4878 - B1091
Pulmonary of Relative Afferent Pupillary Defects in Amblyopia
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Purpose: Relative afferent pupillary defects (RAPDs) in amblyopia have been reported and it is widely accepted that amblyopes can have an RAPD. We investigated whether this could be confirmed by the use of automated swinging flashlight test with binocular pupillometry.

Methods: We examined eighteen patients with unilateral amblyopia (6 male and 12 female, aged 7–75 years) using binocular infrared video pupillography (Vision module, Newopto, Kawasaki, Japan) in a darkened room. Five patients had detectable fundus abnormalities, and one patient was diagnosed as having cone dystrophy OU using ERG. The remaining twelve patients had functional amblyopia associated with anisometria and/ or strabismus. Light stimuli with white light-emitting diodes were presented to the right and left eyes alternately. The right and left horizontal pupillary diameters were simultaneously recorded 30 times per second. The sum of contraction amplitudes of both eyes was compared.

Results: One patient’s data had to be excluded because of poor recording due to his narrow palpebral fissure. Among the patients with functional amblyopia, only one patient with moderate amblyopia was found to have an RAPD in the amblyopic eye, which was reproduced on a different day. Other even denser amblyopes with worse visual acuities did not have an RAPD. On the other hand, all the organic amblyopes showed RAPDs in the eyes with worse visual acuity.

Conclusions: Only one patient with functional amblyopia had an RAPD in the affected eye. This study has shown that only a small portion of unilateral amblyopes has an RAPD in the affected eye, which is not necessarily associated with dense amblyopia.

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4879 - B1092
A Comparison of OKN Asymmetry in Normal and Amblyopic Subjects

Purpose: It is well documented that there is a horizontal OKN asymmetry in amblyopic subjects with a preference to nasally moving stimuli. No horizontal asymmetry exists in the normal adult visual system. Vertical OKN asymmetry is less well understood, however from our previous work, there is no evidence of a vertical asymmetry. We investigated vertical and horizontal OKN asymmetry in normal and amblyopic subjects.

Methods: The right eye of 17 healthy volunteers and the amblyopic eye of 16 strabismic subjects were investigated for OKN gain asymmetry whilst viewing a square wave grating moving at 10, 20 and 40°/s covering 70° horizontally and 50° vertically. An asymmetry index score was calculated from horizontal and vertical OKN gains. The asymmetry indices for normal and amblyopic subjects were compared.

Results: A horizontal OKN asymmetry with nasallyward preference was evident in a subset of the amblyopic group whilst no asymmetry was seen with normal subjects. No vertical OKN asymmetry was seen in either the amblyopic or normal subject groups. We found no correlation between the horizontal asymmetry and vertical asymmetry in amblyopes (r = 0.14, 0.28 and 0.01 for 10°/s, 20°/s and 40°/s, respectively). The correlation between horizontal asymmetry and vertical asymmetry was stronger in controls at faster velocities (r = -0.01, 0.63 and 0.45 for 10°/s, 20°/s and 40°/s, respectively). The spread of the asymmetries was greater for the vertical than for the horizontal axis and the spread of asymmetries increased with increasing target velocities.

Conclusions: We found no correlation between horizontal and vertical asymmetries for amblyopes suggesting that abnormal visual cortical development which leads to preference for nasallyward stimuli does not lead to an equivalent vertical bias. In contrast there was a correlation between horizontal and vertical asymmetry in controls at faster velocities.

CR: C.M. Knapp, None; R.J. McLean, None; F.A. Proudlock, None; I. Gottlob, None.
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4880 - B1093
Children Requiring Spectacle Correction After Treatment for Capillary Hemangiomas
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Purpose: Capillary hemangiomas of the eyelids and orbit can cause both refractive and occlusive amblyopia. The aim of this study is to determine which characteristics of the hemangioma are related to the need for spectacle wear after oral or injection steroids or surgical treatment of the hemangioma.

Methods: From the database of 129 patients with capillary hemangiomas previously described by Schwartz et al., 54 patients were treated for amblyogenic factors. This study is a retrospective chart review of the 12 patients in this subgroup requiring spectacles after treatment.

