of V pattern, anisometropia and macular torsion were main outcome measures. Abnormal head posture was measured by goniometer. Fundus torsion was evaluated by macular optical coherence tomography imaging performed at the last visit.

Results : A total of 26 patients were identified (16 female and 10 male patients) with an age range at referral of 8 months to 11 years (mean 51+/- 31.4 months), mean follow-up period was 43,5 months. Three patients had bilateral Brown's syndrome and right eye was effected in 11 patients. Sixteen patients were orthotropic in PP, stereopsis was present in 23 patients. Compensatory head position was present in 8 patients, 5 with chin elevation 8 to 10 degrees, 3 patients had contralateral face turn 8 to10 degrees. One patient had total improvement from a -4 limitation in 6 years follow up , 1 patient with bilateral -4 limitation had asymmetrical improvement inducing hypertropia at the resolved side. Orbital magnetic resonance imaging was performed in 10 patients; 1 patient displayed superior oblique muscle belly atrophy (4.2 mm² versus 5.8 mm² at the normal side) and 1 patient revealed tendon-trochlear complex enlargement and contrast enhancement.

Conclusions: Conservative approach seems to be adequate in most congenital Brown's syndrome cases. Spontaneous resolution of congenital Brown's syndrome should always be considered before planning surgical treatment.



Session: Free papers Session VI - Vertical Strabismus

Modified Nishida Procedure versus Single Horizontal Muscle Transposition in Monocular Elevation Deficits

Hala ELHILALI¹, Ahmed AWADEIN¹, Sara MAHER¹

¹Faculty of Medicine, Cairo University, Cairo, Egypt

INTRODUCTION: Management of patients with monocular elevation deficits (MED) poses a challenge because of the difficulty to improve the alignment without compromising the downgaze. This study aims to compare the outcomes of 2 modalities for the management of MED: modified Nishida procedure (MN) and single horizontal muscle upward transposition (SHMT).

METHODS: A retrospective review was conducted on patients who had intervention for MED. Patients were divided into 2 groups; MN group in which both the medial and lateral rectus muscle bellies were fixated to the sclera above the horizontal meridian without disinsertion or splitting of the muscle bellies and SHMT group in which either the lateral or medial rectus muscles were disinserted and fully transposed adjacent to the insertion of the superior rectus muscle, together with an augmentation suture. Ductions, versions, fundus torsion, and angle of deviation were analyzed before and after surgery.

RESULTS: Thirty-two patients were identified; 12 in the MN group and 20 in the SHMT group. Mean age was 13.8 ± 13.5 (range, 1 to 51 years). Mean preoperative vertical angle of deviation was 24 ± 8 PD in MN group and 24 ± 6 PD in the SHMT. Ipsilateral inferior rectus recession was performed in 3 patients in the MN group and 17 patients in the SHMT group. Mean follow-up was 8.5 ± 8.2 months. The postoperative improvement of elevation in adduction and abduction was comparable in both groups ($P= 0.47$ and 0.16 , respectively). Deficits in depression occurred in 3 patients (25%) in the MED group and 1 patient (5%) in SHMT group ($P= 0.14$). Deficits in abduction occurred in 1 patient (5%) in the SHMT group. No change in fundus torsion occurred with SHMT. Mean postoperative vertical angle was significantly lower ($P = 0.009$) in the SHMT group (0 vs 3 PD).

CONCLUSIONS: Both MN and SHMT procedures were equally effective in improving the elevation in MED. Postoperative vertical deviation was slightly smaller with SHMT.



Session: Free papers Session VI - Vertical Strabismus

Surgical treatment of larger DVD in the fixing eye

Susana GAMIO¹

¹HNRG, Buenos Aires, Argentina

It is often assumed that asymmetric DVD is larger in the non-fixing eye. However, cases with larger DVD in the fixing eye do exist and require a specific surgical treatment

Methods: Retrospective study of patients who underwent surgery for asymmetric DVD with an asymmetry $>$ or $=$ of 5 PD between each eye. We recorded visual acuity, amount of DVD in each eye obtained with prism cover test, incomitance pattern, fixing eye, asymmetry of the vertical deviation and performed surgical treatment.

Results: 18/32 patients that had surgery for DVD had larger DVD in the fixing eye. The mean age was 13,5 years (range 10-21). 8/18 had A pattern, 4/18 had V pattern and 6/18 did not have incomitance pattern. The average amount of asymmetry was 9.7 PD (range of 5-22 PD) Regarding the employed surgical procedure, most cases with A pattern received bilateral asymmetric Superior Rectus recession larger in the fixing eye and patients with V pattern, bilateral graded IOAT

Conclusions: Asymmetric DVD larger in the fixing eye is a frequent clinical finding even in the presence of good bilateral visual acuity. Patients with asymmetric DVD have larger DVD in the fixing eye in half of the cases, independently of the presence of an alphabetical pattern or not. We found a tendency toward larger DVD in the fixing eye in patients with A pattern.



Session: Free papers Session VI - Vertical Strabismus

Combined superior oblique and superior rectus surgery for unilateral superior oblique palsy

François AUDREN¹, Maroun EID¹, Vincent TOANEN¹, Catherine VIGNAL-CLERMONT¹

¹Hôpital Fondation Adolphe de Rothschild, Paris, France

Introduction: In case of unilateral superior oblique (SO) palsy with hypertropia in primary position (PP) exceeding 15-20D, a surgical procedure on 2 muscles is often recommended. A procedure consisting in a unilateral combination of a SO tendon tuck and a superior rectus (SR) recession is a surgical option recommended by some authors but the reports about this procedure are rare. The purpose of this study is to describe a series of patients with unilateral SO palsy treated by a combined procedure of SO tucking and SR recession.

Methods: We retrospectively the files of patients with a SO palsy who underwent a combined procedure of SO tucking and SR recession as a first surgery between 2013 and 2021 in our institution. The indication was a hypertropia of large angle without major elevation in adduction.

Results: 34 patients (8 female, 24%), mean aged of 36 years (6 to 80) were included. The median preoperative angle of hypertropia in PP was 25D (10 to 35). During surgery, the SR elongation measured using the Rapp-Roth myometer was decreased in all the patients but two, with a mean hypolongation of 3 mm (0 to 7). The surgery consisted in mean SO tuck of 8mm (5 to 12), and a mean SR recession (based on the SR elongation) of 4mm (2 to 6). The median follow-up 13 month (2 months to 10 years). The median postoperative (2 months) angle of hypertropia in PP was 3D (-8 to 20). The surgery induced a median decrease of the objective torsion (measured using retinophotography and Strabochek® online software) of 2,7° (-4,4 to 11,0) in the operated eye ($p < 0.001$). 6 patients underwent a later surgery (only one for an inversion of the angle).

Conclusions: The combined procedure of SO tucking and SR recession for unilateral is an interesting option for first surgery for large angle SO palsy. It is efficient on the vertical angle, with a low (but non-reproducible) torsional effect.



Session: Free papers Session VI - Vertical Strabismus

Inferior Oblique Anterior Nasal Transposition (IOANT) effect on vertical, torsional and horizontal alignment - our first 86 cases

Jon Peiter SAUNTE¹, Tobias TORP-PEDERSEN¹, Mikael HOFSLI¹, Claes S LØNKVIST¹

¹Copenhagen University Hospital Rigshospitalet Glostrup, Copenhagen, Denmark

Introduction

The inferior oblique anterior and nasal transposition (IOANT) is a surgical technique used in patients with fourth nerve palsy exhibiting significant torsional and/or vertical deviation, along with substantial inferior oblique muscle overaction (IOOA). This technique involves transfer of the inferior oblique (IO) nasal to the inferior rectus muscle. Our study aims to assess the impact of IOANT on vertical and torsional deviation, as well as on IOOA. It builds upon the findings from our initial 21 IOANT cases presented at the 2021 ESA meeting.

Methods

Records of patients who underwent surgery with IOanterior and nasal transposition at the Department of Ophthalmology, Rigshospitalet - Glostrup, Copenhagen University Hospital, , from January 1, 2018, to December 31, 2023, were reviewed. The primary endpoints were changes in vertical deviation measured in prism diopters (PD), alterations in IOoveraction (IOOA) graded from 0 to 4, and variations in cyclotropia measured in degrees. Surgeries of transitioning from IO transposition (IOt) to IOANT were analyzed separately.

