Successful Amblyopia Therapy by Using Synoptophore

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Abstract

Background : Amblyopia is the most common cause of monocular visual impairment in children. Even though occlusion therapy is the treatment of choice, the success rate has not been well achieved due to poor compliance. Other alternative treatments have been tried for a better outcome.

Objective : To report successful therapy for amblyopia using synoptophore.

Method : A retrospective study of 25 amblyopic children enrolled in the amblyopic treatment program, from September 18, 1996 to October 14, 2002. The program included patching of the good eye, stimulating the amblyopic eye with synoptophore, and recording the visual acuity of both eyes each time. All children were regularly examined every 3 months by the same ophthalmologist. The compliance of each individual was reassessed and adjusted. At the end of the training program, visual acuity of the amblyopic and the good eyes were measured, plus the binocularity of both eyes were recorded as the main outcome measurement.

Result : Final (best) visual acuities were between 20/20 and 20/30 for 19 cases of 21 cases (90%). Final best binocularity was maintained in 15 of 25 patients (60%), including 4 anisometropic patients (100%), 2 ptosis patients (50%), 4 pseudophakic patients (80%), 2 strabismic patients (40%), and 3 combined group patients (100%)

Conclusion : By using synoptophore to stimulate the amblyopic eye, while occluding the good eye, it improved the level of vision to a certain acceptable degree. Thus, compliance of the treatment can be well achieved. However, the understanding and good cooperation of the parents were also a must for successful amblyopia therapy.

Key word : Amblyopia, Synoptophore, Occlude the Good Eye

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Amblyopia is the most common cause of monocular visual impairment in children[1-3]. Most cases are associated with strabismus in infancy or early childhood. Less frequent are anisometropia, combination of strabismus and anisometropia, or visual deprivation[4,5]. About 25 per cent of patients have visual acuity in the amblyopic eye worse than 20/100 and about 75 per cent have acuity of 20/100 or better[4,6-8].

Occlusion therapy and patching of the good eye has been described for more than 200 years and remains the accepted treatment[9]. It is generally held that the response to treatment seems best when instituted at an early age[10,11] and is poor after the age of 8 years[12-14]. Compliance is often a major problem because of the child's dislike of occlusion owing to visual, skin irritation, psychological and social reasons prospectively[4,11,15-22]. Other alternative treatments to occlusion therapy have been reported such as pharmacological penalization by installation of a long acting topical cycloplegic agent: atropine sulfate[23,24], and using drug treatment: Levodopa and Carbidopa, in amblyopia[25-27]. Orthoptic and pleoptic treatment of amblyopia have been maintained in Europe since 1950 using the principle that providing the amblyopic eye with the appropriate kind of visual stimulation or making specific functional demands on it, during the period of occlusion therapy, might accelerate the improvement in its vision[28]. The purpose of this consecutive compliant patient series, studied retrospectively, was to suggest that amblyopia can be improved with the help of orthoptic stimulation by using synoptophore. It can improve the level of vision, at the first phase, to a certain degree for the children to accept the patching and resume their usual daily life. Thus, the compliance of the treatment can be well achieved.

PATIENTS AND METHOD

Twenty-five children were the subjects of this retrospective study conducted from September 1996 to October 2002. Amblyopia was defined as an interocular difference in visual acuity of at least two lines with the best-corrected vision[29]. Only patients with an initial visual acuity of 20/50 or worse were included[30]. For each patient, amblyopia was classified as either strabismic, anisometropic, deprivation, or combined of strabismic and anisometropic, to indicate the presumptive cause of amblyopia. Strabismic amblyopia was defined as amblyopia in the presence of either heterotropia at a distance and/or near fixation. Anisometropic amblyopia was defined as the difference of a diopter or more in any symmetrical meridian. Combined mechanism amblyopia was defined as amblyopia in the presence of strabismus and anisometropia[31] Deprivation amblyopia resulted from conditions that caused substantial impairment of the image clarity formed at the retina in early infancy[32].

All parents gave informed consent regarding the diagnosis and standard treatment of amblyopia according to the cause. Additional information was given about synoptophore when used as combined therapy with occlusion. Visual acuity was measured by means of linear Snellen optotypes, or by LEA 3D test in small children. At the time many of these patients were seen, devices were not available to constantly generate random letters by a computer driven apparatus; therefore, familiarity of letters or memorization factors could not be eliminated. A binocularity index was determined with the use of Titmus stereo test with a scale ranging from 0 to 4, as follows:

0. Indicated complete suppression
1. A moderate central suppression scotoma with peripheral fusion at near.
2. A small suppression scotoma and peripheral fusion indicated by fusion of the Titmus stereo fly.
3. Moderate stereoacuity (100-400 arc/seconds) on the stereo test animal (1 to 3 animals) and/or on the stereo test circles (1 to 5 circles)
4. Good stereo acuity (≤ 80 arc/seconds) on the stereo test circles (6 to 9 circles) (30).