Results: 5 of the 28 (18%) patients whose hemangioma was treated secondary to astigmatism required spectacles after treatment. These patients had at least 1.25 diopters difference in astigmatism between their two eyes. 3 of the 15 (20%) patients whose hemangioma was treated secondary to threatened occlusion of the visual axis required spectacles after treatment. 2 of the 3 patients developed occlusion of the visual axis during treatment. 4 of the 11 (36%) patients whose hemangioma was treated secondary to occlusion of the visual axis required spectacles after treatment. In all, 7 of the 12 patients treated with spectacles had occlusion at one point in time. (One patient treated for astigmatism had presented with occlusion to another physician.) In addition, 11 of the 12 patients had a hemangioma affecting the upper eyelid. 7 of the 54 patients treated for amblyopia had globe displacement. 3 of the 7 (43%) required spectacles after treatment.

Conclusion: Characteristics most often associated with the need for spectacles include anisometric astigmatism greater than 1.25 diopters, occlusion of the pupil, location in the upper eyelid, and globe displacement.

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4881 - B1094
Interest of VEP in the Management of Lid Hemangiomas

Purpose: Lid hemangiomas in newborns are at risk of amblyopia because of the occlusion of the visual axis and also because of the astigmatism they can induce. The diagnosis of amblyopia is not always easy and can be asserted by Visual Evoked Potentials (VEP).

Methods: We present 4 observations of children with unilateral lid hemangiomas who had VEP performed with portable achromatic flash. The implicit time of P2 was compared between both eyes. A refraction with atropine cycloplegia was performed in all patients.

Results: VEP was performed between the age of 3 and 5 months in the 4 patients. No anisometropia of more than 1 spherical dioptre or more than 0.75 cylindrical dioptre was found in any patient but one. A difference between both eyes of more than 10 ms of the implicit time of P2 was found in 3 of the 4 patients. There was no such a difference in the 4th patient despite a difference of visual acuity asserted by the Teller test.

Conclusions: Diagnosis of amblyopia in newborns is asserted on a body of proof. It is very important to be sure of the diagnosis especially in the cases of lid hemangiomas, because along with the patching of the better eye, it can be an argument to begin a systemic corticosteroid therapy which is not without risks in very young children. VEP is an objective exam compared to the Teller test; those two exams can be discordant. It is not resolved what is the significant threshold of the difference of implicit time between the two eyes. We consider a difference more than 10 ms as significant.VEP in children with lid hemangiomas is an interesting tool to assess or not amblyopia.

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4878-4881
Support: it is only possible to record a child’s acuity using single letter optotypes (e.g. between vernier acuity does not provide additional magnitude of spatial deficit at the end of occlusion. Residual amblyopia as measured with vernier acuity was 0.42±0.28 at the start and 0.24±0.22 observed in vernier acuity (0.32±0.35 logMAR) as a result of therapy. Residual acuity (0.23±0.17 logMAR) were not significantly different (p=0.11) from changes (0.46±0.28 and -0.18±0.49) respectively at the beginning of therapy. Changes in visual were prescribed either 6 or 12 hours of occlusion per day. Monocular logMAR letter methods suggests that equivalent eccentricity provides a reasonable account of acuity and crowding in amblyopia.

**Results:** Non-compliance With Referral After a Positive Screening Test: Parents Who Denied Being Referred


**Purpose:** Screening for visual disorders is performed in the Netherlands at 9, 14, 24, 36, 45, 54 and 60 months. Children should be referred after a positive screening test, but many do not reach the orthoptist or ophthalmologist. We previously reported on parents truly non-compliant with referral (Tijam AM, et al. 2006; ARVO E-Abstract 04A) and now examined parents who denied being referred.

**Methods:** The Rotterdam Amblyopia Screening Effectiveness Study, a 7 year-prospective-birth cohort study, comprised 4624 children. In 195 out of 750 children with a positive screening test, the referral was unclear. These parents were reached by phone calls or house visits to verify, whether they remembered the referral. Parents who did not remembered the referral were divided into the following categories: Parents, who actually were not referred; parents, who did not understand the referral recommendation and parents, who denied being referred, may have not spoken the truth. Fluency in Dutch was rated by the researchers on a five-point scale, from one “not speaking the national language at all”, three “moderate fluency” and five “excellent fluency”.

**Results:** Out of 195 cases, 77 had actually been compliant, 14 truly non-compliant and 81 parents, subjects of this study, denied being referred. Of the 81 parents 61 parents had not understood the referral recommendation or denied being referred, 20 actually had not been referred. The group that denied having been referred had a fluency in Dutch that ranged between “not speaking the national language all” and “moderate fluency” for 50% of the parents. Approximately 70% of these live in the western and southern parts of Rotterdam, low SES suburban areas. Contrary to the parents of the true non-compliant group, 75% of them have an excellent fluency in the Dutch language and had no geographical prediction.