Results

IOANT was performed in 86 patients and reduced median vertical deviation from 22 PD to 1 PD with a mean effect of 21PD (range 0-48PD). Median IOOA decreased from 3 to 0.5 with a median effect of 2.6 (interquartile range [2;3]). Excyclotropia was reduced with a mean of 7 degrees (range -2-16). In 6 patients we performed a transitioning procedure from inferior oblique transposition (IOt) to IOANT, and median vertical deviation decreased from 10 PD to -1 PD with a mean effect of 10PD (range 2-17PD), and median IOOA decreased from 1 to 0 with a median effect of 1.

Discussion

IOANT is an effective, single-muscle procedure for addressing fourth nerve palsy characterized by substantial vertical deviations, excyclotropia, and significant IOOA. Additionally, the conversion from IOt to IOANT is a valuable procedure in instances of undercorrection following the initial surgery.

Characters total: 1975



Session: Free papers Session VI - Vertical Strabismus

Evaluation of objective cyclodeviation following inferior oblique muscle weakening procedures for V-pattern strabismus.

Agata ORDON^{1,2,3}, Justyna SIMIERA^{2,3}, Piotr LOBA^{2,3}

¹Independent Public University Eye Hospital, Department of Ophthalmology, Medical University of Warsaw, Warsaw, Poland

²Department of Binocular Vision Pathophysiology and Strabismus, Medical University of Lodz, Lodz, Poland

³Laser Eye Microsurgery Centre Clinic of Prof. Jerzy Szaflik, Warsaw, Poland

Introduction: The primary inferior oblique overaction (IOOA) manifests as excessive elevation in adduction and V-pattern strabismus, most commonly associated with infantile esotropia, accommodative esotropia, or intermittent exotropia. The most commonly used surgical procedures to treat IOOA are recession and anterior transposition. Cyclodeviation is defined as the rotation of an eyeball along the anteroposterior axis. The study aimed to assess changes in objective cyclodeviation after two different weakening procedures (inferior oblique muscle recession and anterior transposition) in cases of V-pattern horizontal strabismus with inferior oblique overaction.

Methods: Retrospective analysis of medical records of 19 subjects, 37 eyes (mean age: 10.89; range: 5-48) undergoing inferior oblique muscle recession or anterior transposition for IOOA. Objective cyclodeviation was measured employing fundus photography with the determination of the disc-foveal angle using Cyclocheck® software before and three months after the surgery. Cyclodeviation alterations (change in disc-foveal angle) were assessed and subjected to statistical analysis.

Results: Both procedures (inferior oblique recession and anterior transposition) resulted in significant changes in objective cyclodeviation ($p < 0.001$ – inferior oblique recession, $p = 0.049$ – anterior transposition). The mean reduction in excyclotorsion was $9.46^\circ \pm 7.96^\circ$ (inferior oblique muscle recession) and $18.17^\circ \pm 14.58^\circ$ (anterior transposition). Negative correlations were observed between the amount of muscle recession and change in cyclodeviation, as well as between preoperative excyclotorsion and change induced by inferior oblique recession.

Conclusions: Inferior oblique muscle recession and inferior oblique anterior transposition produce different changes in cyclodeviation in patients with IOOA and V-pattern strabismus. The amount of recession is well correlated with the change in objective cyclorotation.



Session: Free papers Session V - Esotropia 2

Retrospective review of features, investigation and management of acquired esotropia associated with high myopia (heavy eye syndrome) at Moorfields Eye Hospital

Katie WILLIAMS^{1,2,3,4}, Michael GILHOOLEY^{1,3}, Indran DAVAGNANAM¹, Aditi DAS^{1,3}

¹Moorfields Eye Hospital, London, United Kingdom

²Great Ormond Street Hospital, London, United Kingdom

³University College London, London, United Kingdom

⁴Kings College London, London, United Kingdom

Introduction | The prevalence of myopia is increasing globally, most dramatically in Urban Asian populations but also across Western Europe. Acquired esotropia in high myopia, often termed 'heavy eye syndrome', generally develops in adulthood. There are no diagnostic criteria but MRI measurements of extraocular muscle paths and posterior eyeball prolapse can provide quantifiable evidence. MRI studies have shown inferior shift of lateral rectus (LR) and nasal shift of superior rectus (SR). The muscle union procedure, developed by Yokoyama in 2013, has been widely accepted as a primary procedure.

Methods | We performed a retrospective review of adults (≥ 18 years old) seen at our institution with a diagnosis of high myopia (spherical equivalent $\geq -6D$) and strabismus. We use free text search functions on our electronic medical records (initiated 2018) to identify patients. We were keen to focus on MRI findings and therefore excluded those without neuroimaging. Presenting features including full orthoptic assessment, spherical equivalent, and associated myopic features were noted. In those who underwent surgery, the surgical technique chosen, and outcome was examined.

Results | We identified 69 adults with high myopia and associated strabismus, in all cases a predominant esotropia, attending Moorfields between 2018 and 2023. The mean age at initial assessment was 50 years (SD 18.1) with a minimum age of 18 years and maximum age of 89 years. We will describe presenting features, MRI findings (including where possible calculation of the angle formed by the globe, LR & SR = 'angle of dislocation of the globe'), surgical approach and outcome.

Conclusions | The number of patients presenting with acquired esotropia as a result of high myopia may become an increasing burden. Classical features, the benefits of MRI assessment, and surgical approach will be discussed.



Session: Free papers Session V - Esotropia 2

Supraequatorial displacement with lateral rectus myopexy for treatment of myopic sagging/heavy eye

Pilar MERINO¹, Pilar GÓMEZ DE LIAÑO¹, Victor ANTÓN¹, Maria CHAMORRO¹, Jacobo YÁÑEZ-MERINO²

¹HGU Gregorio Marañón, Madrid, Spain

²Hospital Miguel Servet, Zaragoza, Spain

Purpose: To describe the outcome of the patients diagnosed of sagging/heavy eye associated to myopia, that were operated on with the supra-equatorial displacement with lateral rectus (LR) myopexy

Methods: a retrospective study of 9 cases between 2017-2023. The following data were analyzed: horizontal and vertical deviation, diplopia, amblyopia, ductions, ocular torsion, sensorial test, macular pathology, and the orbital magnetic resonance. Treatment was considered successful if the diplopia was improved or eliminated and a final vertical deviation (VD) \leq 5 prism diopters (PD).

Results: The mean age (SD) was: 62.11 (4.6) years (100% women). A total of 88.88% presented diplopia. The mean preoperative hypotropia was: 11.33 PD (SD 3.16), and the mean final VD 3.44 PD (SD 3.05). After surgery, the hypotropia was overcorrected in one case, under corrected in 5, and orthophoria was achieved in another three. The technique was associated with surgery of another rectus muscle in 4 subjects. The mean follow-up time after surgery was 34 months (SD 34.62). Six of the 9 patients improved with a vertical deviation \leq 5 PD. In 3 patients, the diplopia was eliminated, while in 5 it remained intermittent (three with macular pathology).

Conclusion: supra-equatorial displacement with LR myopexy for treatment of myopic sagging/heavy eye, is a therapeutic option if hypotropia is less than 12 PD or the Yokoyama technique is not indicated. A good result was obtained in most cases, although diplopia could only be totally suppressed in three, and another five remained intermittent.



Session: Free papers Session V - Esotropia 2

Lateral Rectus Superior Plication Using Non-Absorbable Sutures for Divergence Insufficiency Esotropia

Yair MORAD¹, Idan HECHT¹

¹Shamir Medical Center, Tel Aviv University, Tel Aviv, Israel

Background: Divergence insufficiency esotropia, resulting from the downward displacement of the lateral recti (LR), is a frequent cause of diplopia in adults. Conventional surgical interventions like bi-medial recession (BMR) or LR resection often yield late under-correction. We introduce a novel approach: superior plication of the LR using non-absorbable sutures, coupled with a single medial rectus recession on adjustable sutures. This procedure aims to rectify the LR's downward sagging and produce stable long-term results.

Methods: This retrospective study encompassed all patients operated on by a single surgeon for divergence insufficiency esotropia between January 2021 and June 2023. We recorded pre- and post-operative measurements, along with intraoperative and postoperative complications.