Visual acuity was recorded using age approval methods of assessment. In the youngest children this was done by LEA 3 D test. In most children linear Snellen acuity was used. Initial therapy consisted of full optical correction (cycloplegic refraction) for the amblyopic eyes and full-time occlusion, (micropore paper tape) for the nonamblyopic eye, except when sleeping and taking a bath. Combined with synoptophore to stimulate the vision of the amblyopic eye, by flashing and Haidinger's brush. The orthoptic training was done daily for about 15 to 30 minutes based on the child's attention span. Visual acuity of both eyes was recorded at each session of training to prevent occlusional amblyopia. Because the rate of recovery of visual acuity seemed to be non-linear, follow-up visits were initially at frequent intervals (1-4 weeks) to give encouragement, document compliance and solve all the problems that occurred. There was a

uniformly rapid rate of improvement to the 20/200 level of visual acuity. Later follow-up visits were less frequent, 2-3 months to encourage and instruct more advanced training programs. There was a slower rate of improvement to 20/30 or 20/20 level of visual acuity. This therapy continued until there was no further improvement in the visual acuity of the amblyopic eye, and good stereo acuity had been gained. After this, part-time occlusion and interval orthoptic training were used for maintenance for the final best visual acuity for at least 6 months to diminish recidivism. After maintenance therapy was discontinued, the visual acuity was re-tested in 3 to 6 months, and if there was any decrement in visual acuity, maintenance therapy was employed again. The synoptophore training scheme was as follows:

Step I : Flashing and Haidinger's brush, until the vision improved and stable fixation was achieved.

Step II : Along with step I, additional spontaneous perception slide with flashing in the amblyopic eye until all the 3 sizes of spontaneous perception slide could be fused.

Step III : Using the fusion slides and flashing in the amblyopic eye, until 3 fusion slides were fused and stable.

Step IV : Using stereopsis slide for training the stereopsis until a good stereo acuity was obtained.

RESULTS

The clinical variables for each of the 25 compliant patients are shown in Table 1, which include sex, refraction of each eye, amount of anisometropia and presence of strabismus. Table 2 illustrates details of the initial (worst) and final (best) amblyopia characteristic, including age at start of therapy, initial visual acuity, final visual acuity and final binocular index.

There were 25 patients; 10 boys and 15 girls, 14 cases were referral cases. The average age at initial amblyopia treatment was 5.96 year, range 2-13.6 years. Anisometropic amblyopia were presented in 5 cases, with the mean age of 9.5 years (range 6-13.6 years). Sensory deprivation amblyopia were 10 cases, due to ptosis 4 cases with the mean age was 4 years (range 3-5 years), due to post congenital cataract surgery, pseudophakia and aphakia 6 cases with a mean age of 5.6 years (range 2-9 years) Strabismic amblyopia were 6 cases: 4 cases of esotropia, 2 cases of exotropia, with a mean age of 5.3 years (range 3-7 years). Combined strabismic and anisometropic amblyopia 4 cases: all were exotropia, with a mean age of 6.4 years (range 3-9 years). The initial visual acuity range from 20/50 to 20/1200 with the best optical correction, mean was: 20/200 for all patients, 20/200 for anisometropia, 20/155 for ptosis, 20/600 for pseudophakia, 20/100 for the strabismus and combined group. The best final visual acuity ranged from 20/20 to 20/50. 19 cases of 21 cases (90%) had 20/20 to 20/30. 4 cases of 20/100 were excluded, due to loss to follow-up in 3 cases and still under treatment 1 case. 1 case had 20/40 and another case had 20/50, due to nystagmus. Binocular function at the end of therapy was obtained in 60 per cent (15/25), anisometropia 100 per cent (loss to follow-up in 1 case), ptosis 50 per cent (2/4), pseudophakia 80 per cent (4/5) one case is still under treatment, strabismus 40 per cent (2/5) one case is still under treatment and 100 per cent (3/3) in the combined group. Mean duration of therapy was 2.5 years for anisometropia, 2.4 years for ptosis, 4.5 years for pseudostrabismus, 1.5 years for strabismus and 2 years for the combined groups.