**Discussion:** This study shows that lack of good communication hampers adequate referral after a positive screening test.

**CR:** E. Vulovic, None; A.M. Tijam, None; S.E. Loudon, None; W.L. Asjes-Tyedman, None; H.J. de Koning, None; H.J. Simonsz, None.

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4886 - B1099
Implementation of a Compliance-Enhancing Program for Occlusion Therapy

Purpose: We previously found that compliance in patching for amblyopia is low when parents do not speak the national language; an educational program improved compliance (IOVS 2006;47: 4393-400). Now this program is implemented in the Netherlands, first in low-SES suburban areas, then nationally.

Methods: Baseline knowledge and attitude of orthoptists towards compliance were assessed. An anonymous questionnaire was developed, consisting of the following domains: knowledge of non-compliance in general, occlusion therapy and non-compliance in own practice and relationship with patients. It was sent to all orthoptists in the Netherlands (n = 350).

Currently, in the first year of the main study, orthoptists registered all new amblyopic children and treated as they always did. Compliance will be measured with Occlusion Dosed Monitor, only in the low-SES. Meanwhile, the factors influencing implementation are being assessed by a qualitative interview and observing the orthoptists in practice. Thereby, to increase the ability to implement the educational program, strategies like motivational interviewing will be developed and a course on non-compliance will be given at the beginning of the second year. In the second year, the new registered children will receive the educational program. The orthoptist will implement the strategies learned during the course on motivational interviewing.

Results: 51% of all orthoptists in the Netherlands returned the baseline questionnaire. 65% answered that they can recognize non-compliance, though only 3% responded having a lot of non-compliance in their practice. 41% gave no extra explanation to parents, who speak the Dutch language poorly. For the main study 11 orthoptists in 4 hospitals located in the suburban areas of Amsterdam, Rotterdam, Utrecht and The Hague were recruited. 25 orthoptists in 13 hospitals were recruited for the national part of the study. Factors, influencing the implementation and the ability to implement are very diverse, therefore various strategies are developed for each orthoptist.

Conclusions: The baseline questionnaire showed that orthoptists are relatively unaware of the extent of non-compliance in their practice and strategies to cope with non-compliance are not wide spread. Organising this implementation study is difficult, but that is a part of the implementation itself. We observed that the studies on non-compliance in occlusion therapy have enhanced the awareness in the Netherlands, however.

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4887 - B1100
Comparison of Landolt-C and ETD-RS Visual Acuity in Healthy Subjects and Patients With Different Eye Diseases
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Purpose: Assessment of visual acuity depends on the optotypes used for measurement. The ability to recognize different optotypes differs even if their critical detail appears under the same visual angle. Since optotypes are evaluated on individuals with good visual acuity and without eye disorders, differences in the lower visual acuity range cannot be excluded. This especially applies for patients with strabismus amblyopia.

In this study, visual acuity as measured with the commonly used ETD-RS charts was compared to the Landolt C acuity in healthy subjects and patients with different eye disorders.

Methods: 100 patients (age 8-90 years, median 60.5) with different eye disorders (39 strabismus-amblyopia, 24 cataract, 32 retinal disease, 5 retiform acuity) and 13 healthy volunteers (age 18-33 years, median 24) were tested. Visual acuity assessment was performed using retroilluminated ETD-RS 1 charts and ETD-RS-type Landolt C charts (Precision Vision). 3 out of 5 optotypes per line had to be correctly identified, while wrong answers were monitored. In the group of patients, the eyes with the lower visual acuity, and for the healthy subjects, the right eyes were evaluated. All units of acuity are given in logMAR notation.

Results: Differences between Landolt C (LC) and ETD-RS 1 acuity were small and statistically not significant. The mean logMAR values (SEM) for LC / ETD-RS 1 were: normal: 0.60 (0.04) / 0.55 (0.04), strabismus amblyopia: 0.85 (0.08) / 0.80 (0.08), cataract: 0.57 (0.07) / 0.51 (0.07), retinal disease: 0.67 (0.06) / 0.61 (0.06), refractive amblyopia: 0.27 (0.04) / 0.23 (0.05), healthy eyes: -0.17 (0.03) / -0.17 (0.02). The mean difference between LC and ETD-RS 1 was 0.049 lines in the entire group and 0.51 lines in the strabismus amblyopia group, with higher values for ETD-RS 1. In the acuity range below 0.1, the mean difference between LR and ETD-RS 1 was 0.42 lines for the entire group and 0.33 lines for the eyes with strabismic amblyopia with slightly higher values for ETD-RS 1 in both groups. This also applies for the entire and lower visual acuity range for the patients with cataract, retinal disease, refractive amblyopia and the healthy eyes.