Results: Our cohort consisted of 24 patients with acquired esotropia and diplopia, aged 13 to 77 years (mean 41.9±16 years). 58% were female, and 87% were myopic. Three had previously undergone BMR. Neuroimaging confirmed the downward LR shift, and myasthenia tests were negative. All patients underwent 3-5mm superior plication of both LR muscles using non-absorbable sutures. In one eye, the medial rectus was placed on adjustable suture. In seven cases it was recessed 2-4mm within 24 hours postoperatively. After an average follow-up of 21.70±6.5 months, all patients achieved orthophoria, except one who had 6PD esophoria for distance. No cases of diplopia were reported. Two patients experienced suture extrusion, which was treated in-office.

Conclusions: This study introduces an innovative surgical procedure for addressing divergence insufficiency esotropia. Our consecutive cases demonstrated minimal manifest deviation and diplopia during follow-up, along with minimal postoperative complications.



Session: Free papers Session V - Esotropia 2

Surgical management of residual infantile esotropia using lyophilized bovine pericardium (Tutopatch®)

Mohamed ELABBASY¹, Michael P. SCHITTKOWSKI¹

¹Medical Center of Göttingen - Department of Strabismus, Neuroophthalmology and Oculoplastic Surgery, Göttingen, Germany

Purpose: To evaluate tendon elongation with Tutopatch® for secondary management of residual infantile esotropia, particularly in patients with limited abduction due to secondary restrictios and when a further conventional surgery might not be successful.

Methods: The data of patients with residual infantile esotropia, managed using Tutopatch® between 2009 and 2023, were analysed. Those include the preoperative deviation angle and the postoperative angle at one day, three months, and 12 months. The dose-effect relationship (deviation angle in degrees per effective operative distance in mm) and the overall success were analyzed.

Results: Twenty-nine patients were included in our study. The median preoperative deviation angle was +15° (range +6° to +27°) which had decreased to -1.5° (range -12° to +7°) at the three-month follow-up in 22 patients. A late follow-up in ten patients after a median of 34.5 months (range 13 to 69 months) showed a median deviation angle of -1° (range -15° to +15°). The postoperative adduction reduced with a median of 5° (range loss of 25° and gain of 15°).

No postoperative complications were observed. An overcorrection had to be re-operated in five patients, which was uneventful. The median postoperative deviation angle was then -1° (range -5° to +8°).

Conclusion: The management of significant residual infantile esotropia by tendon elongation using Tutopatch® is helpful, in some complicated cases, with little effect on duction limitation. Overcorrection may occur in some patients in the long-term. In such cases, the patients can be re-operated without difficulty.

Keywords: infantile esotropia, medial rectus recession, tendon elongation, Tutopatch®.



Session: Free papers Session V - Esotropia 2

Horizontal three-muscle surgery for large esotropia

Michael GRAEF¹, Jutta FRANK¹, Julia RÖHM¹, Heiko WASSILL¹

¹Justus-Liebig-University Giessen, Department of Ophthalmology, Giessen, Germany

Background: Bilateral medial rectus muscle recession with or without Cüppers' posterior fixation suture and recess and resect surgery are used to correct for large esotropia. There are only few reports on 3-muscle surgery (3MS). We analyzed results of 3MS.

Patients and methods: Between June 2016 and December 2023, 133 patients received 3MS for esotropia ≥ 27 deg. Additional oblique muscle surgery was performed, if needed. Simultaneous (SPCT) and alternating prism and cover testing (APCT) were performed at 5 m and 0.3 m. The mean total amount of surgery was about 0.5 mm/deg (APCT at 5 m). It was adapted to the individual axial eye length. Medium-term results of 80 patients were available at the time of abstract submission.

Results: Medians and ranges (min-max) were: Age, 6 years (3-56). Preoperative APCT at 5 m, 34 deg (27-45), at 0.3 m, 36 deg (27-50). Amount of surgery, 17 mm (15-21), oblique muscle recession in 30 cases. APCT after 5 months (3-24), far 2 deg (-10-18), near 2 deg (-8-18). Success rates (absolute deviation ≤ 6 deg), APCT 68% and 67% (5m and 0.3 m), SPCT 79% and 74%. Exotropia >6 deg at 5m occurred in 6 cases (7.5%), esotropia $>6^\circ$ remained in 20 cases (25%).

Conclusion: 3MS is a suitable first step procedure to correct for large esotropia in the analysed age range.



Session: Free papers Session IV - Eye muscle surgery

Induced Incomitance Following Primary Single-Muscle Recession versus Recess-resect or Bilateral Recession Procedures for Strabismus

Aleksander STUPNICKI¹, Surinder DOSANJH², Saurabh JAIN^{1,2}

¹UCL Medical School, London, United Kingdom

²Royal Free London NHS Foundation Trust, London, United Kingdom

Introduction: Single-muscle recessions (SMR) for small-angle strabismus offer advantages including shorter operative time, faster recovery and fewer complications while preserving the antagonist muscle for future surgery. However, the asymmetric nature of the procedure poses a risk of inducing incomitance. This study compares the prevalence of induced incomitance following single-muscle recessions with recess-resect procedures (RR) and bilateral recessions (BLR).

Methods: 52 patients with strabismus underwent either single-muscle recession (n=16), recess-resect (n=18) or bilateral recessions (n=18). The exclusion criteria included previous squint surgery, simultaneous surgery on the oblique muscles and previous muscle transposition. From pre- and post-operative measurements of deviation in 9 positions of gaze, the difference in deviation in lateral gaze and vertical gaze was calculated for horizontal and vertical strabismus respectively. Incomitance was defined as a difference in deviation >5PD.

Results: Surgically-induced incomitance occurred in 1 patient following SMR (12.5%), 1 patient following RR (16.7%) and 2 patients after BR (20%) with a range of 6-10PD. Fisher's exact test showed no statistically significant difference in induced incomitance between either group ($p>0.05$). We observed a significant correlation between the occurrence of surgically-induced incomitance and pre-operative mean angle of deviation for all groups combined ($p=0.04$), and the total amount of incision for SMR and BLR combined ($p<0.01$).

Conclusions: The risk of induced incomitance following SMR is comparable to RR and BLR, but increases for large-angle strabismus and with larger incisions. Due to numerous advantages, ophthalmologists should continue to consider single-muscle recessions for small-angle strabismus but bear the risk of incomitance when operating on patients with large deviations.



Session: Free papers Session IV - Eye muscle surgery

Comparison of resection and plication in horizontal strabismus surgery

Lauriana SOLECKI¹, Frédéric VINÉE¹, David GAUCHER¹, Tristan BOURCIER¹, Arnaud SAUER¹

¹University Hospital of Strasbourg, STRASBOURG, France

Introduction: Plication and resection are common tightening procedures in strabismus surgery. Surgical outcomes of both techniques are debated. The aim of the study was to compare the results of both techniques on a large cohort of patients.

Methods: 181 consecutive patients (109 with exotropia, 72 with esotropia) who underwent strabismus surgery (87 with resection, 94 with plication) were retrospectively reviewed. Binocular alignment and success rates were assessed 12 months after surgery. Success was achieved by a deviation angle ≤ 10 prism diopters (PD). Post operative pain level at 1 day was collected using the visual analogue scale (VAS).

Results: The mean preoperative deviation angle at distance was 37.9 \pm 14.3 PD (mean \pm standard deviation) for the resection group and 28.4 \pm 10.7 PD for the plication group ($p < 0.0001$). At the 12-month follow-up visit, deviation angles at distance were reduced to 9.5 \pm 8.4 PD after resection and 8.5 \pm 7.2 PD after plication ($p = 0.38$). Surgical success rate was 71.2% after resection and 58.5% after plication ($p = 0.073$) and considering exotropia only it was 80.8% after resection and 63.4% after plication ($p = 0.056$). Anesthetic time was longer for resection (31.0 \pm 4.7 min) than plication (29.38 \pm 5.05 min), ($p = 0.02$). Pain was higher after resection (4.82 \pm 2.25) than plication (3.99 \pm 1.81), ($p = 0.006$).

No significant differences were found in ocular motricity, diplopia, reintervention rates and aesthetic satisfaction rates.