DISCUSSION

5 types of amblyopia were grouped according to the causes. Each type had its own characteristics. In the anisometropia group, all were boys, with the oldest age range but with moderate amblyopia. The youngest age group was the ptosis group, with the amblyopia being rather mild and had a good result in treatment, as in other studies, that the earlier the treatment was started the better the rate of success (10,11). The deepest amblyopia group was the pseudophakia and aphakia group. Even though they had all had cataract surgery within the first year of life, there was failure to respond to occlusion therapy during childhood because of poor compliance. By the time, they were referred for treatment, the amblyopia was deep plus there were other muscle disorders such as esotropia, exotropia, with or without nystagmus. The strabismus and combined group had moderate amblyopia with mean ages of 5.3 and 6.4 years respectively, which was not much different from the study of The Pediatric Eye Disease Investigator Group with mean ages of 5.1, 5.4 and 5.2 years in strabismic, anisometropic and combined group respectively(31). The presented data, however, differed from that of Shaw et al(5), in the United Kingdom in which the median ages of children with strabismic, anisometropic and combination were 3.6, 6.3 and 4.7 years, respectively.

Table 1. Clinical characteristics of 25 patients.

Patient/sex	Refraction RE	Refraction LE	Anisometropia	Strabismus
Anisometropic amblyopia				
1/M	-12.00~-0.50	-13~-4.00	3.25	0
2/M	+2.5	-0.5	3	0
3/M	-0.75	-16.75	16	0
4/M	-5	-15	10	0
5/M	+2	+7	5	0
Stimulus deprivation amblyopia ptosis with amblyopia				
1/F	+1.5	+1.5	0	XT
2/M	+1.5	+1.5	0	XT
3/F	0	0	0	0
4/M	-11.5	-9.25	2.25	0
Aphakia and pseudophakia				
1/F	0	IOL (+14.00)	0	0
2/F	0	IOL (+26.00) -10	10	ET
3/F	0	+24	24. contact lens	XT & Nystagmus
4/F	IOL (+23.00) -2.25	0	2.25	XT
5/M	IOL	IOL	0	ET & Nystagmus
6/F	IOL - 10	0	10	ET & Nystagmus
Strabismic amblyopia				
1/M	+1.5	+1.5	0	ET
2/F	+1	+1	0	ET
3/F	+4	+4	0	ET
4/F	+4	+5.5	1.5	ET
5/M	+0.5	+0.5	0	XT
6/F	-1	-1.75	0.75	XT
Anisometropic and strabismic amblyopia				
1/F	0	-1	1	XT
2/F	+2.50 ~ -4.00	+2.50 ~ -0.50	3.5	XT
3/F	+1.50 ~ -3.00	0	3	XT
4/F	+2.25 ~ -1.00	+6.00 ~ -7.00	3.75	XT

It is generally held that the response to treatment seems best when instituted at an early age and is poor after 8 years[10-14]. Most of the presented cases started treatment rather late, 76 per cent (19/25) started at age 5 years or more, and 28 per cent (8/25) started at age 7 years or more. The amplitude of amblyopia was also much deeper than other studies. Most of these cases were of school age and if the good eye was occluded this would hinder the learning ability, thus lessen the compliance. With the help of synoptophore in stimulating the fovea of the amblyopic eye, while fully occluding the good eye, it improved the vision up to a certain degree acceptable for school life, thus making the occlusion much easier to comply. This also applied in small children, besides improving the vision, it also helped them to know how to fix the eye. When the vision was gained, synoptophore helped in fusion activities step by step from spontaneous perception, fusion to stereopsis. The orthoptist and older children also knew the progression of the binocular function. That helped in programming the training suitable to each individual correctly. Once the eyes accomplished stereopsis, which means, there was binocular function, the use of both eyes was maintained. Thus, the visual acuity will stabilize in the amblyopic eye[30]. However, the success of occlu-

Table 2. Initial/final amblyopia characteristics.