Conclusions: Using ETD-RS- and ETD-RS-type Landolt C charts, there was only a slight overestimation of visual acuity using ETD-RS charts, even in patients with different eye disorders. This also applies for the lower visual acuity area. However, small differences have to be considered.

CR: R.C. Becker, None; G. Teichler, None; M. Graf, None.

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4888 - B1101
The Effect of Amblyopia on Motor and Psychosocial Skills in Children
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Purpose: To evaluate the fine motor skills, reading eye movements and perceived self esteem in amblyopic children compared with age-matched controls.

Methods: This case-control study included children who had been diagnosed and treated for amblyopia (n=82) and age-matched controls (n=37). The mean ages of the test and control groups were 8.2 ± 0.2 years and 8.3 ± 0.2 years respectively. Of the amblyopic children, 22 had aetiology of infantile esotropia, 28 acquired strabismus, 15 anisometropia, 13 mixed aetiology (had both anisometropia and strabismus) and 9 had deprivation amblyopia. All participants were assessed on a battery of vision tests including logMAR visual acuity (VA), stereopsis by Randot Preschool stereopsis test and reading eye movements assessed by the Developmental Eye Movement (DEM) test. Fine motor skills were assessed using Visual-Motor Control and Upper Limb Speed and Dexterity subtests of the Brunicks-Oseretsky Test of Motor Proficiency and perceived self esteem assessed using the Harter Self Perception Profile for Children.

Results: Stereocuity was significantly reduced and inter-ocular VA differences were greater in the amblyopes compared to controls (p<0.05). Amblyopes had poorer fine motor skills compared to controls for 10 of 16 sub-tests and for the overall age-standardised scores for both visual-motor control and upper limb speed and dexterity items. Subgroup aetiology significantly affected Visual-Motor Control and Upper Limb Speed and Dexterity results. Performance on fine motor skills tasks was not significantly related to level of stereopsis or inter-ocular VA differences in the amblyopic group. No differences in eye movements were found between the amblyopes and controls. Of the self-esteen measures, only social acceptance was decreased for the amblyopes relative to controls.

Conclusions: Fine motor skills were significantly worse and perception of social acceptance was lower in amblyopic children, whilst reading eye movements were unaffected. Performance on the fine motor skills tasks could not be predicted by level of stereopsis or inter-ocular VA difference in the amblyopic group.

CR: A.L. Webber, None; J.M. Wood, None; G.A. Gole, None; B. Brown, None.

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4889 - B1102
"Slow" Perceptual Learning of Vernier Acuity in Adult Amblyopia: An Intensive Amblyopia Treatment Study
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Purpose: Our previous studies1, 2 demonstrate that practicing position discrimination can lead to rapid and robust gains in acuity. Using ETDRS charts, only in the low-SES. Meanwhile, the factors influencing implementation are being assessed by a qualitative interview and observing the orthoptists in practice. Thereby, to increase the ability to implement the educational program, strategies like motivational interviewing will be developed and a course on non-compliance will be given at the beginning of the second year. In the second year, the new registered children will receive the educational program. The orthoptist will implement the strategies learned during the course on motivational interviewing.

Results: Differences between Landolt C (LC) and ETD-RS 1 acuity were small and statistically not significant. The mean logMAR values (SEM) for LC / ETD-RS 1 were: normal: 0.60 (0.04) / 0.55 (0.04), strabismus amblyopia: 0.85 (0.08) / 0.80 (0.08), cataract: 0.57 (0.07) / 0.51 (0.07), retinal disease: 0.67 (0.06) / 0.61 (0.06), refractive amblyopia: 0.27 (0.04) / 0.23 (0.05), healthy eyes: -0.17 (0.03) / -0.17 (0.02). The mean difference between LC and ETD-RS 1 was 0.049 lines in the entire group and 0.51 lines in the strabismus amblyopia group, with higher values for ETD-RS 1. In the acuity range below 0.1, the mean difference between LR and ETD-RS 1 was 0.42 lines for the entire group and 0.33 lines for the eyes with strabismic amblyopia with slightly higher values for ETD-RS 1 in both groups. This also applies for the entire and lower visual acuity range for the patients with cataract, retinal disease, refractive amblyopia and the healthy eyes.

