Is there an Age Limit While Treating Amblyopia in Adults?

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Summary: ***A 56-year lady presented with poor vision in right eye since child-hood. She had been refused therapy by various ophthalmologists for her "Lazy Eye' since she was considered past the "treatable age". A detailed ophthalmological assessment of her visual status, Best Corrected Visual Acuity for distance and near was done. She was found to have anisomyopic amblyopia. Full-time occlusion therapy was started. Within 6 weeks, her near vision improved from worse than N18 to N6 while her distance vision improved from 0.1 to 0.8 (decimal fraction) in further 3 months. Her progress was monitored for 2 years, and no regression in visual acuity was noted.***

Amblyopia or lazy eye, is a disorder of the visual system in which visual loss is out of proportion to any structural abnormality in the eye[1]. It results from disuse of an eye, either due to an inadequate foveal or greater peripheral retinal stimulation (where there is a lesser concentration of cones), or due to an abnormal binocular interaction resulting from variable visual inputs from both fovea[2]. Human brain is designed to allow both eyes to function together to explore space. If signals from one eye are blurred or absent, brain blocks visual input from that eye. In the neuronal visual pathway, the synapses are broken due to disuse of the amblyopic eye[3,4]. This may occur due to constant strabismus, disproportionately high refractive error in one eye, a combination of both factors, or blocked vision in an eye due to a droopy upper lid, media opacity like cornea/vitreous or congenital cataract[5].

Amblyopia has been estimated to affect 1–5% of the population[6,7]. It is generally believed to be fully treatable only till the age of 6-8 years; beyond that age only some visual improvement is considered to be possible. Many clinicians refuse therapy after the age of 8-12 years.

An adult person with unilateral amblyopia is at three times greater risk and a child, 17 times that of a normal person for losing vision in the better eye[8]. There are anecdotal evidences of spontaneous improvement of vision in an amblyopic eye after loss of vision in the good eye. This spontaneous improvement of visual acuity to a usable level (6/24 or better) is relatively low (<17%) unless a complete visual loss occurs in the better eye[9].

Full-time occlusion therapy for treating amblyopia has been practiced since decades. The case discussed here shows that it can result in improvement of visual acuity at any age.

CASE REPORT

A 56 years old lady presented at our tertiary care centre accompanying her 6 years old grandson for the treatment of his lazy eye. While the grandson was being explained the rational of therapy, she queried if it was possible to treat her 'Lazy Eye' as well at her age, though she had been refused therapy by various ophthalmologists since her childhood.

A detailed ophthalmological assessment including her visual status, Best Corrected Visual Acuity (BCVA) for distance and near, pupil, colour vision, stereopsis, status of muscle balance by cover-uncover test, slit-lamp and fundoscopy, assessment of foveal fixation by visuoscope was done. She was found to have a BCVA of 0.9 (Decimal fraction on TSCP-700 Chart Projector) OD and Counting finger (CF) OS with a correction of OD = -0.5DS and OS= -5.50DS / -2.00Dcyl@90. She could only read a font much larger than N18 with OS (newspaper headlines only with difficulty), with no improvement for near after an add of +2.5DS into her distance correction. She was prescribed glasses for full-time use and asked to return for follow-up after 1 month.

On first follow-up, her BCVA improved from CF to 0.1 so she was asked to continue with glasses only for a further period of one month. On second follow up, her BCVA had not shown any improvement. She was prescribed full-time occlusion therapy of her good eye along with active usage of the amblyopic eye by forced reading, writing, for 4-5 hours per day. She was explained to start reading a large font that she was comfortable with and shift to smaller fonts every day. The need for regular follow-up was stressed. A written consent form was obtained and commercially available eye patches to be worn over good eye were prescribed for all waking hours daily, to be removed at night while going to sleep. After 2 weeks of starting full-time occlusion therapy, her near vision improved to N18 but there was no improvement in distance vision. On further follow-up, the near vision showed a steady, gradual improvement to N6 with 6 weeks of occlusion therapy and the distance vision also improved to 0.2. With regular follow-up, the distance vision also showed a gradual improvement and after 4 months of full-time occlusion therapy, her BCVA for distance vision was 0.8 while the good eye VA remained at 0.9. After that, a gradual weaning protocol of occlusion therapy was started with 1 day off-patching in first week with 6 days full-time patching, 2 days off-patch in the second week with 5 days full-time patching and follow-up after every 2 weeks. Since the BCVA was maintained at 0.8, weaning schedule was continued till patching was totally off after 7 weeks. She was kept under regular follow-up for 2 years and no regression in BCVA was noted. She was strictly counselled to wear spectacle correction and have a regular follow-up.