Conclusions: Resection achieved better surgical success rates, especially in exotropia, though not in a statistically significant way, while having no other serious pejorative repercussions on patients.



Session: Free papers Session IV - Eye muscle surgery

Safety and efficacy of squint surgery under sub-tenon's local anaesthetic in adult cohort

Zhihang CHENG¹, Thomas WEATHERBY¹, Ian MARSH¹

¹Liverpool University Hospitals, Liverpool, United Kingdom

Introduction

This study of a single tertiary referral adult strabismus service aimed to assess the safety, efficacy and patient satisfaction of strabismus surgery performed under sub-tenon's local anaesthetic.

Methods

This is a retrospective cohort study of consecutive patients who had strabismus surgery under local anaesthetic from June 2021 to November 2023. Those without follow up data were excluded. Electronic patient record is used to extract demographics, procedure details and outcomes. Oculocardiac reflex (OCR) episodes were measured as a decrease in pulse rate of 20% compared from baseline. A subset of patients were asked to complete a patient satisfaction questionnaire to assess patient experience throughout the procedure.

Results

116 patients were included. There were 57 males and 59 females. The mean age was 59 years (21-89). Most underwent single muscle procedures including recessions, resections, transpositions of horizontal and vertical recti, and inferior oblique myectomies. 10 cases were 2 muscle procedures.

52 patients had hyalase (hyaluronidase) used in their sub-tenon's injection and 2 patients had oral benzodiazepine sedation.

There were no anaesthetic complications, particularly no OCR, all patients had pupil dilation post anaesthesia. There were no surgical complications and the intended outcome was achieved in 98 out of 116 cases (84%). Of the 18 patients for whom the intended outcome was not achieved, 8 have subsequently undergone further procedures and 4 requiring prism correction.

Of the respondents to the questionnaire, 93% of patient were very satisfied with intra-operative pain control. Patient returned to normal daily activities within 2.6 days (range 0-7 days).

Conclusions

Local anaesthesia is safe and effective in our cohort of patients. There were no cases of OCR. We postulate the presence of pupil dilation after administration of sub-tenons indicates anaesthesia of the ciliary ganglion with blockage of the afferent arc of this reflex.



Session: Free papers Session IV - Eye muscle surgery

Perfusion Monitoring in Real-Time During Strabismus Surgery with Laser Speckle Contrast Imaging

Linn ENGQVIST¹, Hanna-Maria ÖHNELL¹, Jonas BLOHMÉ¹, Ulf DAHLSTRAND¹

¹Department of Ophthalmology, Lund, Sweden

Anterior segment ischemia is a dreaded complication to strabismus surgery caused by damage to the anterior ciliary arteries. To reduce the risk, surgical protocols generally advocate that a maximum of two rectus muscles are detached at a time. However, these recommendations are not based on objective perfusion measurements but rather empirical observations of clinical outcome. We have used the non-invasive imaging tool Laser Speckle Contrast Imaging (LSCI) to capture perfusion in real-time during strabismus surgery, as well as in enucleations to enable perfusion monitoring as all four rectus muscles are detached.

Data have been collected during 85 strabismus surgeries and 24 enucleations. Measurements on the iris- and paralimbal tissue were performed before- and after rectus muscle detachment and compared.

The images vividly capture the perfusion of the anterior segment. Measurements following both horizontal- and vertical rectus muscle surgery revealed a decrease in perfusion, however the decrease was greater for the vertical muscle detachments. In the enucleations, perfusion remained relatively stable until the fourth rectus muscle was detached. Then, a pronounced and significant decrease was observed.

This is the first time perfusion has been visualized in real-time during strabismus surgery. The larger decrease in perfusion in vertical rectus muscle detachment strengthens the clinical belief that vertical anterior ciliary arteries have a greater contribution to the perfusion of the anterior segment. The results from the enucleation study indicate that detachment of three rectus muscles in a surgical session may be feasible with little effect on anterior segment perfusion. Perioperative perfusion monitoring with LSCI has the potential to identify patients with a higher risk of anterior segment ischemia, which would enable tailored surgery. While future studies are needed, LSCI may be a valuable tool in reducing the risk of ASI following strabismus surgery.



Session: Free papers Session IV - Eye muscle surgery

Characterization and Classification of Postoperative Cysts After Strabismus Surgery: Clinical, Histological, and Anterior Segment OCT Analysis in a Large German Cohort

Karsten HUFENDIEK¹, Martin BREDT¹, Maximilian BINTER¹, Carsten FRAMME¹, Michael SCHITTKOWSKI², Katerina HUFENDIEK¹

¹Medizinische Hochschule Hannover, Hannover, Germany

²University Medical Center Goettingen, Goettingen, Germany

Introduction: In this work, we provide a detailed characterization of a rare complication - subconjunctival cyst formation after strabismus surgery - in a large German cohort. **Methods:** We conducted a retrospective analysis of 822 consecutive patients who underwent strabismus surgery between 2015 and 2022. The patients received comprehensive eye and orthoptic examinations preoperatively, at 1 day, and at 3 months postoperatively. Cysts were analyzed with slit-lamp examination, anterior segment optical coherence tomography (AS-OCT), and histopathological subsumption. **Results:** Nineteen cases of postoperative cysts were observed (2.3%), 12 of which underwent surgical revision. Clinical evaluation including slit-lamp and AS-OCT as well as histological analysis resulted in a classification of three types of cysts: type 1, which is a single hyporefective cyst, type 2, which is a multilobular hyporefective cyst, and type 3, a dense hyperreflective granulomatous-like cyst. Eta (g) correlation ratio analysis could show a correlation between time of clinical appearance and type of cyst (Eta = 0.63). Most cysts developed within 20 days after surgery. Not only did cysts more frequently affect the medial rectus muscle, which in most cases underwent a shortening procedure (11/19 tucks, 4/19 resections) for intermittent exotropia (X(T)), but the cyst also formed earlier than in the lateral rectus muscle (Eta = 0.45). No correlation could be shown between the type of surgical procedure and time of cyst occurrence (Eta = 0.1). Patient age and cyst type correlated strongly (Eta = 0.47). The underlying type of strabismus did not correlate with the type of cyst observed. **Conclusions:** Our cases showed a strong positive correlation to the type of strabismus (X(T)), age (young patients), and the procedure (tuck/resection). We introduce a grading system for postoperative cysts after strabismus surgery, complementing histopathology and slit-lamp aspects with AS-OCT information.



Session: Free papers Session III - Incomitant Strabismus

Superior rectus – lateral rectus co-contraction syndrome

Michael STRUCK¹

¹Children's Mercy Hospital , Kansas City, United States

Introduction

Exotropia, which is small in primary position, but increases significantly in up gaze has been termed 'Y' pattern strabismus. A specific variant of this pattern of strabismus has been termed pseudo-inferior oblique overaction. We report a case series of subjects that fulfill the criteria for aberrant mis-innervation of the lateral rectus muscle, resulting in exotropia manifested in up gaze.

Methods: A retrospective review of patients evaluated for Y or T pattern exotropic strabismus. All patients had exotropic strabismus, absence of hypertropia in side gaze and normal sensory binocular status. Video documentation of the pathognomonic co-contraction phenomenon was recorded for 8. Surgery correction for the exotropia in up gaze in 5 subjects consisted of lateral rectus supra-placement with or without simultaneous recession.

Results: Thirteen subjects fit the criteria for SR-LR co-contraction syndrome. 10 were female. Mean age at diagnosis was 7.4 years (\pm 4.7 years). Eight were classified as Y pattern with exotropia (mean 16pd) in primary position, and 5 were classified as T pattern exotropia with no deviation in primary. Mean deviation in up gaze was 22pd (\pm 11pd). 2 were noted to have an esotropia in one horizontal side gaze position prior to surgery. 5 were noted to have compensatory head position. Mean age at surgery was 10 years. One patient required reoperation for the development of symptomatic exotropia in downgaze. Mean follow-up for all subjects was 5.5 years (\pm 3.5 years).

Conclusions: In this select group of subjects with SR to LR co-contraction, segregate into Y or T pattern strabismus. Further, we show with video that activation of the superior rectus creates an abducting force on the eye, signifying co-contraction of the ipsilateral lateral rectus muscle. Typically asymmetric or unilateral in nature, creating a compensatory head posture. Additionally, asymmetric recession of the lateral rectus muscles at the time of surgery may be indicated.