Patient	Initial age (year)	Year of treatment	Visual initial	Visual end	Binocularity end
Anisometropic amblyopia					
1	13.6	3	20/2,000	20/30	3
2	6	2	20/70	20/20	4
3	7	1.6	20/600	20/100	loss to follow-up
4	11	2	20/100	20/20	4
5	10	2	20/100	20/20	4
Stimulus deprivation amblyopia ptosis					
1	3	3	20/50	20/20	3
2	4	-	20/300	20/20	under treatment
3	4	0.1	20/70	20/20	4
4	5	4	20/200 LE	20/40	0, coloboma RE
Aphakia and pseudophakia					
1	5.9	4.9	20/400	20/20	4
2	5	6	20/600	20/30	1
3	6	2.9	20/200	20/20	3
4	2	3.8	20/1,200	20/20	3
5	9	5	20/100	20/50	0 (nystagmus)
6	6	-	20/1200	20/100	under treatment
Strabismic amblyopia					
1	5	3	20/200	20/20	0
2	1	1	20/50	20/20	4
3	6	1	20/70	20/20	0
4	3	-	20/160	20/100	under treatment
5	5	1.6	20/100	20/30	0
6	6	1	20/70	20/20	4
Combined anisometropia and strabismus					
1	8	2	20/100	20/20	4
2	3	2	20/100	20/30	3
3	9	3	20/200	20/100	loss to follow-up
4	5.6	3	20/50	20/20	4

sion therapy was reported to be dependent on compliance. Reported rates of compliance ranged widely from 49 per cent to 87 per cent[4,11,15-22]. In the present study, only 2 cases were lost to follow-up from a total of 25 cases (92%). The high rate of success was owed to the understanding and good cooperation of parents, besides the proper therapy and the compliance of the children.

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ความสำเร็จในการรักษาตาขี้เกียจโดยใช้เครื่องซินออพโตฟอร์

*ไอรีน ศุภางคเสน, พบ**

ความเป็นมา : ตาขี้เกียจเป็นสาเหตุที่พบบ่อยที่สุดในเด็กที่มีสายตาผิดปกติข้างเดียว การรักษาทำโดยปิดตาข้างดี แต่มักจะไม่ได้รับความร่วมมือจากผู้ป่วย ทำให้ผลของการรักษาไม่ได้ดีเท่าที่ควร จึงได้พยายามทำการหาวิธีรักษาแบบอื่น ๆ มาเสริม เพื่อให้ประสบผลสำเร็จมากขึ้น

วัตถุประสงค์ : เพื่อรายงานความสำเร็จของการรักษาตาขี้เกียจโดยใช้เครื่องซินออพโตฟอร์

วิธีการ : ทำการทบทวนรายงานผู้ป่วยที่ได้รับการวินิจฉัยว่าเป็นโรคตาขี้เกียจ 25 ราย ตั้งแต่วันที่ 18 กันยายน 2541 ถึงวันที่ 14 ตุลาคม 2545 และเข้าโปรแกรมการรักษาโดยปิดตาข้างดี และกระตุ้นตาข้างขี้เกียจโดยเครื่องซินออพโตฟอร์ เด็กทุกคนจะได้รับการตรวจสายตาและดวงตาเป็นระยะโดยจักษุแพทย์ท่านเดียวกัน มีการประเมินและปรับโปรแกรมการฝึกตามความเหมาะสมของคนไข้แต่ละราย เมื่อสิ้นสุดโปรแกรมการรักษาวัดผลสำเร็จของการรักษา โดยการวัดระดับสายตาของทั้ง 2 ตาทีละข้างและวัดภาวะการใช้ตาทั้ง 2 ข้างพร้อมกัน

ผลการวิจัย : พบว่าผู้ป่วย 19 รายใน 21 ราย (90%) มีระดับสายตาดีขึ้น อยู่ระหว่าง 20/20 และ 20/30, ผู้ป่วย 15 รายใน 25 ราย (60%) มีการใช้ตา 2 ข้างพร้อมกัน ซึ่งพบในผู้ป่วยสายตาไม่เท่ากัน 2 ตา 4 ราย (100%), ผู้ป่วยหนังตาตก 2 ราย (50%) ผู้ป่วยหลังผ่าต้อกระจกและใส่เลนส์ในลูกตา 4 ราย (80%) ผู้ป่วยตาเหล่ 2 ราย (40%) และผู้ป่วยที่มีปัญหาตาเหล่และสายตาร่วมกัน 3 ราย (100 %)

สรุป : จากการใช้เครื่องซินออพโตฟอร์ ในการกระตุ้นตาข้างที่ขี้เกียจนั้น มีผลทำให้ระดับของสายตาดีขึ้นมาระดับหนึ่ง ที่ทำให้คนไข้ยินยอมให้ความร่วมมือในการปิดตาข้างดี ร่วมกับความเข้าใจในโรคและความร่วมมือของผู้ปกครอง จึงทำให้ผลของการรักษาโรคตาขี้เกียจประสบผลสำเร็จได้

คำสำคัญ : ตาขี้เกียจ, เครื่องซินออพโตฟอร์, ปิดตาข้างดี

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