REVIEW

In general, the amblyopic adult patients are refused

therapy beyond a certain age because of misinterpretation of "Critical Period for Visual Development." According to Wiesel and Hubel[10], this period exists from 1-5 years of age. It means that during this period, an individual's retina and brain are most sensitive to outside environment and stimuli than at other periods of life. This does not mean that the visual cortex becomes unresponsive to retinal stimulation once that period is over and the "gates' leading from retina to visual cortex close tightly; rather these gates remain very slightly open and get rustic by disuse.

Recent findings of neuroplasticity have shown that brain is not a physiologically static organ and it can modify throughout life[11,12]. Its development does not end after a certain age; it can be stimulated to form new connections between existing brain cells and strengthen older ones in any part of the brain, any time in an individual's life by strong, persistent and appropriate stimulation. This ability is strong in early childhood when maximum brain growth occurs, slows down with age, but it never stops[13]. The molecule responsible for neuroplasticity is a protein receptor[14] which is in an "OFF" mode in adults but can be turned "ON" by continued, active brain stimulation. GABA (Gamma Amino Butyric Acid)[15,16], acts as an excitatory neurotransmitter in immature, developing brains and regulates proliferation of neural progenitor cells, proliferation and elongation of neurons and formation of synapses by releasing Brain-Derived-Neurotrophic Factor. This results in important brain functions like memory, learning, speech, motor control. It not only gradually decreases with age but in mature brains, it has an inhibitory affect by activating GABA-receptors and causing cell arrest in the S-phase (static phase). GABA given exogenously cannot cross the blood-brain barrier. Researchers obtained GABA secreting neurons from young mice while they were in their "critical period" and transplanted into the brains of adult, amblyopic mice. After some time, they found new neural connections forming in the visual pathway and restoration of normal eyesight in those adult, amblyopic recipient mice[17,18]. Similarly, in other studies, plasticity of brain was shown to improve in specific regions by a specified stimulus. The brain receptors which were turned "Off" with age, could be turned "On" by GABA released in response to a stimulus. An increase in the gray matter volume has been observed in professional typists' due to long-term bimanual typing, suggesting that learning can affect not only function but brain structure as well in adults[19]. Dopamine is another neurotransmitter that stimulates receptors and turns them "On". It is present in retina and cerebral cortex but does not cross the blood-brain barrier. Its precursor, Levodopa, crosses that barrier and is converted to Dopamine in the brain. These studies prove that neural stem cells (progenitor cells) can be made to generate neurons in various brain areas of mammals[20]. Adults continue to learn throughout life and this is because of continued neurogenesis in the memory area.

Hence, in case of amblyopia the closed, rustic gates in the visual pathway can be fully opened and turned active again but this needs a strong, persistent stimulation, without any inhibitory influence. The brain favors neural transmission from the good eye; it is a known fact that the good eye has an inhibitory influence over the amblyopic eye. As shown in this case-report, full-time occlusion of the good eye removed this inhibitory effect over the development of neural connections of the amblyopic eye for the whole duration of therapy. This was combined with the active use of amblyopic eye till neural connections became fully functional. Once that was achieved, the connections were given adequate time to stabilize to avoid regression of amblyopia; this was provided by following a very slow and gradual weaning protocol for occlusion therapy in this case.

This case report proves the concept of neuro-plasticity and shows that amblyopia in adults can be fully treatable. But this needs highly motivated and inspired patients who are ready to cooperate and comply with therapy. They must manage their lives for a period of 2-3 months by keeping their good eye closed and actively using an eye that had been neglected for decades. This is not an easy job either for the patient or the treating ophthalmologist, but this is the only way to ensure full visual recovery by very simple means with no economic burden either on the patient or the health services. Once the visual recovery is achieved, it may be permanent.

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