Conclusions: Using ETD-RS- and ETD-RS-type Landolt C charts, there was only a slight overestimation of visual acuity using ETD-RS charts, even in patients with different eye disorders. This also applies for the lower visual acuity area. However, small differences have to be considered.

CR: R.C. Becker, None; G. Teichler, None; M. Graf, None.

Support: None
Multifocal Visual Evoked Potentials in Strabismic Amblyopes: Decreased Amplitudes and Shortened Latencies


Purpose: To investigate how strabismic amblyopia affects the amplitude and latency of the multifocal visual evoked potential (mfVEP).

Methods: Twelve patients (19-70 yrs) with strabismic amblyopia were enrolled in the study. Ten had esotropia, one consecutive exotropia and one orthotropia. Visual acuity in the amblyopic eye ranged from log MAR 0.3 to 1.3. Fixation was evaluated using micro-perimetry and visuoscopy. Monocular mfVEPs were obtained from each eye using a 60 sector, pattern-reversal dotboard array (44.5 deg). Recording electrodes were placed at the inion (I) and I+4 cm, and at two lateral locations up 1 cm and over 4 cm from I. Monocular and interocular analyses of amplitude and latency were performed and probability plots were derived [1-3]. Results were compared to 100 normal controls [4]. A mfVEP hemifield was defined as abnormal based on the following cluster test: if 2 or more contiguous points had p<0.01, or 3 or more contiguous points had p<0.05 and at least one of these points had p<0.01.

Results: Ten patients had steady to unsteady foveal fixation, and 2 patients with log MAR 1.0 and 0.7 had unsteady eccentric fixation 1-2 deg nasal to the fovea. For the mfVEP, 11 amblyopic eyes and 6 fellow eyes had significant clusters of mfVEP responses with markedly decreased amplitudes. For 9 of the amblyopic eyes, both mfVEP hemifields were abnormal using the cluster test. Only one patient had normal mfVEP hemifields in the amblyopic eye (log MAR 0.2). Monocular latencies were significantly decreased (i.e. shortened) for amblyopic eyes compared to values for a group of 23 age-similar control eyes (P<0.0001). Ten amblyopic eyes and 9 fellow eyes had decreased or shorter latencies. Only one of the amblyopic eyes, and 3 of the fellow eyes showed an increase in latency.

Conclusions: The mfVEP, which primarily reflects activity in V1, reveals visual field deficits in the amblyopic and fellow eyes of strabismic amblyopes and a paradoxical shortening of response latency. A total of 26 patients (19-70 yrs) with strabismic amblyopia were enrolled in the study. Ten had esotropia, one consecutive exotropia and one orthotropia. Visual acuity in the amblyopic eye ranged from log MAR 0.3 to 1.3. Fixation was evaluated using micro-perimetry and visuoscopy. Monocular mfVEPs were obtained from each eye using a 60 sector, pattern-reversal dotboard array (44.5 deg). Recording electrodes were placed at the inion (I) and I+4 cm, and at two lateral locations up 1 cm and over 4 cm from I. Monocular and interocular analyses of amplitude and latency were performed and probability plots were derived [1-3]. Results were compared to 100 normal controls [4]. A mfVEP hemifield was defined as abnormal based on the following cluster test: if 2 or more contiguous points had p<0.01, or 3 or more contiguous points had p<0.05 and at least one of these points had p<0.01.

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Purpose: To investigate how strabismic amblyopia affects the amplitude and latency of the multifocal visual evoked potential (mfVEP).

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Results: Ten patients had steady to unsteady foveal fixation, and 2 patients with log MAR 1.0 and 0.7 had unsteady eccentric fixation 1-2 deg nasal to the fovea. For the mfVEP, 11 amblyopic eyes and 6 fellow eyes had significant clusters of mfVEP responses with markedly decreased amplitudes. For 9 of the amblyopic eyes, both mfVEP hemifields were abnormal using the cluster test. Only one patient had normal mfVEP hemifields in the amblyopic eye (log MAR 0.2). Monocular latencies were significantly decreased (i.e. shortened) for amblyopic eyes compared to values for a group of 23 age-similar control eyes (P<0.0001). Ten amblyopic eyes and 9 fellow eyes had decreased or shorter latencies. Only one of the amblyopic eyes, and 3 of the fellow eyes showed an increase in latency.

Conclusions: The mfVEP, which primarily reflects activity in V1, reveals visual field deficits in the amblyopic and fellow eyes of strabismic amblyopes and a paradoxical shortening of response latency.