Session: Free papers Session III - Incomitant Strabismus

An Evaluation of 30 years' Experience in the use of Botulinum Toxin Injections in the Management of Sixth Nerve Palsies.

Pia SCHNEIDER^{1,2}, Anne BJERRE²

¹University Eye Clinic Bonn, Bonn, Germany

²University of Sheffield, Sheffield, United Kingdom

Introduction

This service evaluation investigates botulinum toxin (BT) injections into the medial rectus muscle (MR) compared to conservative treatment in sixth nerve palsies. It aims to detect recovery rates and contribute to a more robust decision-making process.

Methods

Retrospectively files of adult patients with a sixth nerve palsy were reviewed. Patients were allocated into two treatment groups: BT injected into MR or conservative treatment. Inclusion criteria were attendance of two visits with basic orthoptic assessment. Exclusion criteria were: presence of further oculomotor palsies, strabismus, strabismus surgery and suppression. Non-parametric statistical analysis was conducted using IBM® SPSS Statistics.

Results

606 patients were identified. 137 patients met the inclusion criteria. 45.26% were treated with BT injections and 54.75% were treated conservatively. The median initial abduction deficit was greater in the BT group, -4 to -5 (after Scott & Kraft) than in the conservative treatment group, -1. As a result, the initial angle of deviation at distance was significantly larger in the BT group than in the conservative group. The recovery rate in the BT group was 24.19% and 20% in the conservative treatment group. The improvement of the angle of deviation at distance in all patients was greater in the BT group. The improvement of motility in bilateral palsies were greater in the BT group, but in unilateral palsies, there was no significant difference in motility improvement in the groups.

Conclusion

BT injections could not improve recovery rates. But BT injections could improve the angle of deviation greater. Additionally, BT was able to improve the motility in bilateral palsies greater than conservative treatment. An injection should be discussed in bilateral paralysis to enable fixation, patients with high levels of suffering and marked abnormal head posture. Patients should be informed about the high risk of adverse events, but also their transient nature.



Session: Free papers Session III - Incomitant Strabismus

Surgical Management of Duane Syndrome with Limitation of Both Adduction and Abduction

Federico G VELEZ¹, Robert TAUSCHER², Stacy PINELES¹, Joshua JONES³

¹Stein Eye Institute, UCLA, Los Angeles, California, United States

²University of Alabama, Birmingham, Alabama, United States

³Heaton Eye Associates, Athens, Texas, United States

Background: Managing Duane syndrome with severe limitation to both adduction and abduction is challenging due to several factors,¹ including misinnervation or absent innervation of the lateral rectus, the potential presence of accessory fibrotic bands, and ipsilateral medial rectus tightness.

Methods: We report six Duane syndrome patients with significant lateral rectus muscle misinnervation causing severe limitation to both abduction and adduction, globe retraction, pseudo-ptosis, and anomalous vertical movements. All six patients were treated with ipsilateral lateral rectus weakening of 10 mm; two also had a Y-splitting of the muscle. Three patients had simultaneous excision of an accessory lateral rectus muscle band. An augmented vertical rectus muscle transposition or augmented, modified muscle belly transposition procedure was performed laterally in 3 patients and medially in one patient. Two patients also underwent simultaneous recession of a cyclovertical muscle.

Results: Postoperatively, all patients were aligned within 10 prisms diopters (PD) of orthotropia. Adduction was markedly improved in all patients. Abduction was maintained or improved in all patients. No patient undergoing transposition surgery developed a vertical deviation in primary position. In the two patients with preoperative vertical deviations in primary position, the vertical deviation improved to less than 3 PD postoperatively.

Conclusion: In Duane syndrome patients with limited horizontal motility, weakening the ipsilateral lateral rectus, along with vertical rectus transposition and/or cyclovertical muscle surgery when indicated, may result in improved adduction, improved vertical movements, and less globe retraction. Additionally, it is important to explore and excise any accessory extraocular muscle bands that may be present.

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Session: Free papers Session III - Incomitant Strabismus

Orthoptic outcomes in Moebius syndrome

Maxence RATEAUX^{1,2}, Cyril GITIAUX^{3,4}, Dominique BREMOND-GIGNAC^{1,5}, Matthieu ROBERT^{1,2}

¹Ophthalmological department, University Hospital Necker-Enfants malades, APHP, Paris, France

²Centre Borelli, Université Paris Cité, ENS-Saclay, CNRS, INSERM, SSA, Paris, France

³Department of Paediatric Neurophysiology, Necker-Enfants Malades Hospital, Paris University, APHP, Paris, France

⁴INSERM U955-Team 10, Department of Neurosciences, Mondor Biomedical Research Institute, Paris-Est University, Créteil, France

⁵INSERM UMRS 1138, Team 17, From Physiopathology of Ocular Diseases to Clinical Development, Université Sorbonne Paris Cité, Centre de Recherche des Cordeliers, Paris, France

Introduction:

Moebius syndrome (MS) manifests as lateral gaze paralysis and non-progressive facial weakness due to congenital lesions affecting the VI and VII cranial nuclei. In the literature, however, oculomotor abnormalities are often referred to as “bilateral sixth nerve palsy”, and adduction is said to be possibly preserved. Quantifying ocular deviation is challenging due to gaze paralysis, hindering any cover test application. This series aims to better characterize MS’s oculomotor features.

Method:

Files of patients clinically diagnosed with MS 01/11/2018 and 01/11/2023 were retrospectively included. A comprehensive orthoptic exam, including quantification of ocular deviation using Krinsky method, monocular and binocular ocular motility assessment, oculocephalic reflex, evaluation of visual acuity and sensory aspects, was conducted. Ophthalmological evaluation also included a slit-lamp exam, fundus examination, and cycloplegic refraction.

Result:

54 patients (32M; 22F), aged 6 months to 24 years (median=7.5; SD=5.5), were included. 53 had complete horizontal gaze palsy with a negative oculocephalic reflex. One patient had unilateral MS with left-sided gaze palsy. Among 47 testable patients, adduction occurred due to convergence recruitment; in no case was adduction in lateral gaze possible. 34 patients (63%) had strabismus: 30 esotropias (including 6 micro-esotropias) (ranging from 2° to 60° (median=30°)), 2 exotropias, and 2 hypertropias. Among the 20 orthotropic patients, 9 (45%) had normal stereopsis.

Conclusion: Adduction, when possible in MS, seems to only result from convergence recruitment, while oculocephalic reflexes always remain absent. This points to a nuclear involvement – bilateral sixth nuclear palsy – and should further prevent any faulty mention of “sixth nerve palsy”. In patients without strabismus, preserved convergence allows good stereopsis, the only mean to ascertain phoria in these cases.



Session: Free papers Session III - Incomitant Strabismus

Strabismus surgery in Moebius syndrome

Matthieu ROBERT^{1,2}, Maxence RATEAUX^{1,2}, Dominique BREMOND-GIGNAC¹

¹Necker-Enfants malades Hospital, AP-HP, Paris, France

²Borelli Centre, URM 9010, CNRS-SSA-ENS Paris Saclay-Paris Cité University, Paris, France

Introduction

Moebius syndrome is characterised by the association of bilateral facial palsy and horizontal gaze palsy, resulting from a congenital dysfunction of both VI and VII nuclei, often associated with other malformations. Convergence is typically preserved. Many patients also present strabismus, which have been the topic of only few studies. We report a series of patients followed for Moebius syndrome and report the clinical and surgical characteristics of their strabismus.

Methods

All files of patients diagnosed with Moebius syndrome and followed at the multidisciplinary Moebius clinic of our institution between 01/01/2018 and 01/11/2023 were retrieved and retrospectively included. The presence and characteristics of a strabismus / a surgery, post-operative status, were studied. Considering the presence of a gaze palsy, cover test measurements were not possible; all measurements were realised using Krimsky test and a specific photographic method (Strabochek^o).

Results

65 patients, aged 6 months to 57 years at last examination, were included. Among them, 37 (57%) presented a strabismus: 31 (84%) esotropias, 3 (8%) hypertropias, and 3 (8%) exotropias. Eight patients, all exhibiting esotropia with abnormal retinal correspondence, were operated during this period, by one surgeon (age at surgery: 5-20 years, med=6.25).

Pre-operative angles (at distance) ranged from 25 to 55 diopters (med=35). Surgery always consisted in a recession of medial recti, which were always very tight. Cumulated recession ranged from 5 to 13mm (med=8.5 mm). Post-operative angles (at distance) ranged from 0 to 12 diopters (med=6). Median dose-response relationship was 2.85 diopters/mm of recession.

Conclusion

Surgery in Moebius syndrome is technically difficult but can achieve good outcomes. The unfolding of the sclera after the section of a tight medial rectus is often considerable. Such interventions should articulate with the other multiple interventions these patients usually undergo.



Session: Free papers Session II - Diagnostics & Amblyopia

Refractive amblyopia risk factors and other eye care needs identified in a school-based vision program

Michael REPKA¹, Xinxing GUO¹, Medha KALLEM⁴, Andrew NGUYEN¹, Christina AMBROSINO¹, Daisy DAI³, Nick KOURGIALIS², Megan COLLINS¹

¹Wilmer Eye Institute, Johns Hopkins University, Baltimore, United States

²Helen Keller International, New York, United States

³Yale School of Medicine, New Haven, United States

⁴Emory University School of Medicine, Atlanta, United States

Introduction: School-based vision programs (SBVPs) can address pediatric eye health disparities by providing vision screenings, eye exams, and eyeglasses to underserved communities directly in schools. While many vision problems can be addressed within the school setting, SBVPs coordinate community referrals for the students with complex eye care needs. To allocate resources, SBVPs need understand the prevalence of refractive amblyopia risk factors (RARF) and other ocular pathology.

Methods: We conducted a retrospective analysis of Helen Keller International's United States Vision Program data from 2016 – 2022. We included students from prekindergarten through grade 12 who received non-dilated eye exams following failed vision screenings. Outcomes included the number of students who failed vision screening, those having a RARF (anisometropia >1.25 diopters [D], hyperopia >4D, astigmatism >1.75D), those with myopia greater than 2D, those prescribed eyeglasses, and those referred to community providers for eye care beyond the scope of the SBVP.

Results: 103,184 of 285,283 (36%) students failed vision screening and received school-based eye exams. Among the 95,874 students with refraction data, mean age was 12±3 years; 46.4% were male. Three quarters of students (n=71,572) were prescribed eyeglasses. 32.6% (n=31,280) had a RARF; 11.5% (n=11,068) had anisometropia, 1.7% (n=1,652) had hyperopia (>4D), and 25.7% (n=24,595) had astigmatism. 51.1% (n=48,988) had myopia (>2D). 17.4% (n=13,897) were referred for further care.

Conclusions: SBVPs address unmet vision needs in underserved communities, primarily myopia. One in 3 students who failed a school-based vision screening had at least one refractive amblyopia risk factor. A smaller proportion needed referral to a community provider. To effectively serve school aged children there needs to be a plan for referral of older children for management of amblyopia and other eye problems, often beyond the traditional timing.



Session: Free papers Session II - Diagnostics & Amblyopia

An eye-tracking based dichoptic home treatment for amblyopia: stability of visual acuity and stereopsis improvement following discontinuation of amblyopia treatment in children aged 4-9 years

Tamara WYGNANSKI-JAFFE^{1,2}, Avital MOSHKOVITZ³, Michael BELKIN^{2,4}, Burton KUSHNER⁵, Oren YEHEZKEL³

¹Sheba Medical Center, Ramat-Gan, Israel

²Faculty of Medicine, Tel Aviv University, Tel-Aviv, Israel

³NovaSight Ltd., , Airport City, Israel

⁴Goldchleger Eye Research Institute, Sheba Medical Center , Ramat-Gan, Israel

⁵Department of Ophthalmology and Visual Sciences, University of Wisconsin, Madison, United States

Introduction: Following A pivotal RCT study with CureSight, we report long-term outcomes of the non-inferiority trial with the CureSight dichoptic home treatment for amblyopia (NovaSight, Israel).

Methods: Prospective, multicenter, examiner-masked, controlled trial with 80 participants with available 28-week data (n=39 in the initial binocular treatment group and n=41 in the initial patching group) Following the initial study period of 16 weeks, between weeks 16 to 28, 19 patients in the original patching group received no additional treatment (patching group), 22 were treated with the CureSight dichoptic home treatment for additional 12 weeks (patching crossover group), whereas patients in the original binocular treatment group received no additional treatment (binocular treatment group)

Results: At 28-week visit, the improvement in VA in the amblyopic eye was maintained vs. baseline ($p < 0.000$, all groups) and vs. 16-weeks visit ($p = 0.2474$, $p = 0.9641$, $p = 0.7699$, binocular treatment, patching, and patching crossover groups, respectively), with similar magnitude of change. Improvement in stereoacuity was also maintained vs. baseline ($p < 0.0001$, $p = 0.0006$, $p = 0.0011$ for binocular treatment, patching, and patching crossover groups, respectively) and vs. 16-weeks visit ($p = 0.8344$, $p = 0.8125$, $p = 0.6426$, binocular treatment, patching, and patching crossover groups, respectively). However, the binocular treatment group showed a trend of further improvement in stereoacuity at the 28-week visit when looking at the magnitude of change compared to 16-week visit. In contrast, the patching group showed a trend of deterioration. The patching crossover group showed an even greater trend of improvement in stereoacuity.

Conclusion: Binocular treatment can benefit patients with amblyopia, including patients with residual or recurrent amblyopia and patients previously treated with a monocular approach.



Session: Free papers Session II - Diagnostics & Amblyopia

Real-world results of binocular amblyopia treatment by CureSight, a home-use eye-tracking-based device

Tamara WYGNANSKI-JAFFE¹, Avital MOSHKOVITZ², Michael BELKIN¹, Oren YEHEZKEL²

¹Sheba Medical Center, Ramat-Gan, Israel

²NovaSight LTD, Airport city, Israel

Introduction: Unlike traditional interventions such as patching or penalization, the binocular treatment, commercially available in the US and Europe as of 2023, has not been extensively explored outside clinical trials. We report the real-world efficacy of binocular treatment for amblyopia using the FDA-cleared CureSight™ eye-tracking-based device for home use.

Methods: Amblyopic children engaged in 90-minute sessions of self-selected internet content five times a week, accumulating a minimum of 18 monthly treatment hours. Baseline and follow-up assessments of visual acuity (VA) and stereo acuity were conducted, with adherence objectively monitored digitally through the eye detection software.

Result: Of the 69 children who reached their first follow-up visit with a mean treatment duration of 61 days, stereo acuity showed a notable median improvement of 0.3 log arcseconds with a significant mean improvement of 1.0 logMAR line in amblyopic eye VA ($p < 0.05$), and a median adherence rate of 88%, of the required 30 monthly treatment hours. The high adherence observed with this binocular treatment distinguishes it from patching and penalization, where real-world adherence typically drops to 50% of the prescribed dose. The stereo acuity improvement is similar to that of CureSight's randomized clinical trials. The slightly lower VA gain compared to that reported in the studies with a similar training period is possibly due to the inclusion of off-label patients as far as age, eye deviation, and depth of amblyopia.

Conclusion: To the best of our knowledge, this is the first study to report the real-world effectiveness of the binocular treatment for amblyopia, emphasizing its potential advantages.



Session: Free papers Session II - Diagnostics & Amblyopia

ORTHOPHTALMO2 study : 2-year outcome of a cohort who underwent visual screening in three-years-old according to recommendations from the French Association for Paediatric-Ophthalmology and Strabismus

Léopoldine LEQUEUX¹, Olivier NORBERT¹, Dominique THOUVENIN¹, Christelle BONIFAS¹, Isabel DEBOUTTE¹, Anne ALBY¹, Justine HUYGENS¹, Célia BONTRON¹, Camille BROVELLI¹, Léa MARTINEZ¹, Caroline PEY¹

¹Ophthalmologie Rive Gauche - Clinique Rive Gauche, Toulouse, France

Introduction

The French Association for Paediatric Ophthalmology and Strabismus (AFSOP) recommends systematic visual screening for amblyopia and risk factors for amblyopia in 3-year-olds. This protocol uses visual acuity, photoscreening refraction and cover test examination performed by an orthoptist. Patient referral to an ophthalmologist is only according to specific criteria. The effectiveness and feasibility of the AFSOP screening protocol as well as the recommended criteria for referral to an ophthalmologist were validated by The ORTHOPHTALMO1 study. The diagnostic parameters found in this study were 90% for sensitivity and 89% for specificity. The ORTHOPHTALMO2 study describes the evolution of the cohort 2 years after the initial examination.

Material and Methods

The 300 patients in the ORTHOPHTALMO1 cohort were asked to undergo a visual check-up from the 5th year of life. Data from this check-up were collected from 173 patients. 68 children (group 1) had a normal initial examination at 3-years-old and we mainly looked for the occurrence of a visual disorder. 105 children (group 2) had a visual abnormality at 3-years-old, of whom 62 (group 2A) had a visual problem without amblyopia (strabismus or refraction disorder) and 43 (group 2B) had amblyopia (mean difference 3.4 lines). In this group, we were interested in the evolution of visual acuity.

Results

6 children in group 1 (9%) had an isolated refractive anomaly, with no amblyopia. In group 2A, no amblyopia appeared. In group 2B with amblyopia, visual acuity improved by 3 lines on average after wearing optical correction alone in 12 cases or combined with amblyopia treatment in 29 cases.

Conclusion

The absence of cases of late-onset amblyopia and the good results of amblyopia management in this cohort study confirm the relevance of the age chosen in the AFSOP recommendations and the value of carrying out systematic visual screening in 3-year-olds.



Session: Free papers Session II - Diagnostics & Amblyopia

The dynamic optotype (Dyop): a novel visual acuity test for use in children

Guy BARNETT-ITZHAKI^{1,2}, Zohar BARNETT-ITZHAKI³, Daphna MEZAD-KOURSH^{1,2}

¹Department of Ophthalmology, Tel Aviv Medical Center-Ichilov, Tel Aviv, Israel

²Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

³Ruppin Academic Center, Emek Hefer., Israel

Introduction: Recently, a new testing modality has been developed that uses a dynamic target visual assessment tool.

This study evaluates the "dynamic optotype" (Dyop), a simple visual acuity test based on a dynamic target that requires minimal knowledge of symbols and letters, in children.

Methods: A total of 160 consecutive, systemically healthy children, 4-17 years of age were prospectively recruited from the Pediatric Ophthalmology Unit of Meir Medical Center. Children were tested with the Dyop visual acuity test and the Early Treatment Diabetic Retinopathy Study (ETDRS) Lea numbers chart. The results of both tests were compared. The eye with the poorest acuity was tested with the new Dyop eye chart and the Lea numbers chart. The order of the testing was reversed between children. The logMAR visual acuity scores for each eye chart were compared.

Results: We found a strong linear correlation ($r = 0.88$) between visual acuity measures. The mean difference in visual acuity was -0.01 (95% CI, -0.02 to 0.01). The 95% limits of agreement were ± 1.2 lines. The logMAR equivalent mean difference was about less than 1 letter. The Dyop test underestimated visual acuity relative to the Lea numbers chart.

Conclusions: The results of this study support the Dyop eye chart as a valid measure of visual acuity in children 4-17 years of age, with visual acuity ranging from 20/16 to 20/200.



Session: Free papers Session II - Diagnostics & Amblyopia

Microesotropic children up to 3 years: is the new lang stereopad test effective? A preliminary report

Andrea Cristiano PIANTANIDA¹, Giulia GEROSA¹, Manuela SPERA², Mirco DI CANDIDO ¹, Donatella RICCIARDELLA ¹, Davide CALLIGARI¹

¹CENTRO OCULISTICO LARIANO, CERNOBBIO - COMO, Italy

²U.O.C. Oculistica, ASST Valtellina e Alto Lario, SONDRIO, Italy

Introduction: Parks affirms that macular binocular vision is unable to cope with strabismus, therefore stereoacuity tests have been used as screening tools to detect a minimum angle deviation: either indirect (Cover test, Corneal Light Reflex test, Irvine test, Paliaga test), or direct tests (Lang1, Lang 2, TNO, Titmus, Randot test). Aim of our study is to consider the new Lang Stereopad test for the diagnosis of microesotropia in very small children.

Methods: We considered 131 patients whose age ranged from 5 to 33 months (mean 18,54 months) suspected to be microesotropic. Due to the poor cooperation, Paliaga 8 diopters base-in test was considered our gold standard diagnostic test to detect microesotropia, for its high specificity and sensitivity, and its strong Likelihood-ratio. 17 subjects were discarded due to the inability to detect an answer at Paliaga test; 114 patients underwent a full orthoptic and ophthalmological examination. Young babies were tested with Lang Stereopad test according to the Preferential Looking method (PL).

Results: Among 107 patients considered orthotropic, Lang Stereopad detected 73 real-negatives and 34 false-positive. Among 7 subjects considered esotropic, Lang Stereopad detected 6 real-positives and 1 false-negative. We found a specificity of 98,6% and a sensitivity of 15%. The positive predictive value was 85,71% and the negative predictive value was 68,22%. Likelihood ratio corresponded to 11,1.

Conclusions: The diagnosis of small angle esotropia is one of the most difficult to obtain. Small kids should be monitored with tests with good statistical evaluation according to age. Lang Steropad test performed with the PL method seems to facilitate the diagnosis of an healthy patient. According to positive and negative predictive values and Likelihood Ratio the Lang Stereopad test seems to be very useful in detecting the normal stereoscopic status in very small children, but it is less efficient in identifying microesotropic ones.



Session: Free papers Session I - Esotropia 1

Revisiting Posterior Fixation Sutures Surgery: Unveiling Novel Approaches for Primary Management of Diverse Esotropia Cases

Pedro MARQUES COUTO¹, Paulo FREITAS-DA-COSTA^{1,2,3}, Hélio ALVES³, Renato SANTOS-SILVA^{1,2}, Jorge BREDA¹, Augusto MAGALHÃES¹

¹Department of Ophthalmology, Centro Hospitalar e Universitário de São João, Porto, Portugal

²Department of Surgery and Physiology, Faculty of Medicine, University of Porto, Porto, Portugal

³Department of Biomedicine, Faculty of Medicine, University of Porto, Porto, Portugal

Introduction: Strabismus, specifically esotropia, presents a significant challenge in ophthalmic surgery, while several treatment options exist. This study aims to evaluate the results of posterior fixation sutures (PFS) on the medial rectus as a primary approach for some types of esotropia.

Methods: The medical records of consecutive patients who underwent surgery for esotropia over 11 years and had at least 1 year of follow-up were reviewed retrospectively. Patients were classified into one of three types of deviation: infantile (IE), partially accommodative (PAE) and basic (BE) esotropias. An alignment within 16 prism diopters (PD) of orthotropia was a successful outcome.

Results: A total of 404 patients were included: 67 IE, 180 PAE and 157 BE. Before surgery, a deviation greater than 30 PD was present in 88.1% and 80.1%, and a deviation greater than 50 PD was present in 66.5% and 52.9% of patients (near and distance, respectively). In the BE group, PFS was the baseline surgery in a smaller number of cases (75%) compared to the other two groups (versus 86.6% [IE] and 88.3% [PAE], $p = 0.002$). The need for an additional procedure was significantly higher in the infantile esotropia group (44.8% vs. 18.9% and 24.8%, $p < 0.001$). Final surgical success was achieved in 95.3% of all patients. Orthotropia was achieved in 19.4% (IE), 29.6% (PAE) and 25.5% (BE) of cases.

Conclusion: PFS of the medial rectus without recession proved successful as a first-line procedure for esotropia in the subtypes of patients evaluated in this study.



Session: Free papers Session I - Esotropia 1

Incidence and risk factors for development of consecutive exotropia during management of fully accommodative esotropia with optical correction

Hala ELHILALI¹, Rokaya RADWAN¹, Ahmed AWADEIN¹, Heba FOUAD¹

¹Cairo University, Cairo, Egypt

INTRODUCTION: Children with fully accommodative esotropia who initially respond to optical correction may develop consecutive exotropia during their follow-up. The purpose of this study is to identify the incidence and risk factors for development of non-surgical consecutive exodeviation.

METHODS: A retrospective chart review was performed of all children with a diagnosis of fully accommodative esotropia and a minimum follow-up of 3 years after initial prescription of spectacles. The age at onset of esotropia, the age of initiation of spectacles, the initial best-corrected visual acuity (BCVA), the initial and final refractive errors, the presence of amblyopia, angles of deviation, and stereoacuity were recorded and tabulated. Patients who developed consecutive exodeviation during follow-up were analyzed.

RESULTS: A total of 178 children were identified. The mean age at presentation and at prescription of spectacles was 2.3 ± 1.4 years and 2.9 ± 1.5 years respectively. The mean spherical equivalent was $+4.3 \pm 1.8$ D. The mean follow-up was 6.9 ± 3.7 years. Consecutive exodeviation developed in 31 children (17.4%), mean time to development was 3.5 ± 3.6 years after prescription of spectacles. Children who developed consecutive exotropia had a higher prevalence of amblyopia ($P < 0.001$), higher initial spherical error ($P = 0.024$), higher initial cylindrical error ($P = 0.009$), higher initial spherical equivalent ($P = 0.004$), higher prevalence of coexisting vertical deviations ($P < 0.001$) and neurological problems ($P = 0.0374$). There was no statistically significant difference between both groups regarding the age of onset, the age of initiation of spectacles, angles of deviation.

CONCLUSIONS: Children with fully accommodative esotropia are at risk of development of consecutive exotropia, especially if they present with a higher refractive error, amblyopia, or a coexisting vertical deviation. Careful follow-up is needed to identify these children and manage them promptly.



Session: Free papers Session I - Esotropia 1

?Disruption of binocularity in pediatric acute acquired concomitant esotropia: botulinum toxin, a chance of recovery?

Laura MOSCHETTA¹, Martha TJON-FO-SANG¹, Jan Tjeerd DE FABER¹

¹The Rotterdam Eye Hospital, The Netherlands, Rotterdam, Netherlands

Introduction Acute acquired concomitant esotropia (AACE) is defined by acute onset, concomitant convergent deviation and normal ocular motility. AACE may reduce the quality of life, causing diplopia and impaired stereopsis. Options for treatment include horizontal rectus muscle surgery and botulinum toxin injection. Among the pediatric population, the most effective therapy is still a matter of debate, due to the uncertainty of the ideal target patient in terms of diagnosis-to-treatment time and lack of sensorial binocularity investigation before the onset.

Methods In a retrospective cohort study, 9 patients with AACE were elected to receive bilateral/unilateral medial rectus injections of 5 units of botulinum toxin from 02/2020 to 09/2023. Median age was 7 yo, 67% boys. Median diagnosis-to-treatment time was 7 months. Angle of deviation in prism diopter (PD) and stereopsis were evaluated at baseline, at 1-, 12- and 24-week after treatment. Cosmetic success was defined as tropia less than 10 PD or phoria less than 15 PD. Functional success was defined as phoria less than 15 PD and normal binocular vision.

Results Cosmetic success rate was 55% at 1- and 12-weeks follow-up, and up to 66% at the end of the follow-up. Functional success rate was of 66% at 24-week follow-up. One patient did not maintain a stable ocular position after toxin treatment and later required squint surgery which did not solve the diplopia. The rates of overcorrection and undercorrection were found to be higher at the first follow-up (33% and 12% respectively). Diagnosis-to-treatment time was not correlated to the clinical outcomes.

Conclusions Botulinum toxin therapy is a less invasive technique in the treatment of pediatric AACE, with 66% functional success rate at 6-month follow-up. This approach allows to avoid prolonged general anesthesia and to spare muscle integrity in case of subsequent surgery. The proof of pre-onset binocularity remains a crucial point for functional success.



Session: Free papers Session I - Esotropia 1

The clinical features and management of acute-onset concomitant esotropia in children. The clinical features and management of acute-onset concomitant esotropia in children

Jingjing JIANG¹, Ying WANG¹, Li LI¹

¹Beijing Children's Hospital, Beijing, China

Introduction: The aim of this study was to evaluate and compare the clinical features and treatment outcomes of botulinum toxin A (BTX-A) injection and surgery in acute-onset concomitant esotropia (AACE) in children.

Methods: A retrospective, comparative clinical study was conducted. A total of 40 children with AACE who underwent treatment in Beijing Children's Hospital and were followed-up for at least six months between January 2020 and January 2022 were enrolled. The patients were assigned to two groups according to treatment method: the surgery group (n = 23) and the BTX-A group (n = 17). The successful motor outcome was defined as a final misalignment of less than 5 prism diopters (PD). Successful sensory outcome was defined as any evidence of sensory fusion or stereopsis. Clinical features and treatment outcomes were evaluated using Burian classifications.

Results: In our study, there were five cases of Type I (12.50%), 26 cases of Type II (65.00%), and nine cases of Type III (22.50%) AACE. Successful outcomes were achieved in 38 (95.00%) and 36 (90.00%) of the patients, respectively for near and distance. There was no significant difference between the motor success rate in the two groups, both at distance (P = 0.749) and near (P = 0.826). After treatment, the overall proportions of AACE patients who exhibited fusion and stereopsis were 94.59% (35/37), 86.84% (33/38), and 72.97% (27/37), respectively. Fusion was observed in 100.00% (15/15) of the patients in the BTX-A group and in 90.91% (20/22) of those in the surgery group. The two groups also exhibited similar stereopsis at near and at distance (P = 0.427; P = 0.339).

Conclusions: In this study, Franceschetti Type II is the most common clinical classification of AACE in children. There was no difference in the efficacy of the treatment methods across the three different clinical types. Thus, BTX-A injection could be considered an equivalent, minimally incisional treatment method to surgery.



Session: Free papers Session I - Esotropia 1

Prism adaptation test vs. standard orthoptic measurement before surgical treatment of decompensated esophoria

Mikael HOFSLI¹, Tobias TORP-PEDERSEN¹, Steffen HAMANN¹, Anton POTTEGÅRD², Jon Peiter SAUNTE¹, Claes SEPSTRUP LØNKVIST¹, Mark ALBERTI¹, Morten DORNONVILLE DE LA COUR¹

¹Department of Ophthalmology, Copenhagen University Hospital, Rigshospitalet-Glostrup, Glostrup, Denmark

²Department of Public Health, Clinical Pharmacology, Pharmacy and Environmental Medicine, Odense, Denmark

Introduction

Decompensated esophoria is a latent esodeviation that progresses into a manifest esotropia, causing substantial discomfort such as diplopia, headaches, and asthenopia. Surgery for esophoria is prone to undercorrection, and prism adaptation test (PAT) has revealed significantly larger angles of deviation (AOD) compared to standard orthoptic evaluation in this patient group. The aim of this study was to compare AOD and reoperation rates between PAT performed vs. standard orthoptic evaluation only in patients who underwent surgery for decompensated esophoria.

Methods

Records of patients with decompensated esophoria who underwent surgery at the Department of Ophthalmology, Rigshospitalet-Glostrup, Copenhagen University Hospital, Denmark, from January 1, 2017, to December 31, 2022, were reviewed. Demographics, medical, and ophthalmological histories were collected. Clinical evaluations included a full ophthalmological examination and orthoptic assessment. Patients were divided into two groups: non-PAT and PAT-group, based on whether prism adaptation was conducted. Duration of PAT lasted from one-half to two hours.

Results

Ninety-seven patients were included, with 59 in the non-PAT group and 38 in the PAT group. Baseline mean AOD at near (AODn) in the non-PAT group was 18.8 ± 9.06 prism diopters (PD), and AOD at distance (AODd) was 18.58 ± 5.89 PD. In the PAT group, mean AODn was 15.39 ± 8.32 PD, and AODd was 15 ± 5.85 PD. After PAT, a significant increase in mean AODn (30.32 ± 10.22 PD, $p < 0.05$) and AODd (30.95 ± 8.34 PD, $p < 0.05$) was observed. Reoperation or postoperative adjustments were significantly less frequent in the PAT group ($n=9/38$) compared to the non-PAT group ($n=27/59$) ($p < 0.05$).

Conclusions

Decompensated esophoria patients exhibit notable AOD increase after PAT. Surgical decisions based on PAT decreases the likelihood of postoperative adjustments or reoperations.